User Manual

Hybrid Inverter

KY-ESS3K0H- KY-ESS8K0H

V1.3

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Software Copyright

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Contents

Introduction

Overview

This manual focuses on product information, installation guides, operation, and maintenance. This manual cannot contain complete information about photovoltaic systems. You can get more information about other devices on the website of the www.koyoe.com or the manufacturer of the relevant components.

Before using or operating the inverter, please read this manual and other relevant document carefully. Please keep this manual and other relevant document safe for reference. The content in this manual is owned by KOYOE, and may not be copied or published in any form without the prior written permission of our company.

Due to product development needs, the content in this manual may be updated or revised periodically. The information in this manual is subject to change without notice. The latest manuals are available on www.koyoe.com.

Applicable Model

This manual only applies to the following models of hybrid inverters. Do not use as a reference manual for other products.

Model	Nominal Power
KY-ESS3K0H	3000W
KY-ESS4K2H	4200W
KY-ESS5K0H	5000W
KY-ESS6K0H	6000W
KY-ESS7K0H	7000W
KY-ESS8K0H	8000W

Suitable Audience

This document is intended for the following people:

- sales engineer
- systems engineer
- Installation and after-sales engineer

Change History

Change history of each document update is accumulated. The latest document issue contains all updates made in previous issues.

V1.1 this issue is second official release（2023.03.01）

V1.2 this issue is third official release（2024.04.01）

1. Safety information

KY-ESS inverters strictly comply with the relevant safety regulations of product design and testing. To use the inverter safely and reliably, the following lists the safety information about different types of inverters. During installation, operation, and maintenance, please read and follow the instructions and precautions carefully. Otherwise, personal and property damage may be caused.

KOYOE shall not be liable for any of the following circumstances.

- Do not operate under the conditions of use described in this manual.
- Installation and use of environment outside the relevant international or national standards.
- Disassemble or change the product or modify the software code without authorization.
- Do not follow the operation instructions and safety warnings in the product and documentation.
- Equipment damage caused by abnormal natural environment (such as earthquake, fire, storm, etc.)
- Transportation damage caused by customer's own transportation.
- Damage caused by storage conditions that do not meet product requirements.
- Shall not be used in the area and environment specified in the product contract.
- Beyond the service life of the product.

⚠ CAUTION

- The safety instructions in this manual do not cover all precautions. Perform operations based on site conditions.
- KOYOE shall not be liable for any damage caused by violation of the safety instructions of this manual.

1.1 General Requirement

⚠ DANGER

It is strictly forbidden to operate with electricity during the installation process, and the switch must be turned off when the battery module is not assembled.

- It is strictly prohibited in the thunder, rain, snow, six levels of gales to the bad weather, the installation, use and operation of outdoor equipment, cables. (This

includes but is not limited to transporting equipment, operating equipment and cables, plugging and unplugging outdoor signal ports, working at heights, and outdoor installation)

- After installing the device, remove empty packing materials, such as cartons, foams, plastics, and cable ties, from the device area.
- In case of fire, evacuate the building or equipment area and press the fire alarm or call the fire alarm number. Do not re-enter a burning building under any circumstances.
- It is strictly prohibited to alter, damage or block the logo and nameplate on the equipment.
- When installing devices, use professional tools to tighten all screws.
- Fully familiar with the composition and working principle of the whole grid-connected photovoltaic power generation system, as well as relevant standards of the country/region where the project is located.
- Paint scratches in the process of equipment transportation and installation must be repaired in time. Long-term exposure of scratched parts to outdoor environment is strictly prohibited.
- Do not remove the components of the device, including the outer enclosure and the switch display.
- In any case, do not change the structure of equipment, installation sequence, etc., without the permission of the manufacturer.
- You are advised to use the original packing case to pack the goods. Do not lift the goods through battery docking terminals.
- It is not allowed to reverse engineering, decompiling, disassembling, disassembling, adapting, implanting or other derived operations on the device software. It is not allowed to study the internal implementation of the device in any way, obtain the source code of the device software, steal intellectual property rights, and it is not allowed to disclose the performance test results of any device software.

1.2 Solar Panel

- You must ask professional personnel to install the photovoltaic panel according to the user manual. Pay attention to the following precautions when installing the photovoltaic panel：

- - When photovoltaic panels are exposed to sunlight, they generate electricity and can cause deadly voltages and shocks.
- - This inverter is a multi-power system, the operator must wear appropriate personal protective equipment: safety helmet, insulated wire, gloves, etc.
- - Before touching the output cable of the panel, use the measuring device to ensure that the cable has no voltage.
- - All warnings on the PV panel and in its manual must be followed.

⚠ WARNING

- The solar panels used with this inverter must conform to IEC61730 and be grade-A photovoltaic panels.

-Do not ground the positive or negative terminals of the PV series.

- If the inverter is damaged due to the installation failure of the solar panel, it is not covered by the warranty.

1.3 Inverter

⚠ WARNING

Improper operation can lead to the risk of electric shock.

Do not open the case at any time, unauthorized opening of the case will not continue to enjoy the warranty.

⚠ WARNING

The following improper operations are prohibited when the inverter is running：

- When the inverter is running, do not remove the photovoltaic connector, AC connector, and battery connector.

- When shutting down an inverter, you must shut down all power supplies to the inverter, including photovoltaic, power grid, and battery, and wait 10 minutes before operating the inverter.

- Before pulling out any connector, ensure that there is no voltage or current in the connector.

⚠ WARNING

After installation, all safety instructions, warning labels, and nameplates on the inverter must meet the following conditions:

- The description must be legible;

- Text should not be removed or overwritten.

WARNING

The hot parts of the inverter are at risk of burning.

- Do not touch any hot parts (such as the radiator) during inverter operation.
- Only the LCD panel and DC switch knob can be safely touched at any time.

WARNING

- Only professionals can change the type setting of safety rules.
- The inverter damage caused by unauthorized change of safety regulations is not entitled to warranty service.
- Note that static electricity may damage the inverter.
- Do not disassemble the inverter or touch the internal components.
- Do not directly touch the connectors of the inverters when they are running.

Warning Label

Please strictly comply with all warning labels and contents in this product.

Label	Description
	Warning! Failure to follow the precautions and warnings in this manual may result in personal injury.
	Risk of high voltage electric shock !
	Hot surface hazard !
	Products should not be disposed of as household waste.
	Please refer to the operation manual.
	To prevent electric shock or personal injury, touch or operate the inverter 10 minutes after all power is turned off or all connections are disconnected.
	CE marked.

Warning!

1. When connecting the input and output of the inverter, connect the ground cable of the inverter first, and then connect the DC input terminal and AC output terminal. When disconnecting inverter cables, disconnect the inverter ground cable at the end.
2. Before connecting the inverter to the grid, obtain permission from the local power

company and hire a professional to install it.

3. Please read all the documents that come with this product carefully.

4. Inverter maintenance and installation must be carried out by professionals in accordance with the correct procedures.

5. Inverter has no maintenance parts. If there is any problem, it must be maintained by a professional.

6. All electrical installations must comply with national standards and local 62109 regulations.

7. The inverter shall be of non-isolated type and the PV module shall conform to IEC61730 Grade A.

8. The inverter may be larger than 18kg. Exercise caution when moving or lifting the inverter. Equipment or parts weighing more than 18 kg should be equipped with lifting and handling tools.

9. Software version information can be read by LCD or computer software.

10. The DC input and AC output of this inverter are non-isolated. Product identification must be clearly visible after installation.

- Risk of electric shock, do not remove the case. There are no repairable components. If in doubt, contact professional personnel.

- When the photovoltaic array is exposed to light, it may produce a dangerously high voltage. Do not contact the output terminals or cables directly.

- The photovoltaic input voltage must be less than 550V. If the voltage is too high, the inverter may be damaged.

11. N on the off-grid side of the inverter is not directly connected to N on the power grid side in the inverter. Install and connect cables according to the requirements of the local power grid.

12. Avoid direct sunlight on the inverter.

13. When the inductive load of the motor is connected to the off-grid port, please note that the instantaneous peak current of the load starting shall not be greater than 40A.

1.4 Electric Safety

⚠ CAUTION

- All electrical connections must meet local and national standards.

- The inverter needs permission from the grid to connect to the grid.

Grounding Requirement

- When installing a device that needs to be grounded, install the ground cable first. When removing a device, remove the grounding cable at the end.
- Do not damage the grounding conductor.
- Do not operate the device without a ground conductor installed.
- The equipment shall be permanently connected to the protected area. Before operating the device, check the electrical connections of the device to ensure that the device is properly grounded.

General Requirement

DANGER

Before electrical connection, ensure that the device is not damaged; otherwise, electric shock or fire may occur.

- All electrical connections must meet national/regional electrical standards.
- You must obtain permission from the electricity authority of your country/region before you can connect to the grid.
- Cables prepared by customers must comply with local laws and regulations.
- When performing high voltage operations, use special insulation tools.

DC Operation

DANGER

Do not install or remove power cables when the power is on. Transient contact between the core of a power cable and the conductor generates electric arcs or sparks, which may cause fire or personal injury.

- Before electrical connection of the device, if live parts may be encountered, disconnect the corresponding breaking device at the front of the device.
- Before connecting a power cable, ensure that the label on the power cable is correct.
- If the device has multiple inputs, disconnect all inputs and perform operations on the device only after the device is completely powered off.

Wiring Requirements

- If cables are used in a high temperature environment, the insulation layer may be aged or damaged. Keep at least 30mm away from the heating device or heat source area.
- Cables of the same type are bound together. Cables of different types are routed

at least 30mm apart. Do not intertwine or cross each other.

- The cables used in the grid-connected photovoltaic power generation system must be securely connected, well insulated, and of appropriate specifications.

1.5 Battery

The batteries recommended by our company are strongly recommended. Please read the corresponding user manual carefully and strictly follow the user manual before installation.

⚠ WARNING

- short circuit or misinstallation of a battery can release energy and may cause combustion or fire hazards.

- Battery terminals and cables of the inverter may have fatal voltage. Contact with the cables and terminals of the inverter may result in serious injury or death.

⚠ WARNING

The battery system must have adequate ventilation to prevent the explosive gases released by the battery from producing flames and sparks。.

Because of the hazards of hydrogen and battery electrolyte：

- Keep batteries in designated areas and comply with local regulations；

- The battery protection case shall not be damaged；

- Do not disassemble a battery with a deformed bulge；

- When handling batteries, wear appropriate protective equipment, such as rubber gloves, rubber boots, and safety goggles；

- If battery acid spatter meets skin, wash immediately with water for a long time and consult a doctor.

⚠ WARNING

- Improper setting or maintenance may cause permanent damage to the battery；

- Incorrect inverter parameters can cause premature battery aging；

1.6 Personnel Requirement

- The personnel responsible for installation and maintenance of the equipment must be trained to understand all safety precautions, master the correct operation methods, have received the installation, commissioning and hazard handling training of the electrical system, and be familiar with the contents of this manual,

other relevant documents and local laws and regulations.

- Only professional or trained personnel can install, operate, and maintain the device.

1.7 Transportation Requirement

- The operation and service life of the energy storage depend on the operating temperature. Install the energy storage at a temperature equal to or better than the ambient temperature.
- The operating temperature of the system ranges from -20 ℃ to 55℃, among which, some functions of the product cannot work at -20 ℃ to 0℃, and the system may run at a load reduction when the temperature exceeds 40℃.
- If stored in a cold environment (e.g., 0°C) prior to installation, the battery modules require additional heating to be recharged. Before installation, you are advised to place the battery module in a relatively warm place to facilitate efficient commissioning.
- When the ambient temperature is higher than 45 ° C or lower than -10 ° C, the battery charging and discharging power may degrade.
- Certified by UN38.3 (UN38.3：Section 38.3 of the sixth Revised Edition of the Recommendations on the Transport of Dangerous Goods: Manual of Tests and Criteria)（This product belongs to Class 9 dangerous Goods）.
- Products meet the requirements of vehicle, ship and other transportation. The packing cases must be firm and conform to the national standard and should be marked "Handle with care" and "Keep away from moisture". Subject to external environment (such as temperature, transportation, storage, etc.), product specifications are subject to the delivery date。

  Avoid it during transportation：
- Direct shower of rain or snow or falling into water
- Fall or mechanical impact

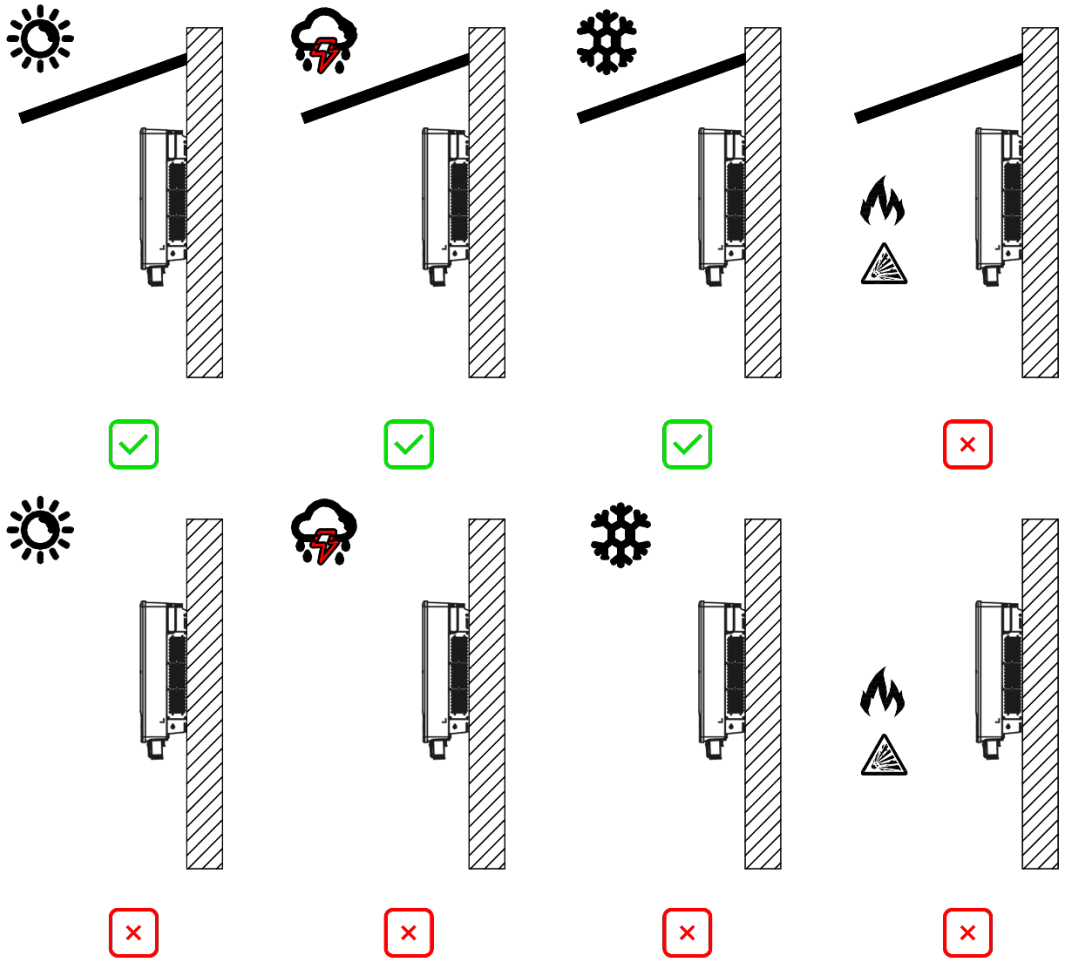
⚠ CAUTION

Do not transport batteries if they leak or bulge. Contact a battery recycling company for handling.

1.8 Installation Environment Requirements

- Install it in a dry and well-ventilated environment to ensure good heat dissipation.
- It is recommended to choose a sheltered installation site, or build an awning.
- Avoid direct sunlight or rain, the surrounding environment is clean, there is no large amount of infrared radiation, organic solvents and corrosive gases.
- Installation position away from fire source.
- The installation position is not accessible to children.
- Installation location away from water sources such as taps, sewer pipes, and sprinklers.
- The cabinet must be fixed to the wall or a fixed object with sufficient bearing capacity to avoid tipping.
- The outdoor unit is recommended to be installed under the eaves or in the garage. The indoor unit must be kept away from rain.
- The device must be on a solid, flat support surface.
- Do not place inflammable and explosive materials around the device.
- When the device is running, do not block the vent or heat dissipation system to prevent high temperature fire.
- Do not place the device in an environment with flammable or explosive gas or smoke, and do not perform any operation on the device.

Figure 1-1 Installation environment requirements



1.9 Installation and Debugging

- When carrying heavy objects, be prepared to bear them to avoid being crushed or sprained.
-

<18 kg (<40 Ib)	18 kg ~32 kg (40 Ib~70 Ib)	32 kg ~55 kg (70 Ib~121 Ib)	>55 kg (>121 Ib)

- Wear protective gloves when handling devices to avoid injury.
- When the device is powered on for the first time, professionals must set the parameters correctly. Incorrect Settings may cause the device to be inconsistent with the certification of the country or region where the device resides, affecting the normal operation of the device.

2. System

KY-ESS series inverter also known as hybrid inverter, is suitable for energy management systems such as photovoltaic, battery, load, power grid, etc. Electricity from solar panels is used for residential consumption, and excess electricity can be stored in batteries. When the battery is fully charged, users can feed excess power to the public grid.

When the amount of electricity generated by the photovoltaic is not enough to meet the load demand of the user, the battery will discharge to the load. If there is not enough energy stored in the battery, the grid will power the load through the system.

The KY-ESS series is an inverter with a transformerless topology, there is no isolation between DC input and AC output, and the adaptive PV model must meet IEC61730 Grade A. The energy management system is shown in Figure 2-1.

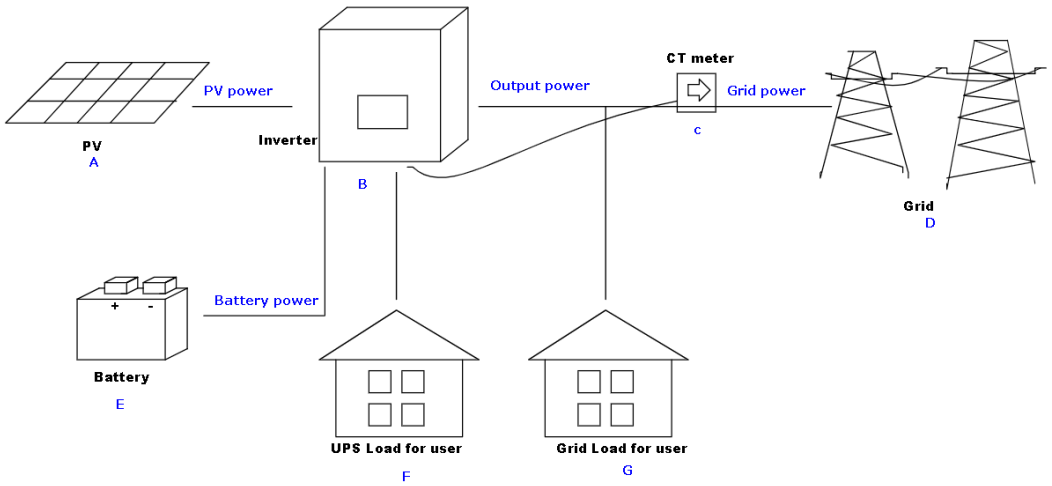


Figure 2-1. Photovoltaic energy storage energy management system

SN	Description	Remarks
A	PV modules	PV Type
B	Inverter	Type KY-5KW-ESS
C	Single-phase meter	RS485 communication with inverter
D	Utility grid	Grid type： TT,TN
E	Battery system	Lead-acid or lithium batteries
F	UPS load	The load connected to the EPS port of the inverter
G	Grid load	Connected to the user load on the grid

⚠ WARNING

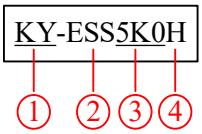
For the grid type of TT system, the voltage of the N phase and the direct earth must be below 30V.

2.1 Product Introduction

2.1.1 Inverter Introduction

Model description

The meaning of this inverter model description is as follows:



1	Abbreviation of a company	KY: KOYOE
2	Type	ESS： Single-phase energy storage inverter
3	Nominal power	5K0：Nominal power 5kW
4	Battery	H：High-voltage battery

Appearance

The following figure is the appearance of this inverter, for reference only, the actual received products may vary.

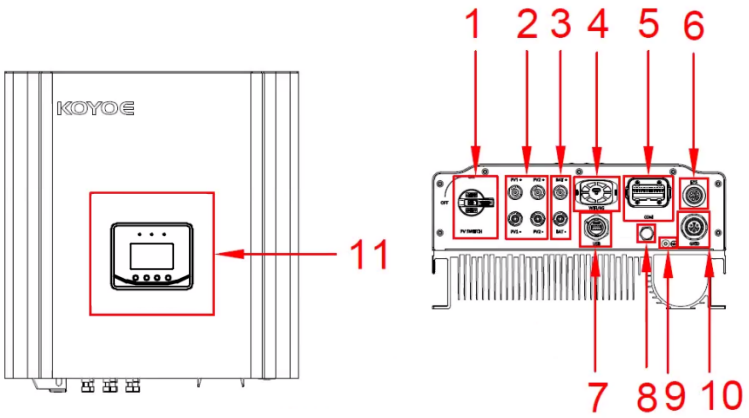


Figure 2-2. Product appearance drawing

Introduction			
NO.	Interface	NO.	Interface
1	PV Switch	2	PV Interface
3	BAT Interface	4	WIFI/4G
5	COM Interface	6	EPS Interface
7	USB Interface	8	Relief Valve
9	Grounding Screw	10	GRID Interface
11	Display Panel		

⚠ CAUTION

This inverter contains PV switch, for safety reasons, it is recommended to configure a DC switch between the PV array and the PV input terminal of the inverter (mandatory in some countries).

Dimension

The dimensions of this inverter are shown in Figure 1-3, and the description of the LCD panel is shown in Figure 1-4 and the table below.

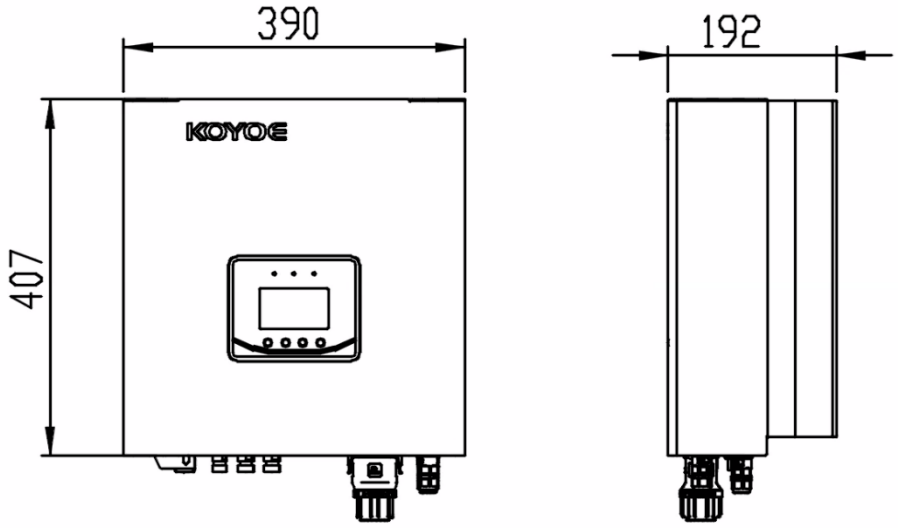


Figure 2-3. Inverter size diagram (unit: mm)

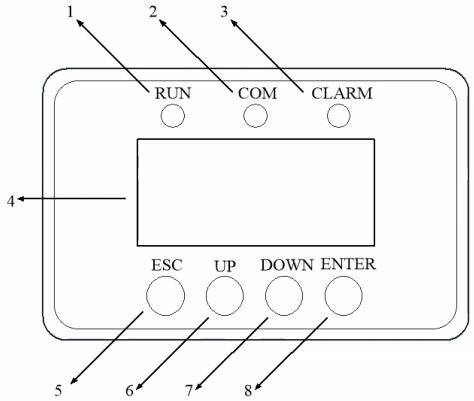
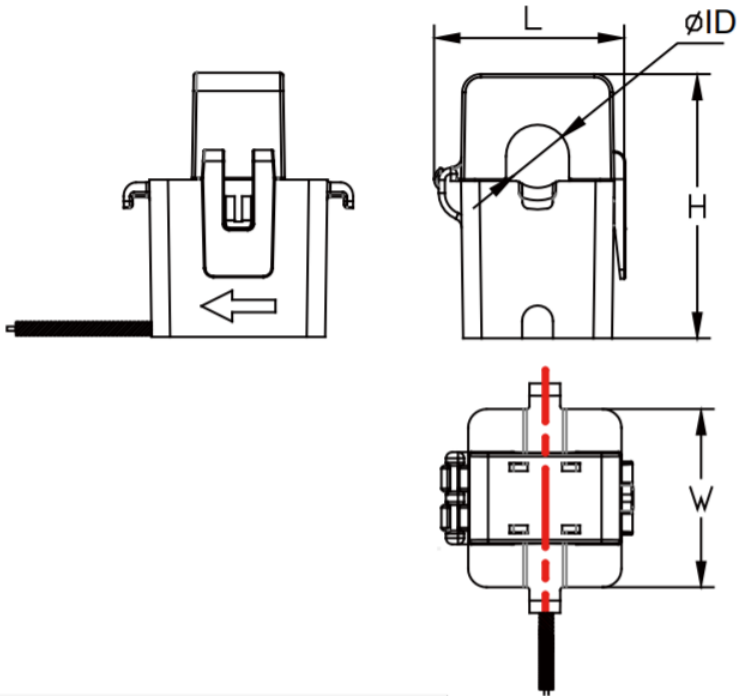


Figure 1-4. LCD panel schematic

SN	NAME	Discription
1	Run indicator (green)	After the inverter is powered on, the LED light flashes. When the inverter is in normal mode, the LED will always be on
2	Communication indicator (yellow)	When the inverter communicates with the host computer through WIFI and GPRS, the LED flashes
3	Warning light (red)	When an alarm occurs, the LED flashes. When a fault occurs, the LED is solid on
4	LCD screen	Screen
5	Exit button	Exit
6	UP button	Page up or move the cursor
7	Down Button	Page down or move the cursor
8	Confirm Button	Confirm

2.1.2 Current Transformers

The meter is installed on the home side of the grid to detect the electrical measurement at the grid-connected point, and it communicates with the inverter via RS485. This inverter uses CT type electricity meter, and the following figure is the size drawing and schematic diagram of CT meter.



The specific size is : ID-L-W-H（mm）： 16.0/37.8/33.9/49

Figure 2-5. CT meter size description (unit: mm)

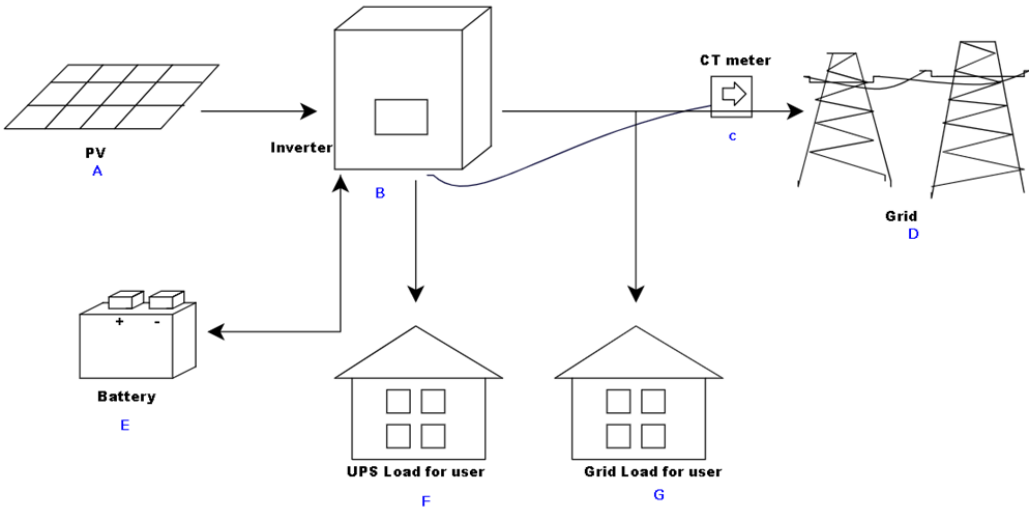


Figure 2-6. Connection diagram of CT meter on the grid side (unit: mm)

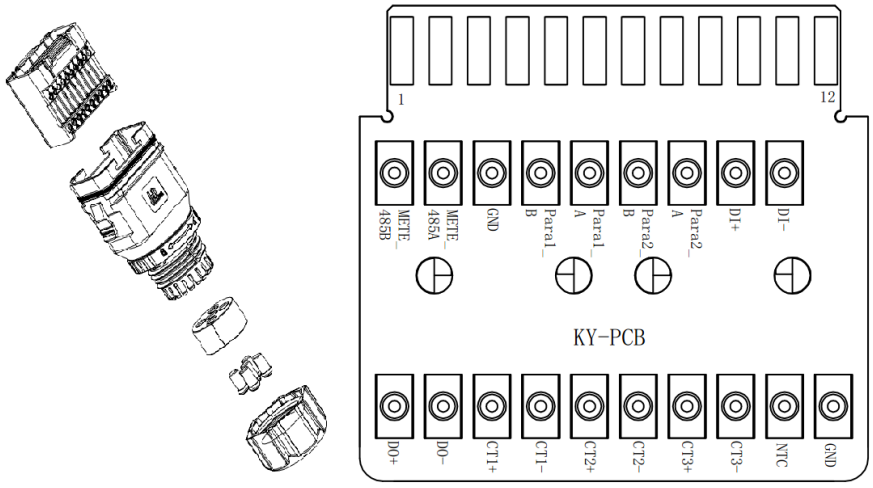


Figure 2-7. Connection mode between CT ammeter and inverter port.

The green line of the CT meter is connected to CT1- and the red line is connected to CT1+

3. Energy Management

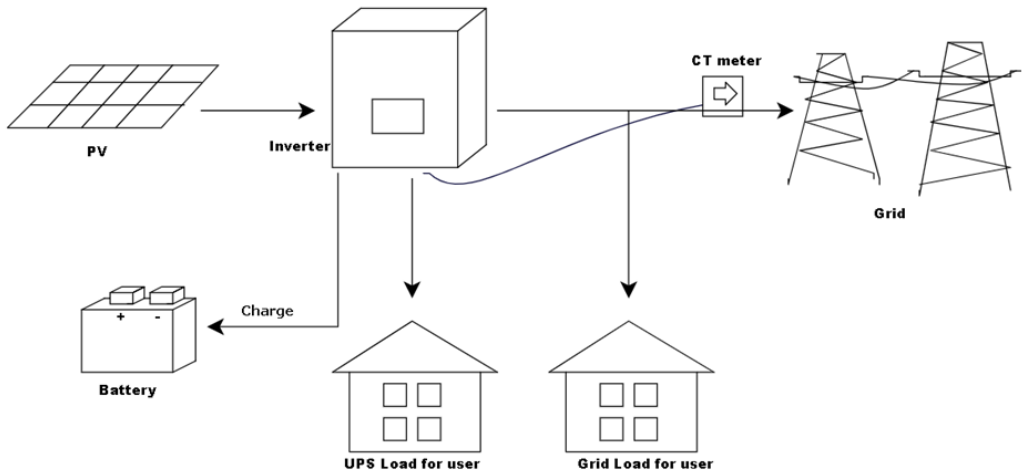
According to different configurations and layouts, this series of inverters usually have the following normal operation modes:

1. Spontaneous self-consumption surplus power grid mode (need to be connected to the power grid, power off and saved)
2. Strong charging mode (need to be connected to the power grid, power failure is not saved)
3. Strong discharge mode (need to be connected to the power grid, power failure is not saved)
4. Peak shaving and valley filling mode (need to be connected to the power grid, power off and saved)
5. Maintenance mode (need to connect to the power grid, power failure is not saved)
6. Emergency charging mode (need to be connected to the power grid, power failure does not save)
7. Off-grid mode (no need to connect to the grid, only for off-grid situations)

Users can set the inverter to the above working mode according to actual needs, and the detailed mode settings and functions are introduced as follows：

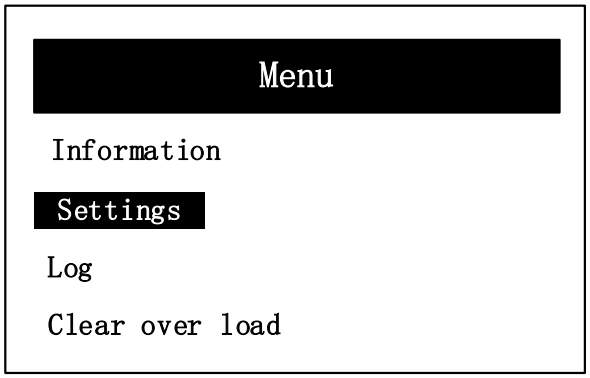
3.1 Self Use

The energy generated by the photovoltaic system is prioritized to meet its own load consumption, followed by excess energy for charging the battery, and finally the remaining energy can limit the power fed into the grid by setting the power size of the grid-connected point, as shown in the figure below.

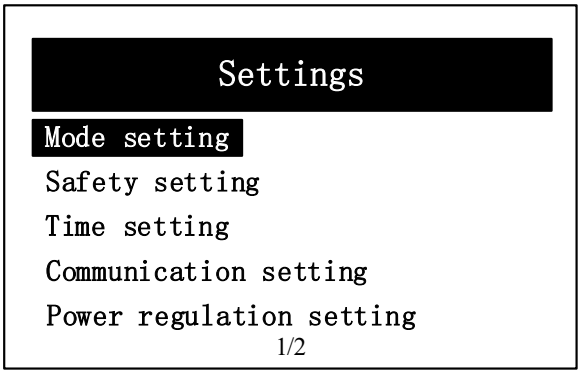


The mode setting process is as follows:

1) After pressing the "ENTER" button under the main interface, enter the following menu, and then select "Settings" through the "UP", "DOWN" button.

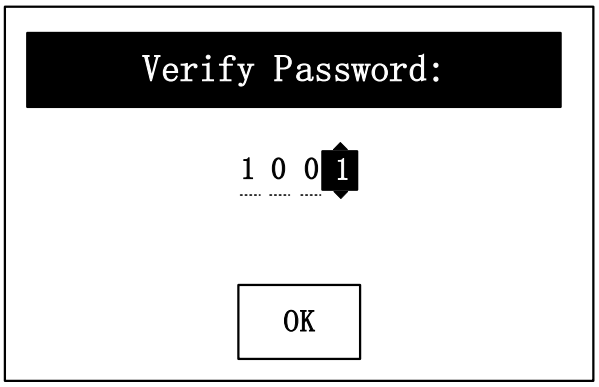


2）After pressing the "ENTER" button under the above interface, enter the following menu, and then select "Mode setting" through the "UP", "DOWN" button.

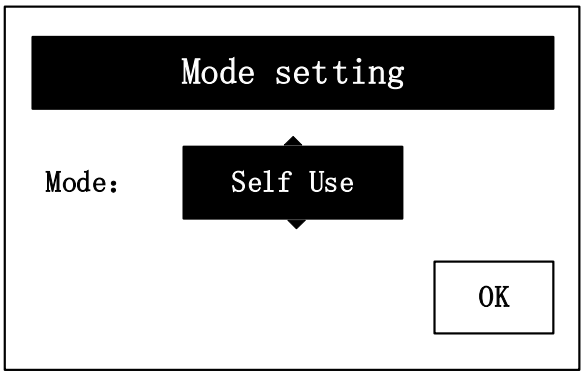


3）After pressing the "ENTER" button under the above interface, enter the password interface, follow the following menu, enter the password, press the "ENTER" key, select the cursor and add or subtract values through the "UP", "DOWN" button, and then press the "ENTER" key again to confirm the value at the input cursor, move the cursor to "OK",

press the "ENTER" key and confirm the input. (Valid within 5 minutes, please re-enter after 5 minutes)



4）Under the above interface, after entering the password, press the "ENTER" key to enter the following menu, the interface will display the current working mode, press the "ENTER" key, select the desired working mode through the "UP", "DOWN" button, press the "ENTER" button again to confirm the selected mode, move the cursor to "OK", press the "ENTER" key and confirm the input.

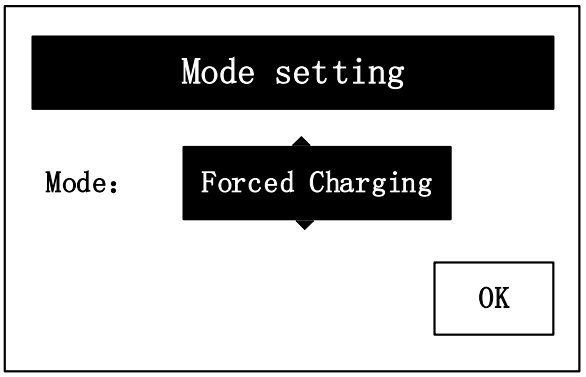


5）After the above operation, press the "ESC" button to return to the main interface, and you can observe the running status after changing the mode.

3.2 Forced Charging

This mode must be connected to the grid to take effect, in the strong charge mode, the inverter selects the appropriate power to charge the battery according to the BMS allowable charging current and energy management calculation value. When the SOC is charged to the upper limit or the working mode is changed, the strong charge mode is exited.

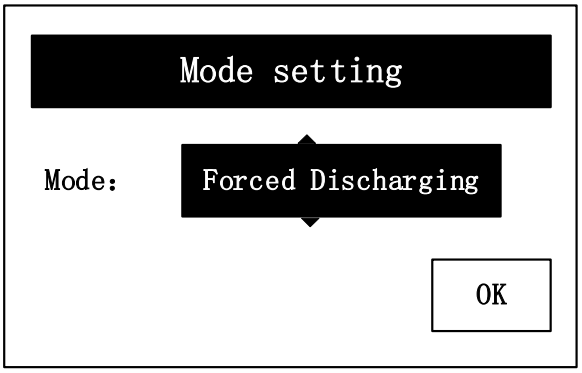
In “Mode setting”, select the content shown in the figure below to set the forced charging mode. For other steps, please refer to 3.1.



3.3 Forced Discharging

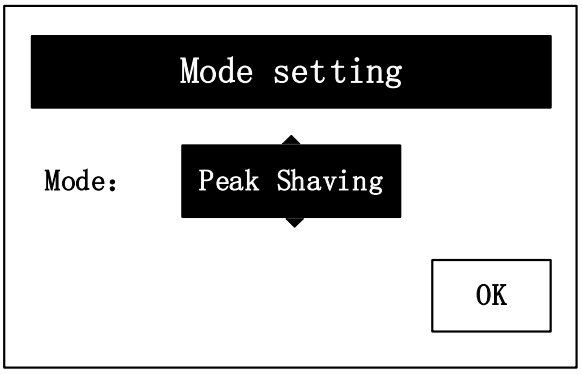
This mode must be connected to the grid to take effect, in the strong discharge mode, the inverter selects the appropriate power to feed into the grid according to the allowable discharge current of the BMS, SOC and energy management calculation value. When the BMS stop discharge command is received or the working mode is changed, the forced discharge mode is exited.

In “Mode setting”, select the content shown in the figure below to set the forced discharge mode, for other steps, please refer to 3.1.



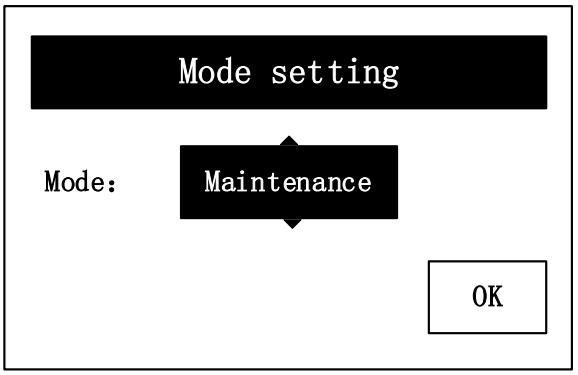
3.4 Peak Shaving

This mode must be connected to the grid to take effect, in the peak shaving mode, the inverter can set up to 10 sets of discontinuous charging and discharging periods within 24 hours; In this mode, priority is given to the load power supply, charging or discharging power is adjusted according to the BMS allowable value and the current energy management.



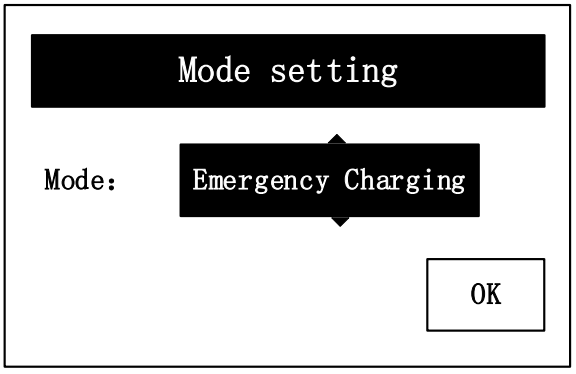
3.5 Maintenance

This mode must be connected to the grid to take effect, in maintenance mode, the inverter will charge the battery until the SOC is 100% charged or set to another mode and automatically exit this mode. The power of the charge regulates itself according to the allowable value of the BMS and the current energy management.



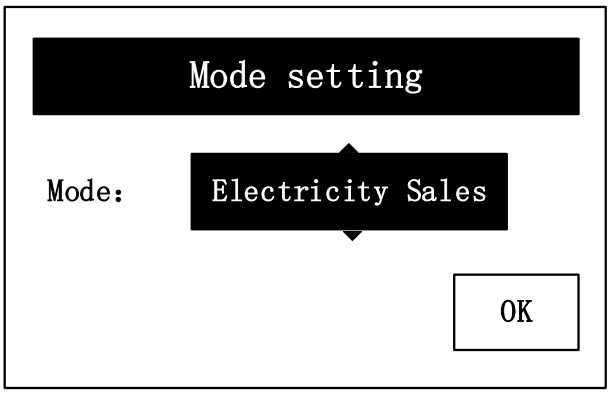
3.6 Emergency Charging

In emergency charging mode, the inverter will charge the battery according to the BMS start or stop charging command until the SOC is charged to the upper limit or set to another mode and automatically exit the mode. The power of the charge regulates itself according to the allowable value of the BMS and the current energy management.



3.7 Electricity Sales

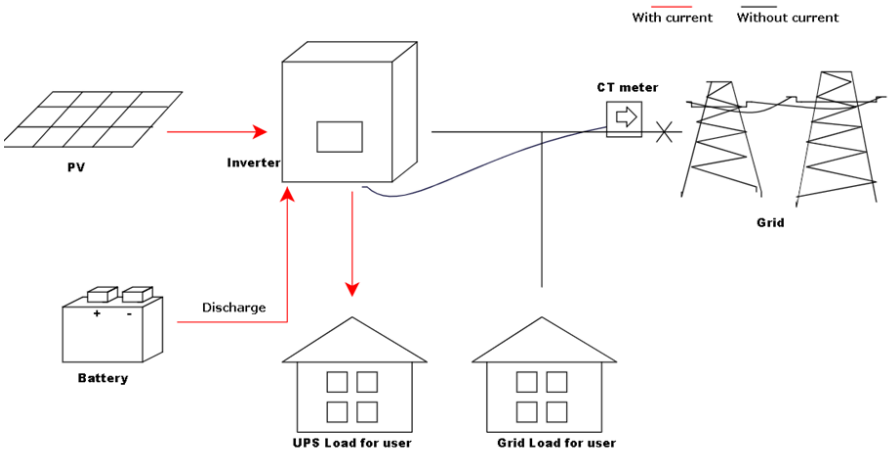
This mode is similar to the peak shaving mode, which supports discharging without load.



3.8 Off Grid

When the inverter only has a battery, or photovoltaic with battery, the inverter is in off-grid mode after normal operation, and when the grid is connected, the inverter will automatically cut into the grid, and automatically enter the "spontaneous self-consumption" or "peak shaving and valley filling" mode according to user settings.

When the grid is disconnected, the inverter will automatically switch to the off-grid state.



Note:

- The utility grid must be an off-grid application of the TN system;
- This mode is not suitable for the provision of life-sustaining medical equipment that may cause personal injury in the event of a power failure;
-In the case that the inverter is only connected to the photovoltaic and the grid, the inverter can also be connected to the grid.

4. Working Status

4.1 Standby Status

When the inverter is only connected to the grid or only connected to photovoltaics, the inverter enters the standby state, at this time the LCD shows "waiting", the inverter will always detect the current working state, and when the conditions are met, the inverter will automatically resume normal operation.

4.2 Self-test Status

After the inverter is powered on or restarted from a recoverability fault, a check self-test will be performed, at which time the LCD will display "checking 60s", and if the self-test is faulty or warning, the inverter will prompt.

4.3 Normal Status

After the inverter self-test is successful, the inverter will enter the normal working state, and the running light of the LCD will be on continuously. Users can view relevant information through the LCD

4.4 Failed Status

When the inverter fails, the inverter will automatically stop the output, enter the fault mode, and the fault information will be displayed on the LCD. Before entering the failure mode, the inverter automatically saves the relevant information. If the fault is recoverable, the inverter will automatically resume operation. When an unrecoverable fault occurs, the inverter stops in failure mode until the relevant technician handles the fault.

⚠ WARNING

- When the inverter failed, it must be repaired by a professional.
- The error code displayed on the LCD can be viewed in the appendix.

4.5 Upgrade Status

Regardless of the operating mode of the inverter, when the system meets the conditions for updating the software, the inverter enters an upgraded state and the firmware is rewritten. Users can download the latest upgrade operation guide from the official website of KOYOE.

5. Feature Description

5.1 Protection Features

The inverter integrates protection functions such as short-circuit protection, grounding insulation resistance monitoring, residual current protection, anti-islanding protection, and DC overvoltage/overcurrent protection.

5.2 Energy Conversion and Management

The inverter converts the DC power supply of photovoltaic panels or batteries into AC power that meets the requirements of the grid. It also transfers the energy of photovoltaics to the cell.

The inverter integrates a bidirectional converter, and the inverter can charge or discharge the battery.

Two PV MPPT trackers can be used to maximize the power of PV panels of different orientations, inclinations, or module structures.

5.3 Power Derating

Power derating is a way to prevent overload or potential failure of the inverter. In addition, the derating function can be activated according to the requirements of the power grid. Inverter power derating is required in the following situations:

- Grid dispatching;
- The internal power module of the inverter or the internal environment of the inverter is over-temperature;
- Limit setting of output power;
- Power response mode;

Grid dispatch derating

The output power is adjusted according to the remote dispatching command, and the inverter is derated to operate.

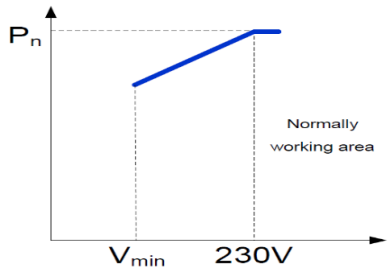
Ultra-high temperature derating

Excessive ambient temperature or poor ventilation can cause inverter derating.

When the internal temperature or module temperature exceeds the upper limit, the inverter reduces the output power until the temperature drops to the allowable range.

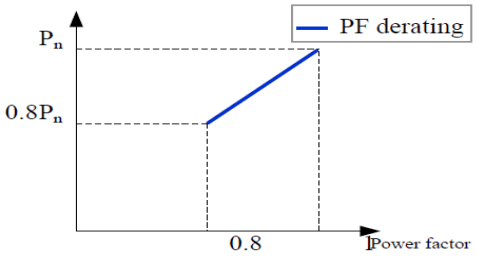
Grid undervoltage drop

When the grid voltage is too low, the inverter will reduce the output power to ensure that the output current is within the allowable range. The undervoltage derating curve is shown in the figure below.



Power factor derating

When the power factor PF<1.0, the inverter reduces the output power to the specified range. The figure below shows the power factor derating curve.



5.4 External Instruction Response

The inverter provides terminal blocks for connection to demand response enabling devices (DRED). DRED Demand Response Models (DRMs) are available in Australia. The inverter detects and responds to all supported demand-response commands within 2s.

The DRM supported by the inverter is shown in the following table.

Mode	Instruction
DRM0	The inverter is in the "off" state.
DRM1	The grid input power is 0.
DRM2	Grid input power does not exceed 50% of rated power.
DRM3	Grid input power does not exceed 75% of rated power.
DRM4	The grid input power is 100% of the rated power, but it is limited by other DRMs.
DRM5	The power output of the inverter to the grid is 0.
DRM6	The power output of the inverter to the grid does not exceed 50% of the rated power.
DRM7	The power output of the inverter to the grid does not exceed 75% of the rated power.
DRM8	The power output of the inverter to the grid is 100% of the rated power, but is limited

	by other DRMs.

DRED can declare multiple DRMs at once, and the inverter responds according to the priority of the instruction, the following is the priority order.

Multiple modes	**Order of precedence**
DRM1…DRM4	DRM1 > DRM2 > DRM3 > DRM4
DRM5…DRM8	DRM5 > DRM6 > DRM7 > DRM8

6. Unpacking and Storage

6.1 Unpacking and Inspection

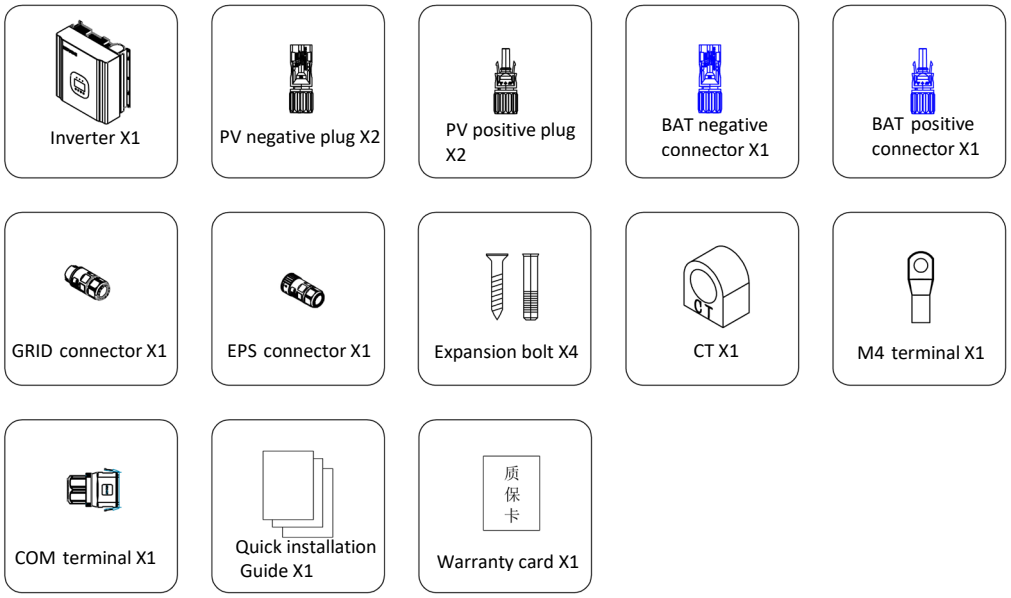
The inverter is fully tested and strictly inspected before leaving the factory. Damage can still occur during transport. Therefore, once you receive your device, the first thing to do is to do a thorough inspection.

1. Check the package for obvious damage.
2. Check whether the shipping content is complete according to the packing list.
3. Check the inside for visible damage.

If there is any damage or incompleteness, please contact the company or supplier. Do not discard the original box. It is recommended to store the inverter in it.

6.2 Packing List

After receiving the inverter, please check if all the following parts are missing or damaged. Among them, the WIFI or GPRS module is configured according to the user's choice when placing an order.



6.3 Inverter Storage

If the inverter is not installed immediately, proper storage is required.

- Keep the inverter in the original box, which has desiccant inside.

-The storage temperature should always be kept between -30 °C ~ +85 °C, and the storage relative humidity should always be kept between 5 ~ 95%.

- When stacking and storing, the number of stacking layers must not exceed the label on the outer packaging of the box (KY-ESS stacking layers is 6 layers).

-The package must stand upright.

- If the inverter has been stored for more than a year, it must be thoroughly inspected and tested by a professional before installation.

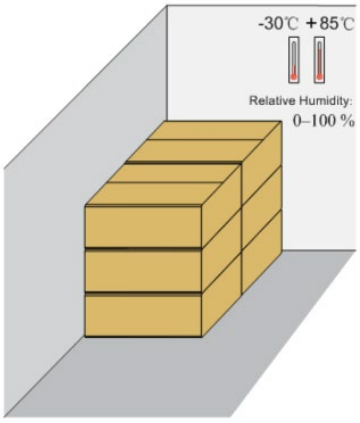


Figure 6-1. Schematic diagram of inverter storage

7. Inverter Installation

7.1 Safety Measure before Installation

⚠ WARNING

Make sure there are no electrical connections before installation.

To avoid electric shock or other injury, it is important to confirm that there are no energized pipes or other devices before drilling.

⚠ WARNING

The following improper actions may cause personal injury.

- When moving and positioning the inverter, it is necessary to follow the instructions.

-System performance degradation may occur due to poor ventilation.

- For safety reasons, it is forbidden to open the upper cover.

WARNING

-Please wear gloves when installing the inverter to avoid scratches.

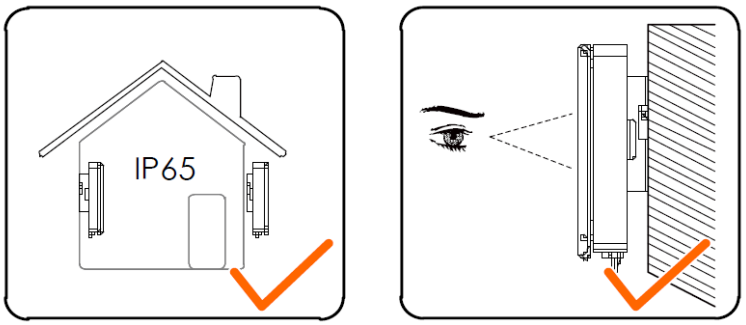
- The inverter must be installed by a professional.

7.2 Installation Position

Choose an optimal mounting position to facilitate safe operation and maximize the performance and long life of the inverter.

This inverter is an IP65 rated inverter, which can be installed indoors and outdoors.

Install the inverter in a place that is convenient for electrical connection, operation and maintenance.



7.3 Installation Environment Requirements

The installation environment of this inverter must meet the following requirements:

-The installation environment must be away from flammable and explosive dangerous goods.

- The inverter must be installed in an environment out of reach of children.

-Ambient temperature (-25°C ~ + 60°C) and relative humidity (4% ~ 95% non-condensing).

-Do not expose the inverter directly to sunlight, rain and snow.

-The inverter should be well ventilated to ensure air circulation of the radiator.

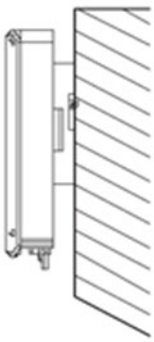
-Do not install the inverter in the living area, otherwise the inverter will generate noise during operation, which will affect daily life.

7.4 Installation Carrier Requirements

The installation environment of this inverter must meet the following requirements:

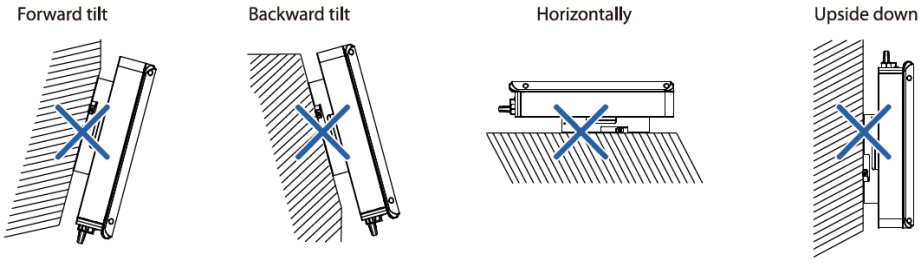
Must be non-combustible material

Must be able to withstand more than 4 times the weight of the inverter



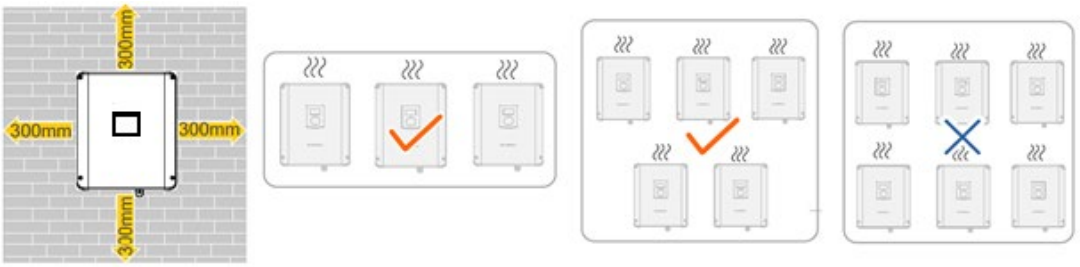
7.5 Installation Angle requirement

Never install inverters horizontally, or tilt them forward or backward, or even upside-down. Otherwise, the inverter will be damaged



7.6 Installation Clearance Requirements

Please reserve enough space around the inverter to ensure that there is enough space to dissipate heat from the inverter. For single-phase PCS, the installation is shown in the figure.

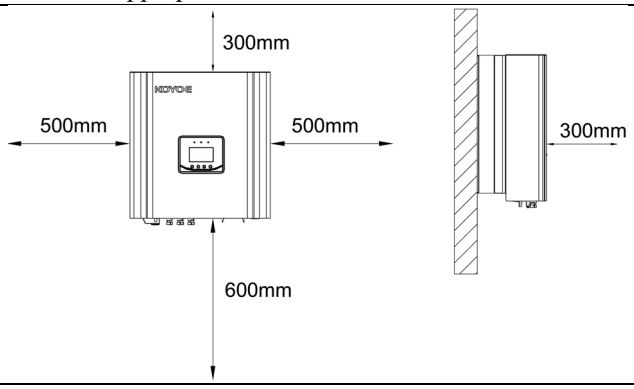


7.7 Install the Inverter

This inverter is heavy! Be careful when taking it out of the package.

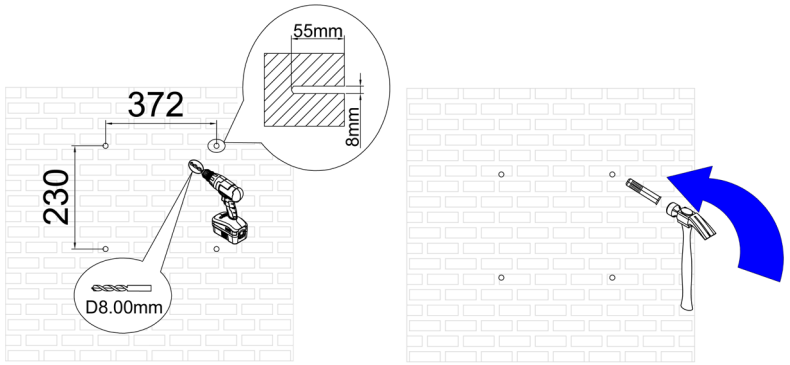
For single-phase PCS, this inverter is only suitable for installation on concrete or other non-combustible surfaces. If the energy storage system is installed with a battery pack, see the battery instructions on the battery side for installation instructions, and install the energy storage system according to the battery instructions

Step 1： Select the appropriate installation location

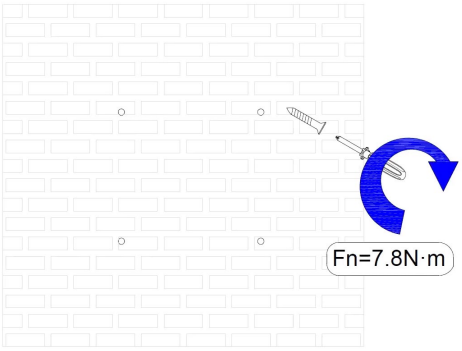


Front：	300mm
Left：	500mm
Right：	500mm
Down：	600mm
Up ：	300mm

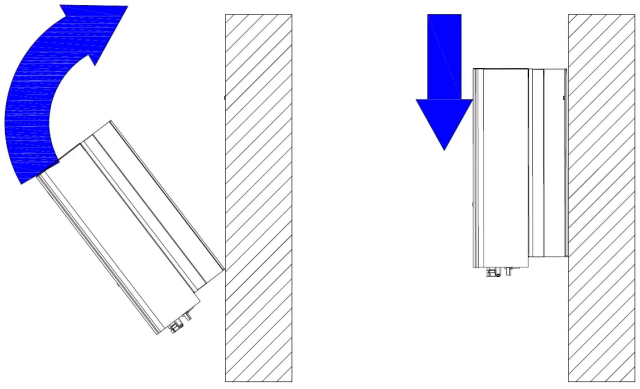
Step 2： Install expansion bolts



Step 3： Lock the expansion screw



Step 4： Install the inverter



8. Electrical Connection

8.1 Safety Caution

Before any electrical connection, keep in mind that this inverter is a multi-power supply. Electrical connections must be made by a professional and personal protective equipment must be worn when connecting.

⚠ WARNING

There is a deadly high voltage inside the inverter, please pay attention to safety when operating.

- PV panels will produce deadly high voltage in sunlight, do not touch PV output cables or interfaces.
- Before starting the electrical connection, it is necessary to confirm that the DC and AC circuit breakers are disconnected and prevent them from being inadvertently reconnected.
-Before connecting cables, make sure that all cables are free of voltage or current.

⚠ WARNING

When connecting cables, personal injury or equipment damage may occur due to improper operation.

Only professional personnel can make cable connections.

All cables must be intact, securely connected, properly insulated and appropriately sized.

⚠ WARNING

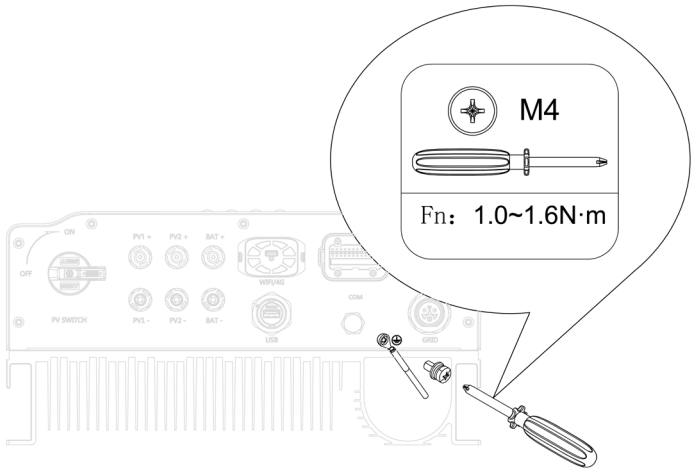
Follow the safety instructions related to photovoltaic panels and the regulations related to the power grid.

All electrical connections must comply with local and national standards.

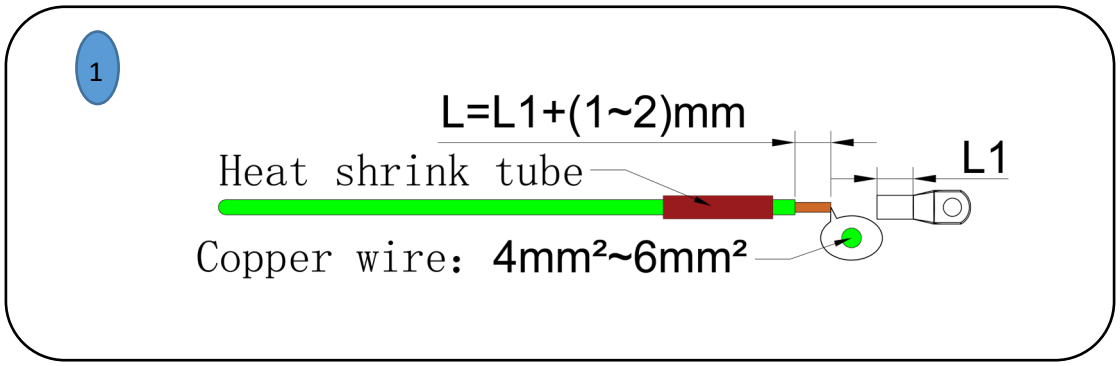
Inverters need to be licensed by the grid to be connected to the grid.

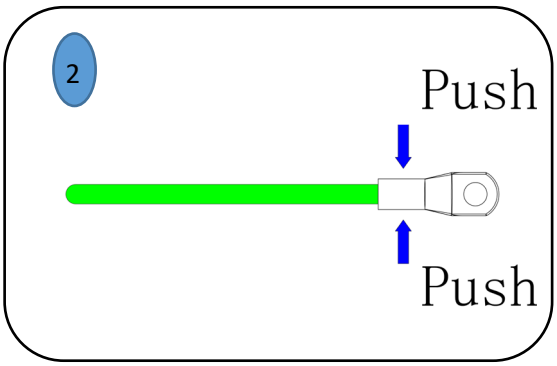
8.2 Ground Wire Connection

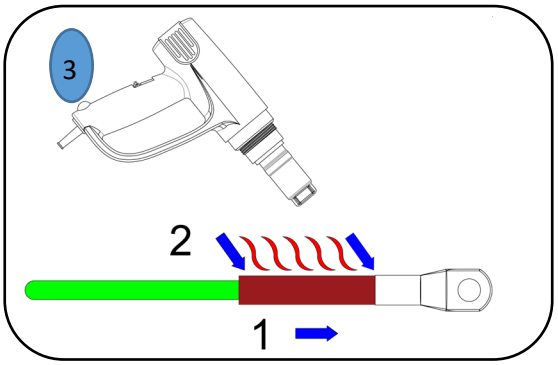
Installation position of the grounding cable



Wiring Harness Making

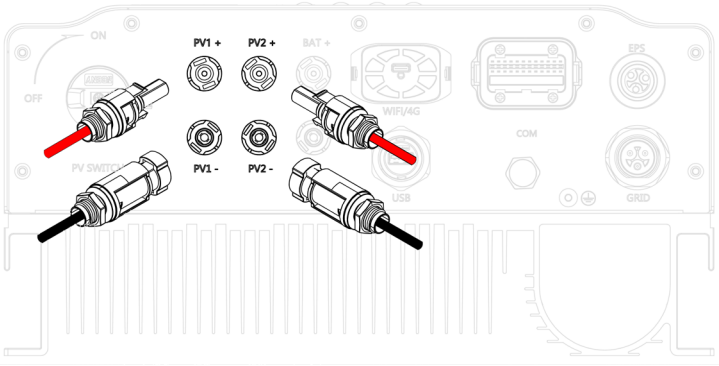




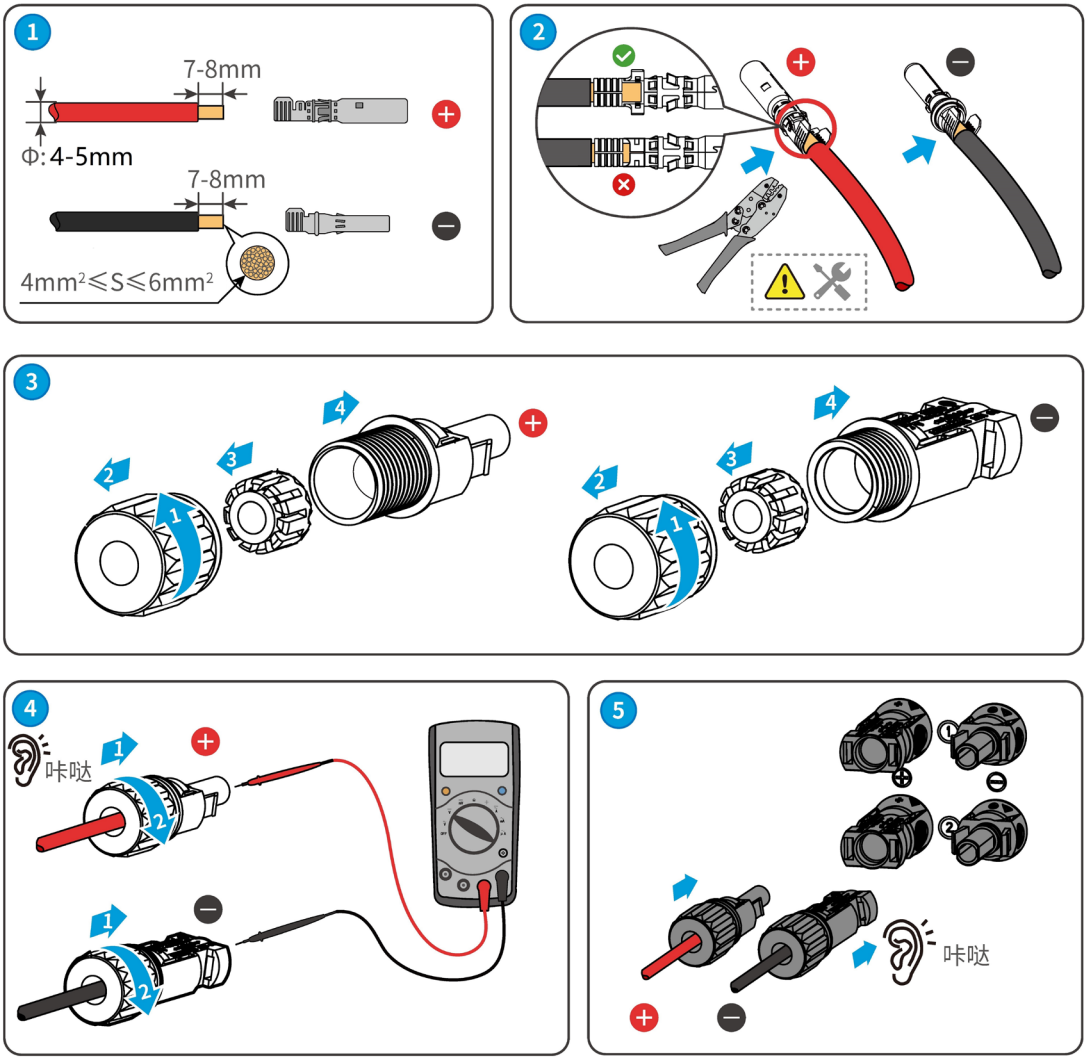


8.3 PV Connection

Installation position



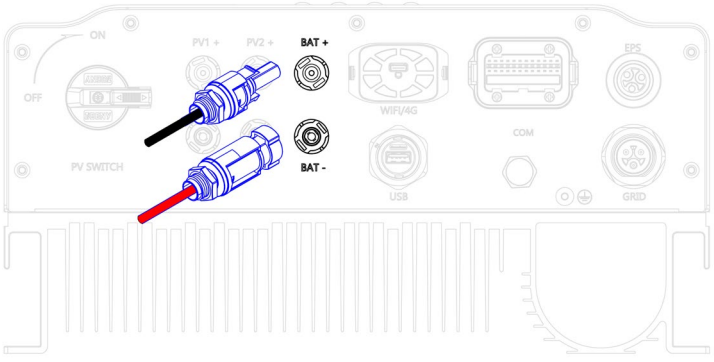
Wiring Harness Making



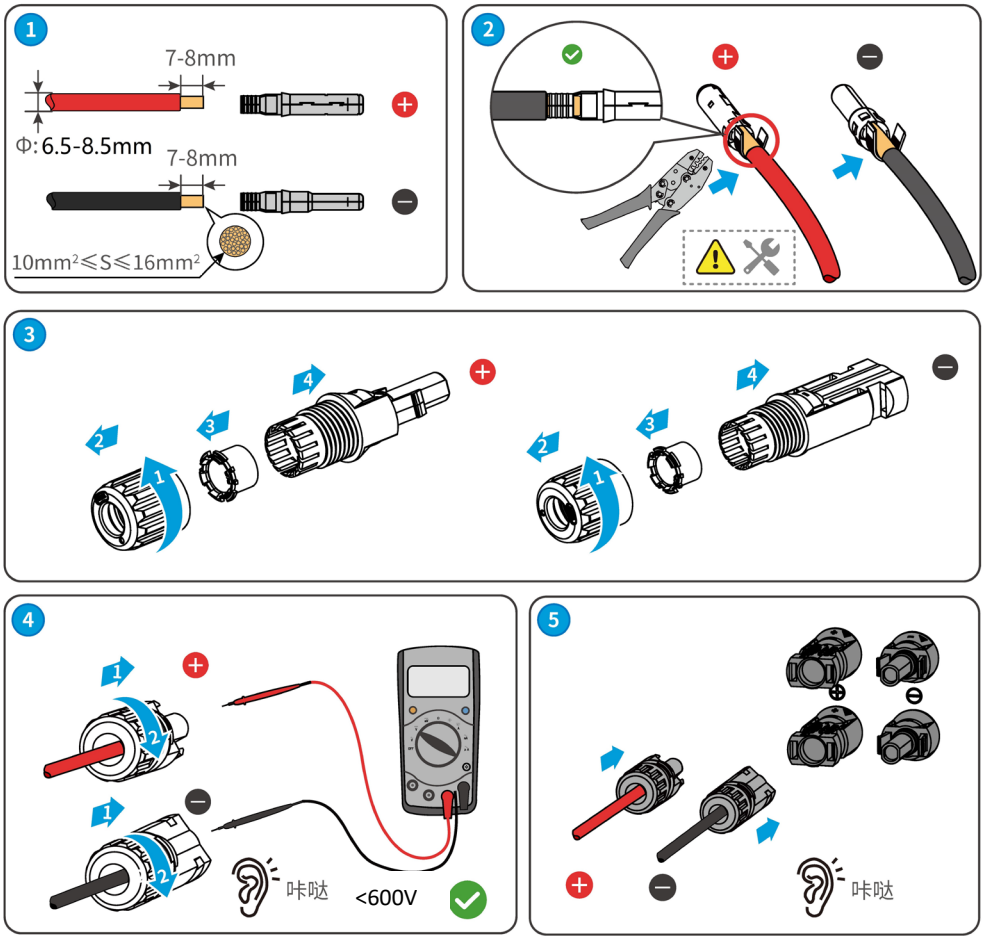
Before inserting the PV interface, please confirm the following two points:
1) The PV module voltage must not be higher than 600Vdc;
2) Before connecting the PV interface to the inverter, please disconnect the PV combiner box switch and the PV switch of the inverter

8.4 Battery Interface Connection

Installation position

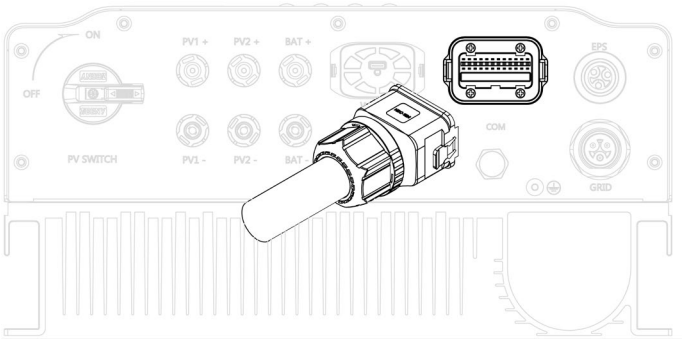


Wiring Harness Making

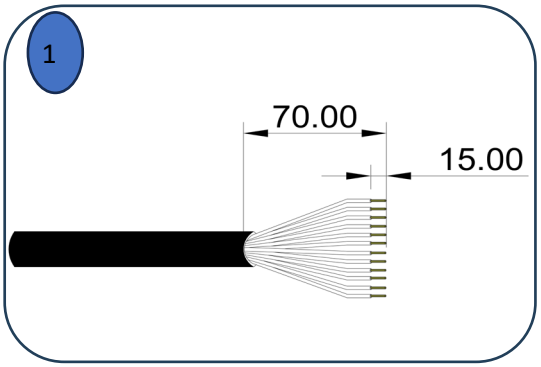


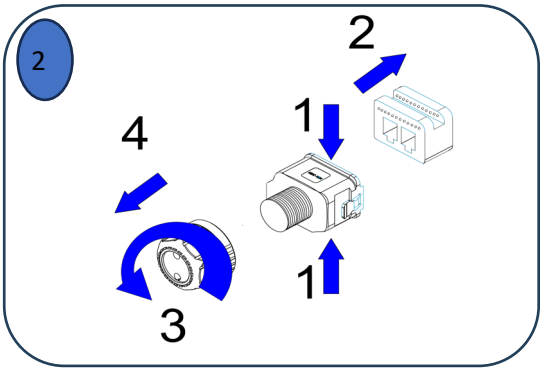
8.5 COM Interface Connections

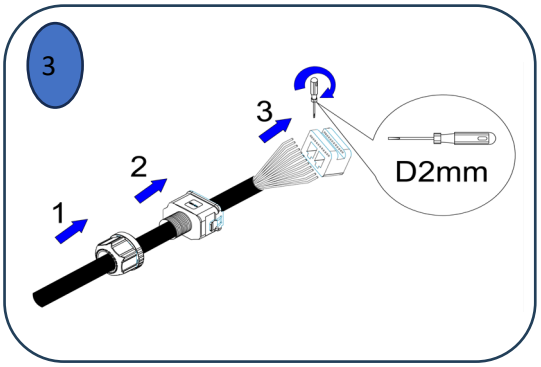
Installation position

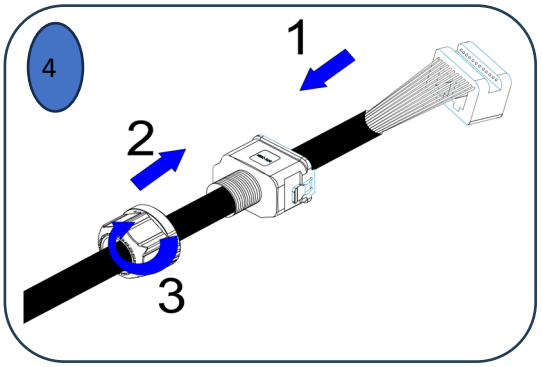


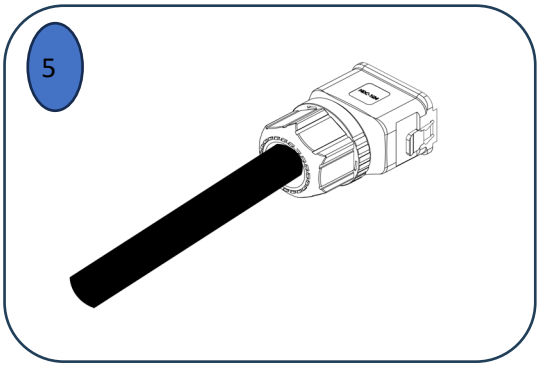
Wiring Harness Making



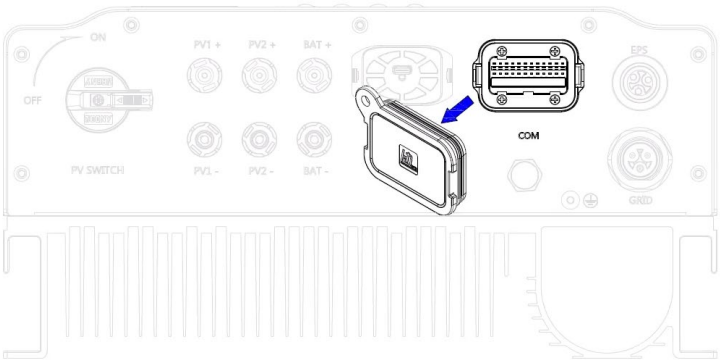




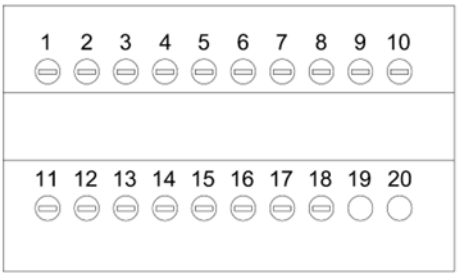


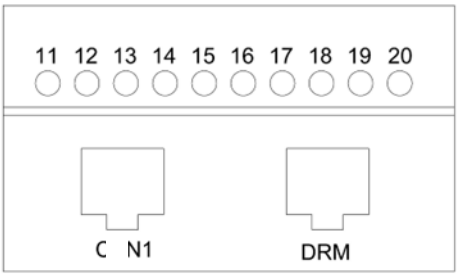


Before installation, the cover plate needs to be removed as shown below



Communication interface location and definition



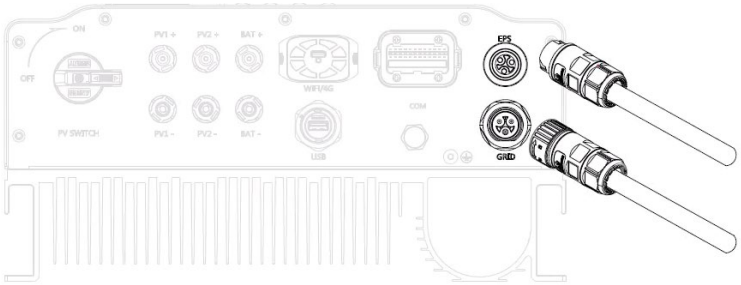


NO.	Description	NO.	Description
1	METER 485B	11	D0+
2	METER 485A	12	D0-
3	GND	13	CT1+
4	Para1_B	14	CT1-
5	Para1_A	15	CT2+ Do not use
6	Para2_B	16	CT2- Do not use
7	Para2_A	17	CT3+ Do not use
8	DI+	18	CT3- Do not use
9	DI- dry contact	19	NTC
10	NC	20	GND

Left net port：CAN				Right net port：DRM			
PIN： Left — Right （PIN1—PIN2）				PIN： Left — Right （PIN1—PIN2）			
PIN1	NC	PIN2	NC	PIN1	DRM1/5	PIN2	DRM2/6
PIN3	NC	PIN4	CAN_H	PIN3	DRM3/7	PIN4	DRM4/8
PIN5	CAN_L	PIN6	NC	PIN5	GEN	PIN6	COM
PIN7	NC	PIN8	NC	PIN7	NC	PIN8	NC

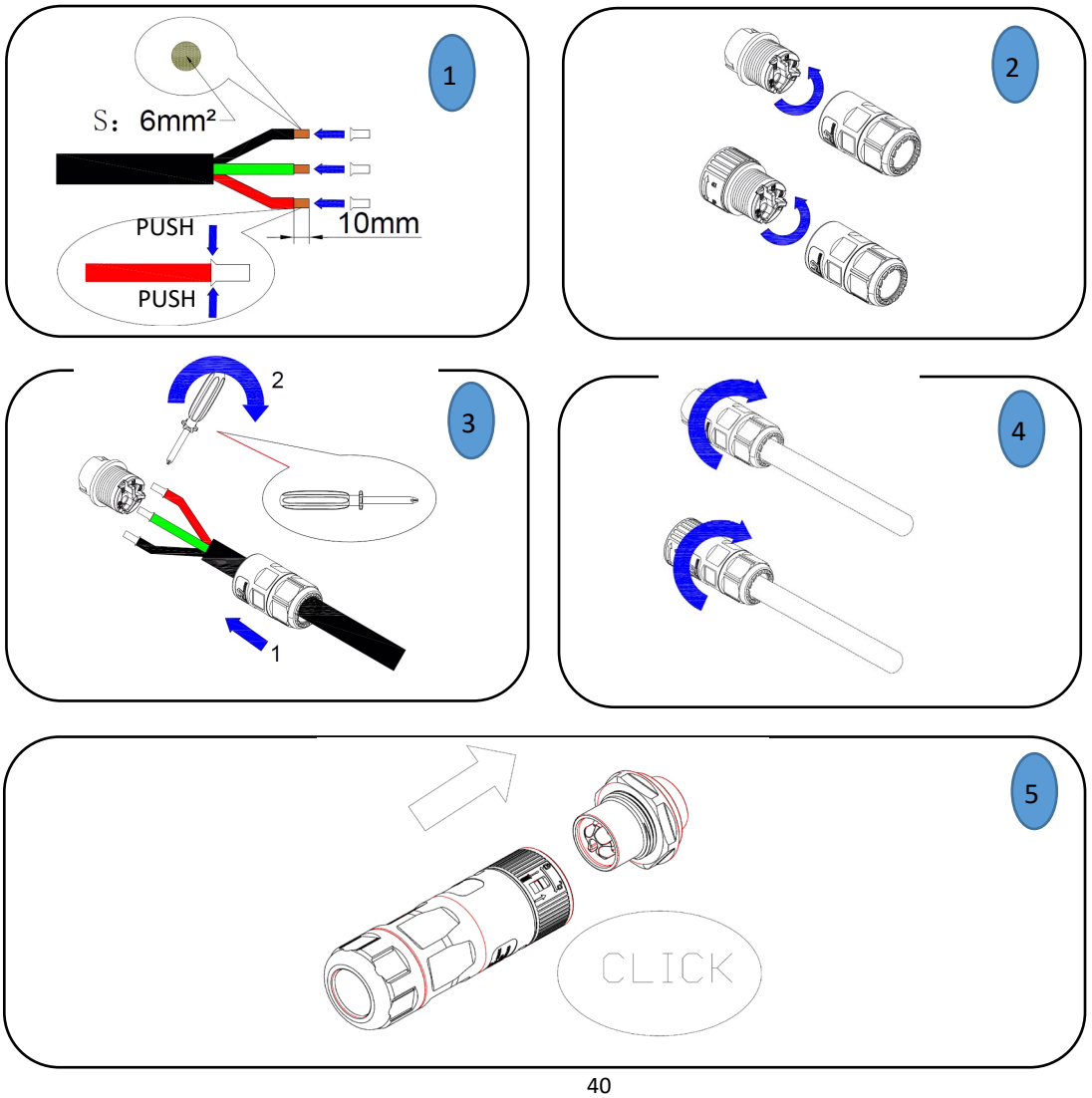
8.6 AC Connection

Installation position



Terminal definition	Phase sequence	Harness color
L	L	Red
N	N	Black
PE	PE	Yellow-Green

Wiring Harness Making



9. Debugging

9.1 Pre-commissioning Inspection

Before the system starts, you need to check the following:

1. Inverter DC switch and external air-open disconnection.
2. The inverter should be easy to operate, maintain and repair.
3. There is no debris on the top of the inverter or battery.
4. The inverter is properly connected to external devices, and the cable routing is safe or without mechanical damage.
5. The selection of AC circuit breakers should follow this manual and all applicable local standards.
6. The unused terminals at the bottom of the inverter need to be sealed.
7. Warning signs and labels fit properly and are durable.
8. When .EPS applying, check the inverter wiring, if the power grid power cord is wrongly connected to the EPS load terminal, there is a risk of damaging the inverter.

9.2 Power up the System

If all the items in Chapter 7 meet the requirements, start the inverter for the first time according to the following steps.

1. Rotate the DC switch on the inverter panel to the "ON" position.
2. Turn on the AC switch between the inverter and the grid.
3. Turn on the switch between the inverter and the battery, and if it is supplied to our company, turn on the switch of the battery main control box.
4. After the LCD screen is on, the inverter will automatically start to detect, the top of the LCD screen will display the current status, if Normal is displayed, it means that the inverter is working normally.

9.3 LCD Introduction

When the LCD display is normal, the user can set and view the parameters through the button. The detailed menu flowchart is shown in Figure 9-1.

The important parameters of the inverter must be set by professionals, otherwise it may cause the inverter to not work properly. Please contact customer service for setting the password of the parameter.

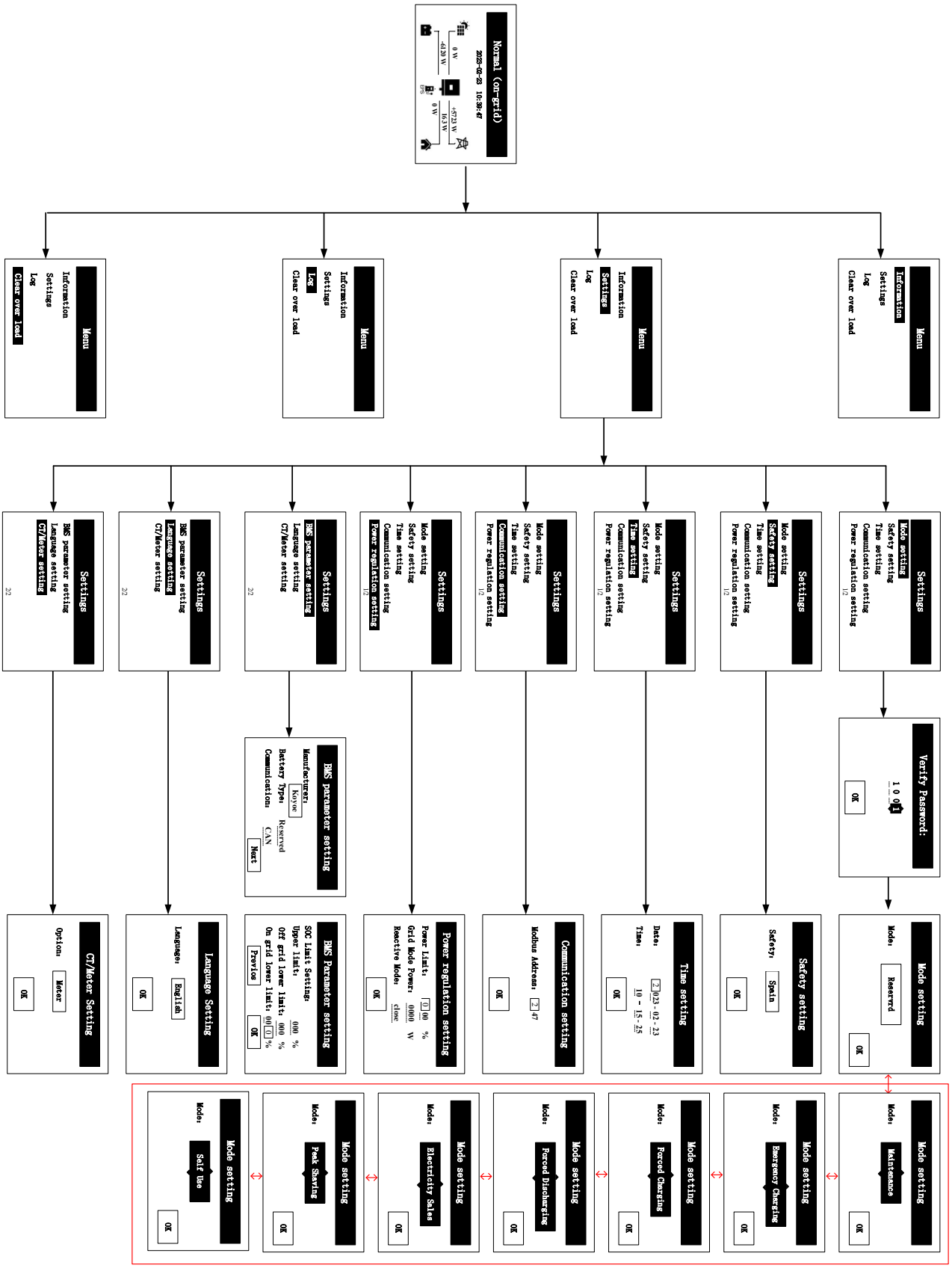


Fig. 9-1 LCD operation flowchart

10. Deactivate

10.1 Deactivate the Inverter

The inverter must be turned off while maintenance or other repair work is being carried out. Follow the steps below to disconnect the inverter from AC and DC power sources. Failure to do so will result in fatal voltage or inverter damage.

10.1.1 Disconnect the Inverter

1. Disconnect the AC circuit breaker to prevent reconnection.
2. Rotate the DC switch to the "OFF" position and disconnect all PV string input connectors.
3. Disconnect the EPS device.
4. Disconnect the circuit between the battery and the inverter (turn off the BMS or DC switch in the main circuit).
5. Wait at least 10 minutes until the capacitor inside the inverter is completely discharged.
6. Remove the DC connector (PV and battery).
7. Remove the AC connector and EPS connector.
8. Install the MC4 waterproof plug and AC waterproof cover.

10.1.2 Remove the Inverter

⚠ CAUTION

Risk of burns and electric shock!

Do not touch the internal live parts within 10 minutes of disconnecting the inverter from the grid and the PV input.

1. All cables connected to the inverter are disconnected in reverse, see "8 Electrical Connections". 2. Please disassemble the inverter according to the steps of 7.2 to install the inverter. 3. If necessary, remove the wall bracket from the wall. 4. If you want to reinstall the inverter in the future, please refer to "6.3 Inverter Storage" for appropriate protection.

10.1.3 Handle the Inverter

The disposal of this inverter is the responsibility of the user.

NOTICE

Some components and devices of the inverter, such as LCD displays, batteries, capacitors, etc., may cause environmental pollution.

Do not dispose of the product with household waste, and should dispose of it in accordance with the electronic waste disposal regulations applicable at the installation site.

11. Communication and Monitoring

11.1 Communication

The inverter supports remote monitoring using WIFI/4G module as well as local monitoring using RS485 module to view output voltage, current, frequency, fault and other information. WIFI/4G module is optional, customers choose according to their needs. WIFI/4G share the same connection terminal.

11.2 Monitor

When the WIFI/GPRS communication module is plugged into the inverter and successfully connected to the network, customers can monitor the inverter information through monitoring website. The user opens a browser and enters the website: http://solar.koyoe.com. After registering an account, users can choose a username or serial number to log in. After the user logs in, he can monitor the voltage, current power and other information of the inverter.

In the Apple and Android app stores, enter the KOYOE-log keyword and users can download the app on your mobile device. After installation, please enter your username and password to enter your power station and view the inverter information.

12. Maintenance and Repair

12.1 Breakdown Maintenance

When the inverter fails, the inverter will automatically disconnect from the grid and send a fault or alarm message. For details about how to deal with simple faults, see "Common Faults" in Appendix 1.

12.2 Security Requirements in Maintenance

	In operation and operation after operation, the temperature of the housing is high due to the heat generated by the power circuit, and there is a risk of burns. Contact operations should be carried out after cooling.
	Before troubleshooting, it is necessary to ensure that the circuit breakers of DC and AC circuits are disconnected and contact a professional for handling. Other personnel shall not close the gate without authorization.
	The inverter has no serviceable parts. If there are any problems, maintenance must be carried out by professionals. Even if the inverter has been disconnected from photovoltaics, batteries and the grid, dangerous voltages may still exist. Before starting the operation of the electronic system related to the cabinet, the DC bus voltage should be measured. The voltage must be below 48V.

12.3 Routine Maintenance

In general, inverters do not require regular maintenance and calibration. Due to natural heat dissipation, the radiator must not be covered with dust and other dirt.

In order to ensure good ventilation of the inverter, it is necessary to check the radiator to ensure that it is unobstructed.

If necessary, clean the inlet and outlet of the inverter with a soft brush. It is forbidden to clean the inverter with water, corrosive chemicals, or strong detergents.

13. Technical Parameters

Model	KY-ESS3K0H	KY-ESS4K2H	KY5-ESS5K0H	KY-ESS6K0H	KY-ESS7K0H	KY-ESS8K0H
PV Input Data						
Max. Input Power[W]	4500	6300	7500	9000	10500	12000
Max. Input Voltage[V]	590					
MPPT Operating Voltage Range/Nominal Input Voltage[V]	80~500/360					
Max. Input Current[A]	16					
Max. Short Circuit Current[A]	20					
Number of MPPT Trackers	2					
Number of Strings per MPPT	1/1					
Battery Input Data						
Battery Voltage Range[V]	85-450					
Input Number	1					
Max.Charge/Discharge Current[A]	25/30					
Max.Charge/Discharge Power[W]	3000/3000	4200/4200	5000/5000	6000/6000	7000/7000	8000/8000
Battery Type	Li-ion/Lead-acid					
AC Output Data(GRID)						
Nominal Output Power[W]	3000	4200	5000	6000	7000	8000
Max. Apparent Power [VA]	3300	4600	5500	6600	7700	8800
Max Input Power[W]	3300	4600	5500	6600	7700	8800
Nominal Output Voltage[Vac]	230,L/N/PE					
Nominal Output Frequency[Hz]	50/60					
Max. Output Current[A]	13	18.3	21.7	26	30.4	34.8
Grid Bypass Current[A]	13	18.3	21.7	26	30.4	34.8
Power Factor	~1 (0.8 lead to 0.8 lag can be set)					
Total Harmonic Distortion[%]	<3					
AC Output Data(EPS)						
Nominal Output Power[W]	3000	4200	5000	6000	7000	8000

Max. Apparent Power [VA]	3300	4600	5500	6600	7700	8800
Nominal Output Voltage[Vac]	230,L/N/PE					
Nominal Output Frequency[Hz]	50/60					
Max. Output Current[A]	14.3	20	23.9	28.6	33.4	38.2
Peak Output Apparent Power[VA](60s)	3600	5040	6000	7200	8400	8400
Peak Output Apparent Power[VA](10s)	5500	5500	7500	9000	9000	9000
On/off Grid switching time [ms]	<10					
Efficiency						
Max. Efficiency[%]	98.2					
European Efficiency[%]	97.1					
Protection						
PV Reverse Polarity Protection	Integrated					
Overcurrent Protection	Integrated					
Anti-islanding Protection	Integrated					
Short Circuit Protection	Integrated					
Leakage Current Protection	Integrated					
Insulation Protection	Integrated					
Surge Protection	DC TypeⅡ/AC TypeⅢ					
General Data						
Operating Temperature Range [℃]	-25℃~60℃（>45 derating）					
Altitude[m]	<4000					
Noise Emission [dB]	<40					
Topology	Transformerless isolation					
Cooling Method	Natural convection					
Ingress Protection Rating	IP65					
Relative Humidity[%]	0-95,No condensation					
DC Connector	MC/Amphenol/Phoenix					
AC Connector	Plug in connector					
Interaction	LCD,RS485					
Cloud Communication	RS485(WIFI/4G optional)					
BMS Communication	CAN					
Meter Communication	RS485					
Installation	Wall-mounted					
Dimension(W*H*D)[mm]	390*407*192					
Weight[kg]	17					
Certification						
Safety Standards	IEC62109-1/2					
EMC Standards	EN IEC61000-6-1/-3					
On-grid Standard	CEI 0-21,G98,G99,NRS097-2-1:2017 ,UNE 217001/UNE 217002/NTS631					

Security	**YES/ON**
Over-undervoltage protection	YES
DC isolation protection	YES
Ground fault protection	YES
Grid protection	YES
DC component protection	YES
Feedback current monitoring	YES
Residual current detection	YES
Island protection	YES
Overload protection	YES
Overtemperature protection	YES

Appendix I: Frequently Asked Questions

If the inverter sometimes does not work properly, the solutions to common problems are listed below. This helps technicians understand the problem and take effective action.

SN	LCD display	Possible causes and solutions
1	GFCI Fault	1. The ground current is too large. 2. After disconnecting the AC side circuit, unplug the photovoltaic terminal at the input end to detect the peripheral equipment of the AC system. 3. After troubleshooting, reconnect the PV terminal and the AC side circuit to detect the inverter status.
2	BMS Communication Fault	1. The communication between the battery pack and the inverter fails. 2. Check whether the communication cable is connected correctly and reliably. 3. Restart the inverter after replacing the connecting cable.
3	ARM DSP Communication Fault	1. Master-slave DSP communication fails, please restart the inverter. 2. If it does not work normally after restarting, please contact customer service
4	PV Overvoltage Fault	1. PV overvoltage fault, please check the PV input voltage, the voltage value must be lower than 550V
5	Isolation Fault	1. Check whether the inverter is effectively grounded and whether the impedance between the positive and negative electrodes of the photovoltaic cell is greater than 1MΩ; 2. Check that the AC side is grounded.
6	Grid Voltage Fault	1. Please check if the grid voltage is too low or too high. 2. Restart the inverter after the power grid is normal

7	Grid Frequency Fault	1. Please check whether the grid frequency is too low or too high. 2. Restart the inverter after the power grid is normal
8	Bus Voltage High	1. The bus voltage is high, please check whether the PV input voltage is less than 550V. 2. After restarting the inverter, if the fault cannot be cleared, please contact customer service
9	Off Grid Over Voltage Fault	1. High off-grid output voltage. 2. Please check whether the off-grid port connection is correct, and confirm whether the off-grid load is working normally.
10	Battery Over Temperature Fault	1. The battery temperature is too high. 2. Please confirm whether the battery is placed in a high temperature area. 3. Please wait for the battery to cool down before restarting the inverter.
11	Inverter Module Over Temperature Fault	1. The inverter module temperature is high. 2. Please confirm whether the inverter heat sink is occluded. 3. Please confirm whether the working environment temperature of the inverter is normal. 4. Restart the inverter after the surface temperature of the inverter cools.
12	Battery Voltage Low Fault	1. Battery voltage low failure. 2. Please check whether the wiring of the battery is correct. 3. Please check whether the battery can work normally and restart the inverter.
13	Low ambient Temperature Warn	1. Low ambient temperature failure. 2. Please confirm whether the ambient temperature of the inverter and battery is lower than the normal value, and restart the inverter after the ambient temperature rises.

In addition to the above common problems, if you encounter other problems that cannot be solved, please contact us, we will try our best to provide you with quality service.

Appendix II: Abbreviation of Terms

AC	Alternating current
DC	Direct current
DSP	Digital signal processor
EEPROM	Electrically erasable programmable read-only memory
EMC	Electromagnetic compatibility
EMI	Electromagnetic interference
GFCI	Leakage current
HCT	Hall current sensor
LCD	LCD
LED	LED
MPPT	Maximum power point tracking
PCS	Power conversion system
PV	Photovoltaic
PVCS	PV Control System
SCI	Serial communication