Off-grid solar inverter

User manual

Product model: HS1033EH24L/HS1030EH24L/HS1022EH24L

HS1033EN24L/HS1030EN24L/HS1022EN24L

CATALOGUE

About this manual

Purpose

This manual describes detailed product information and installation, operation and maintenance instructions of off-grid solar inverters.

Thank you very much for using the HS series off-grid solar inverter which is developed and produced by our company. We sincerely hope that this product can meet your needs, and we look forward more valuable suggestions on the performance and functionality of the product.

This manual is intended for the users who install, operate and maintain the off-grid solar inverters. Operators should have certain electrical knowledge and be familiar with electrical principles and characteristics of electronic components.

How to use the Manual

Please read this manual carefully before using this product. Please keep this manual in a place easy for operation and maintenance personnel to find.

The contents and the pictures, signs and symbols of this manual are owned by our company.The content of this manual shall not reproduced publicly without written authorization except the company's internal personnel.

The contents of the manual will be constantly updated and corrected, but it is inevitable that there are slight inconsistency or errors with the physical objects. Users should request the latest version of the manual from the download or the sales channel.You can get the latest manual through your dealer.

Safety instructions

This manual contains all the safety, installation and operation instructions for the HS series off-grid solar inverters. Read all the instructions and precautions in the manual carefully before installation and use.

- Read this manual before operation and we shall not be liable for any failure or loss caused by improper operation.
- Don't remove the device. Bring it to a qualified service center when a service or repair is required. Incorrect restructuring may cause a risk of electric shock or fire.
- To reduce the risk of electric shock, disconnect all power supplies before trying any maintenance or cleaning. Closing the device doesn't reduce this risk.
- The surface temperature of the off-grid solar inverter may exceed 60℃ during operation, so make sure it is cooled before making contact and place the inverter out of the reach of the children.
- This product is an indoor installation product, if outdoor installation should avoid direct sunlight and rain infiltration.
- Don't install the off-grid solar inverter in a harsh environment such as wet, greasy, flammable, explosive or dust accumulation.
- After the switch of the power supply is turned off, there is still high pressure inside the off-grid solar inverter. Don't immediately open or touch the internal devices. After the capacitor discharge is completed (more than 5 minutes), the relevant operations will be conducted.
- When replacing the battery, the equipment should be fully powered on, and the relevant operation should be conducted after checking that the equipment is out of power.
- Before using the unit, read all the instructions and warning marks on the unit, battery and all appropriate sections in this manual.
- In order to achieve the optimal operation of this off-grid solar inverter, please select the appropriate cable size according to the required specifications. Proper operation of this inverter / charger is very important.
- Be very careful when using metal tools on or around the battery. The throwing tool may generate sparks or short-circuit batteries or other electrical components and may cause an explosion.
- When you want to disconnect AC or DC terminals, follow the installation procedure. Please refer to the installation section of this manual for more details.
- Ground description: This off-grid solar inverter shall be connected to a permanent ground wiring system. When installing this inverter, the local requirements and regulations must be observed. The positive and negative electrode and the PV positive and negative electrode of the off-grid inverter system battery cannot be grounded.
- Don't cause a short circuit of the AC output and the DC input. Don't connect to the mains when the DC input is short circuit.
- You must clearly know what kind of battery you need to use. If the battery is mismatched with the energy storage machine, the system will not operate.
- All the wiring, installation, commissioning and other work should be completed by the relevant professionals.
- During installation, don't touch any component in the junction box below the energy storage.

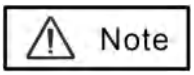
Safety Identification Symbol:

The following lists the symbols that may be used in this manual. Please read them carefully to use this manual better.

"Risk" indicates a high potential danger and a failure to avoid it would result in death or serious injury.

"Warning" indicates a moderate potential hazard and a failure to avoid conditions that could lead to death or serious injury.

"Care" indicates low potential risk and failure to avoid conditions that could lead to moderate or mild injury to a person.



"Note" indicates a potential risk to avoid situations that may cause the equipment to operate properly or cause property damage.


Instructions

"Instructions" is the additional information in the manual, emphasizing and implementing the content, it may also provide tips or tricks for optimizing the use of products, can help you solve a problem or save you time.

Chapter 1 Product description

1.1 Product overview and features

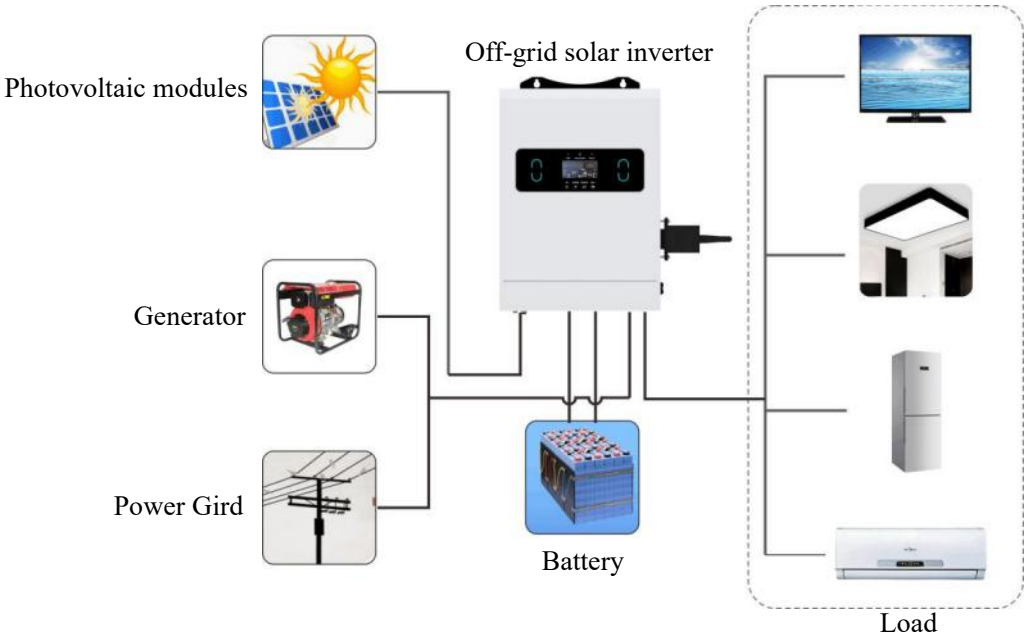
The HS series is a combination of inverters, solar chargers and battery chargers to provide a portable size of an uninterruptible power supply. Its comprehensive LCD screen provides user configurable and easily accessible button operation, with mains first, solar first, mains and solar hybrid, only solar charging four charging modes optional; Three output modes of photovoltaic priority, inverter first and mains priority are optional to meet different application needs.

Features:

1. Pure sine wave inverter with full digital voltage and current with double closed-loop control.
2. The charging module samples the all-digital voltage and current control, which safely and efficiently realizes the charging and protection of the battery.
3. It has three output modes: photovoltaic priority, inverter priority and Utility Power bypass priority, and has uninterrupted power supply function.
4. There are four charging modes: Utility Power first, solar first, Utility Power and solar hybrid, and solar charging only.
5. Advanced MPPT PV maximum power tracking technology to maintain the maximum PV output.
6. LCD screen and LED indicator light design, dynamic display system data and running status.
7. With the energy-saving mode function, to reduce the no-load loss.
8. It is adopted the Intelligent adjustable speed fan for quiet and efficient heat dissipation, extending the system life.
9. With lithium battery, solar energy and mains power activation function, support lead-acid battery, lithium battery access.
10. The device has ON / OFF keys to facilitate the switch operation.
11. It has multiple protection functions, complete short circuit protection, over-voltage/under-voltage, overload, over-temperature, reverse irrigation, and other protections.
12. It can also bypass output without battery, to meet the uninterrupted power supply demand of special scenarios such as battery trip and battery damage.

1.2 Basic system introduction

The following figure shows the system application scenarios of this product. A complete system includes the following parts, and the specific system wiring mode is determined by the actual application scenarios.



As shown in the figure above, a complete off-grid energy storage system must consist of solar photovoltaic modules, off-grid solar inverters, batteries, and the power grid, etc.

1. Photovoltaic modules: convert light energy into direct current energy and charge the battery through an off-grid solar inverter.

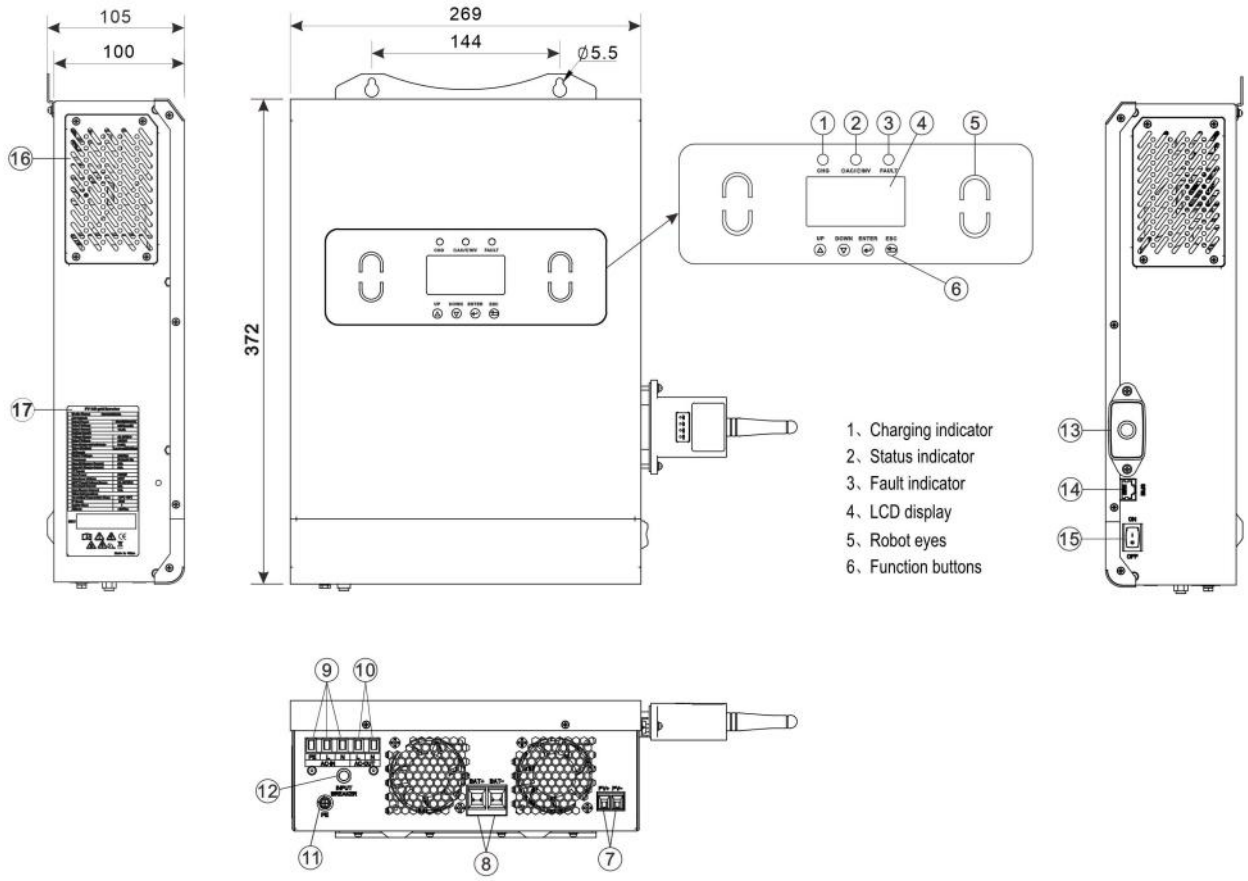
2. Battery: The function of a battery is to ensure the normal power consumption of the system load when there is no or unstable utility power.

3. Utility power or other AC input sources: accessed at the AC input terminal, which can supply power to the load and charge the battery. In the absence of an AC input source, the load is powered by batteries and photovoltaic modules.

4. Load: all kinds of electrical appliances in the home or office environment, including tubular lights, fans, refrigerators, air conditioners, aspirate pumps and other electric electrical appliances.

5. Off-grid solar inverter: a device for overall energy conversion.

1.3 Product appearance introduction



①	Charge lamp	⑩	AC output port
②	AC or inverter indicator lamp	⑪	AC output is ground
③	Fault indicator lamp	⑫	Overload protector
④	LCD display screen	⑬	Communication stick（optional）
⑤	Robot eyes	⑭	BMS communication port
⑥	Function buttons	⑮	ON / OFF push-button switch
⑦	PV port	⑯	Dust guard
⑧	Battery port	⑰	Parameter labeling
⑨	AC input port		

Chapter 2 Installation

About this chapter

This chapter introduces the relevant configuration of the machine and the main installation process. Please read this instructions carefully and be familiar with the installation steps to help the installer correctly install our HS series off-grid solar inverters.

2.1.safety instruction

	**The open-circuit DC voltage of the photovoltaic array is up to 145V, and the AC side voltage of the power grid is up to 280V. Never touch the live terminal directly. Ensure no electric AC / DC side before installation and maintenance.**

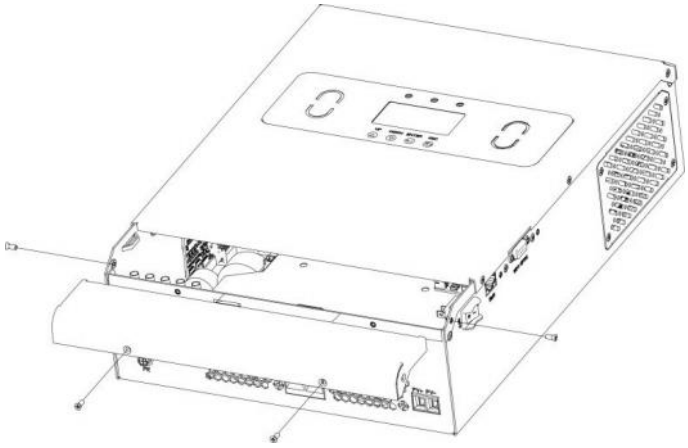
- Before using the unit, read all the instructions and warning marks on the unit, battery and all appropriate sections in this manual.
- Note： To reduce the risk of injury, only deep cycle lead-acid rechargeable batteries. Other types of batteries can burst, causing personal injury and damage.
- Do not disassemble the device. When service or repair is required, bring it to a qualified service center. Incorrect reassembly can lead to a risk of electric shock or fire.
- To reduce the risk of electric shock, disconnect all electrical wires before attempting any maintenance or cleaning. Turning off the device does not reduce this risk.
- Note: Only professional personnel can use the battery and install this equipment.
- Never charge a frozen battery.
- To achieve the optimal operation of this inverter / charger, please select the appropriate cable size according to the required specifications. Proper operation of this inverter / charger is very important.
- Be very careful when using metal tools on or around the battery. The throwing tool may generate sparks or short-circuit batteries or other electrical components and may cause an explosion.
- When you want to disconnect AC or DC terminals, follow the installation procedure. Please refer to the installation section of this manual for more details.
- Ground instructions-This inverter / charger shall be connected to the permanent ground wiring system. When installing this inverter, the local requirements and regulations must be observed. The positive and negative electrode and the PV positive and negative electrode of the off-grid inverter system battery cannot be grounded.
- Don’t cause a short circuit of the AC output and the DC input. Don’t connect to the utility power when the DC input is short circuit.
- Warning! Only qualified service personnel are able to use the equipment. If an error remains after the following troubleshooting table, send this inverter / charger back to your local dealer or service center for maintenance.

2.2.Preparation before installation

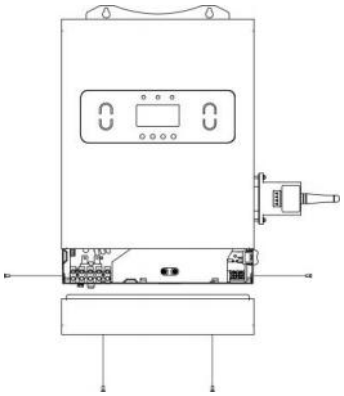
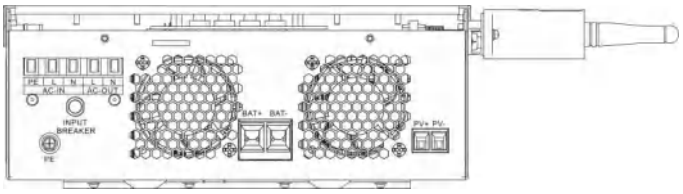
2.2.1. Check the equipment before installation. Ensure that there are no damaged items in the package. You will receive the following items in the package:

- Machine * 1
- Self-tapping screw ST48X30C*2 and its supporting expansion pipe *2
- Communication stick * 1(optional), user manual * 1, warranty form * 1, factory inspection report

2.2.2. Before installing and connecting all wiring, remove the repair cover screws and remove the cover as shown in the figure.



Remove the access cover screws and remove the terminal protection cover:

Front view	Bottom view
	

2.2.3. Wiring specifications and circuit breaker selection

- For the PV input line diameter and switch selection, please refer to the following table:

The PV input wiring line diameter is recommended	Maximum PV input Voltage / current	Recommended air switch or circuit breaker model
6mm² /10AWG	500V/20A	2P-25A
Note: The voltage shall not exceed the maximum PV input open circuit voltage in series.		

➢ Recommended AC input / output line diameter and switch selection please refer to the following table:

The AC input / output is recommended Wiring diameter	Maximum bypass communication Input / output current	Recommended air switch or circuit breaker model
6mm² /10AWG	230V/30A	2P-40A
The above wiring line diameter and circuit breaker are only recommended, please select the appropriate wiring line diameter and circuit breaker according to the actual situation.It is suggested that the input and output cable length of the off-grid solar inverter is consistent with the line diameter.		

➢ For the recommended battery input line diameter and switch selection, please refer to the following table:

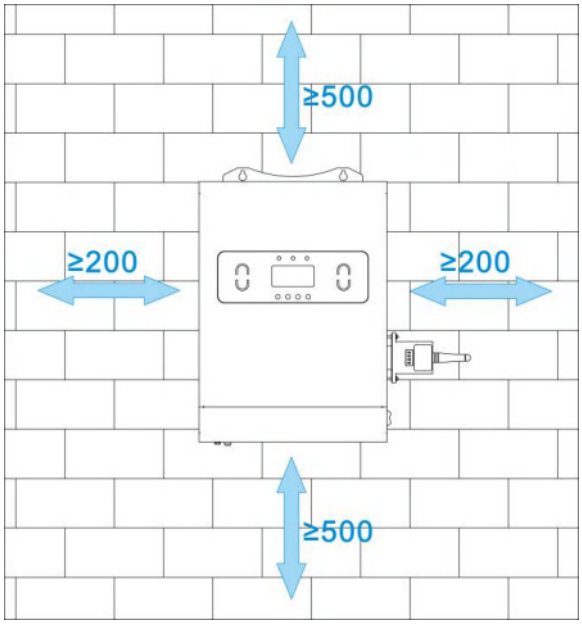
Battery wiring wire diameter is recommended	Battery rated discharge current	Maximum charging current	Recommended air switch or circuit breaker model
4AWG	70A	60A	2P—160A
Note: The wiring line diameter is for reference only. If the distance between the off-grid solar inverter and the battery is far away, the use of a thicker line can reduce the system loss. **It is recommended that the length of the cable between the off-grid solar inverter and the battery should not exceed 3m.For the connection of all machines, the cable shall be of the same length as the wire diameter.**			

2.3.Installation and connection

2.3.1. install machinery:

1．Mounted on a solid and non-combustible wall, install the inverter on the line of sight height and can reach the display start button to read the LCD display and start equipment at any time. In order to ensure the optimal operation condition, with additional protection during the indoor and outdoor installation, the installation ambient temperature shall be between -10℃ and 55℃.

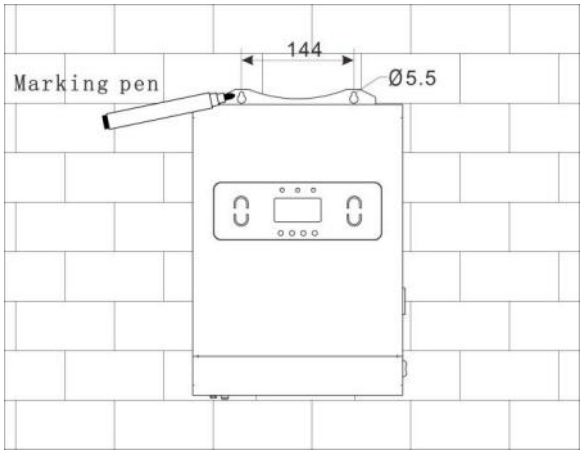
2．When installing the off-grid solar inverter, ensure that there is enough space for installation. The off-grid solar inverter has at least 500mm space, and at least 200mm space between the left and right, to ensure natural convection and heat dissipation. Refer to the whole machine installation schematic diagram as shown below.



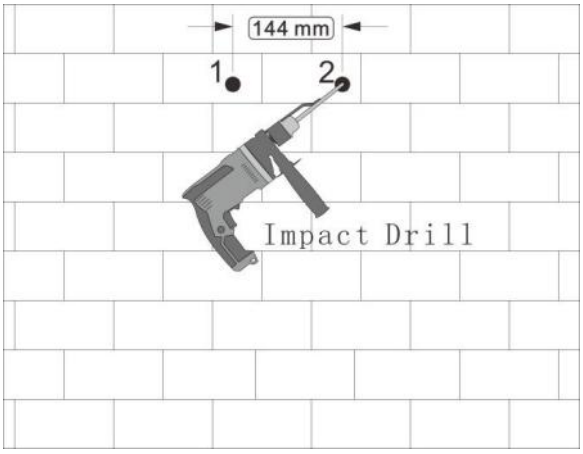
3． The detailed fixing and installation steps are as follows:

Warning: Danger of explosion! Don’t place the off-grid solar inverter with the lead-acid liquid battery in a closed space! Don’t be installed even in closed places where battery gas may accumulate.

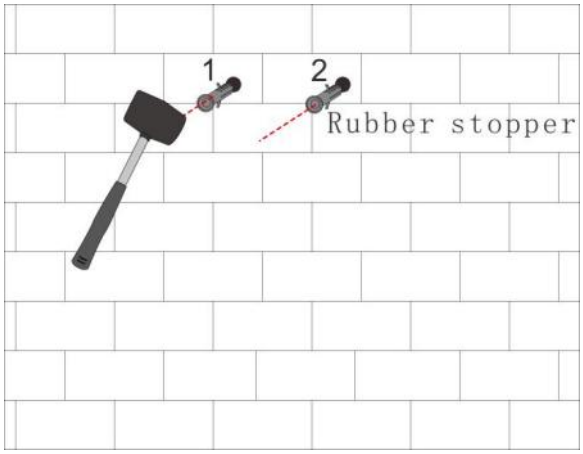
1．Positioning hole mark: mark "◎" on the wall according to the size of the following picture or using the equipment;



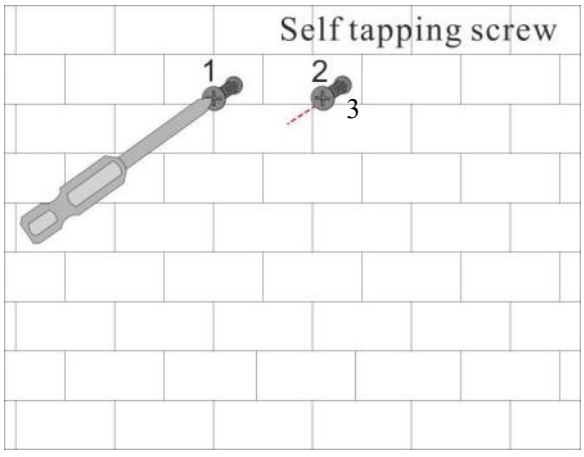
2．Drilling: With Impact drill on the wall mark drilling (2 PCS), drill diameter 7mm and drill depth 40mm;



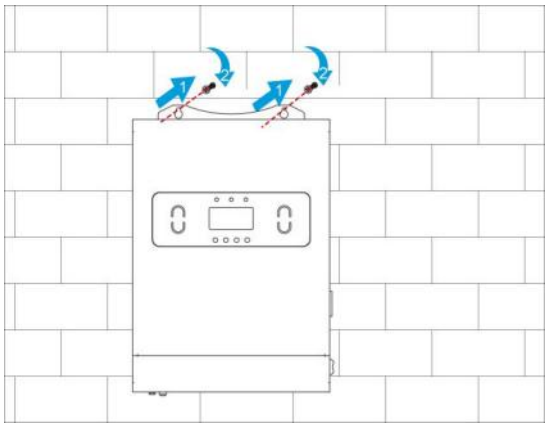
3．Embedded expansion pipe: Embed the expansion pipe in the drilled hole with a hammer, and the end surface of the rubber plug is flush with the wall (2 places);



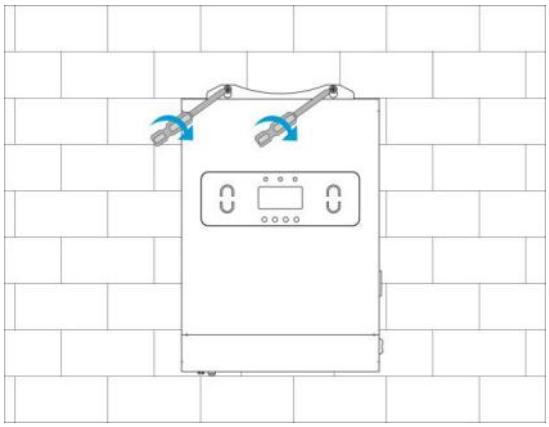
4．Screw in the upper two screws (not all of them are screwed in so that the machine can be hooked up in the next step);



5．Hang the device into the upper two screws.



6．Tighten the 2- ST48X30 self-tapping screws so that the fixation is complete

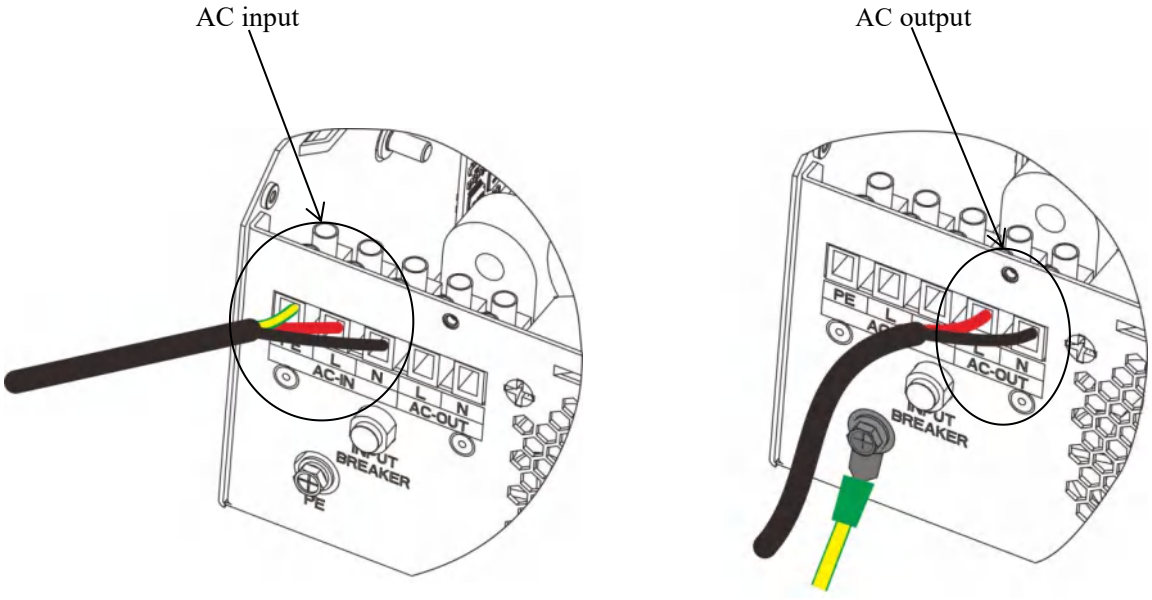


2.3.2. AC input / output wiring:

① Before AC input / output wiring, first disconnect the external circuit breaker, and confirm whether the cables used are qualified. For the selection of cables and circuit breaker, please refer to chapter "2.2.3 Wiring Specification and circuit breaker selection";

② According to the cable order and terminal position shown in the lower left figure, correctly connect the AC input line, please first ground line, and then connect the Live line and Neutral line;

③ According to the cable order and terminal position shown in the lower right figure, correctly connect to the AC output line, please first connect to the surface ground line of the casing, and then connect to the Live line and the Neutral line.



PE: Ground　　L: Live　　N: Neutral

⚠ Note

Note: AC-INPUT represents the AC input, and AC-OUTPUT represents the AC output. Don’t misconnect the input and output connection ports.

Note: Before connecting the AC input power supply, please install an AC circuit breaker between the off-grid solar inverter and the AC input power supply, and ensure that the AC circuit breaker is disconnected.

Warning: Wiring must be performed by a professional person

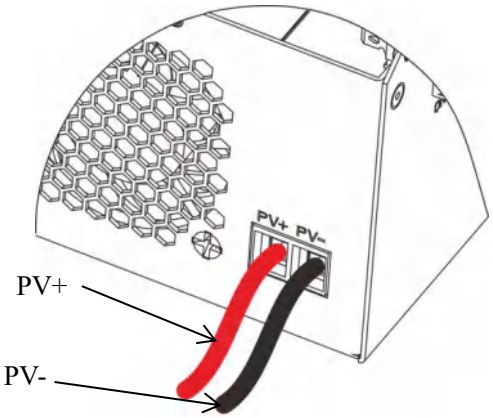
Note: Block the inlet and exit line

2.3.3. Wiring for the PV input:

① Before wiring, first disconnect the external circuit breaker, and confirm whether the cables used are qualified. For the selection of cables and circuit breakers, please refer to chapter "2.2.3Wiring Specification and circuit breaker selection";

② Correct connecting of the PV input line according to the cable order and terminal position shown in the figure below.

PV+: PV input positive electrode PV-: PV input negative electrode



Note: The positive (+) of the PV cable is connected to the positive (+) of the PV input terminal, and the negative (-) of the PV cable is connected to the negative (-) of the PV input terminal. The cable polarity must be correct.

The open-circuit voltage (Voc) of the PV array connected to the inverter shall not exceed the design value of the maximum PV input voltage of the inverter;

Note: Before connecting to the PV module, install a DC circuit breaker from the inverter to the PV module

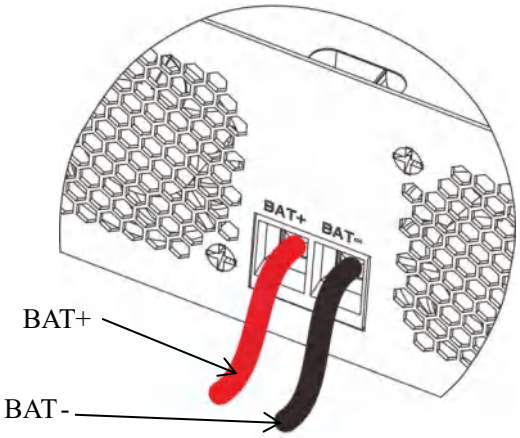
Warning: Wiring must be performed by a professional person

Note: Block the inlet and exit line

2.3.4. Battery wiring:

① Before wiring, first disconnect the external circuit breaker, and confirm whether the cables used are qualified. For the cable and circuit breaker specifications, please refer to the chapter "2.2.3 Wiring Specification and circuit breaker selection". The BAT line needs to be connected to the machine through OT terminals. See article 3 below for the size of OT terminals. T terminals must firmly press the BAT line to prevent excessive contact impedance and cause excessive heating.

② Correct connect the BAT line according to the cable sequence and terminal position shown in the figure below. BAT cable fixing nut torque 22kgf.cm.



Note! Before making a final DC connection or closing the DC circuit breaker / isolation circuit breaker, ensure that the cable positive (+) must be connected to the copper row positive (+) and the cable negative (-) must be connected to the copper row negative (-).

Note! Don't place anything between the flat part of the inverter terminal and the ring terminal, and don't use antioxidants on the terminals until the terminals are tightly

Warning: Wiring must be performed by a professional person

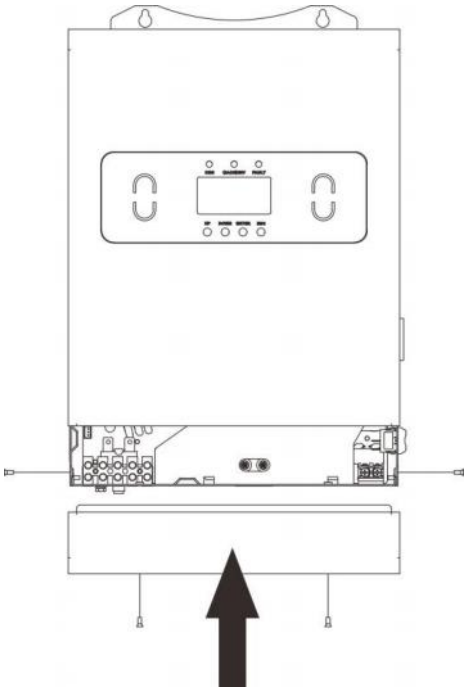
Note: Block the inlet and outlet with fireproof mud

2.3.5. Install the terminal protection cover

① Check whether the battery input is positive and negative is connected, whether the PV input is positive and negative is connected, and whether the screw is firm.

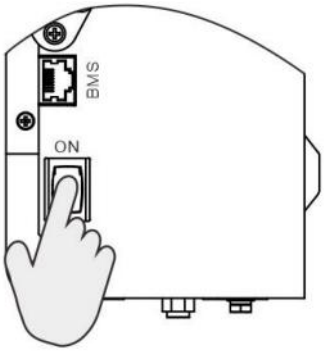
② Check that the AC input and AC output terminals are connected correctly and securely.

③ If there is no abnormality, use the tool to secure the screw protecting the cover.



2.3.6. Start the off-grid solar inverter

First close the battery end circuit breaker, then press the push button switch on the side wall of the machine to the "ON" state, "AC / INV" indicator flashing means the inverter works normally, again close the photovoltaic array and mains circuit breaker, and finally after AC output is normal then open the AC load, lest at the same time open the load produce large instantaneous impact and protection action, off-grid solar inverter to according to the set mode of normal work.



⚠ Note: Note: If power is supplied to different AC loads, it is recommended to open the load with large impact current first, and then open the load with small shock current after the load is stable.

⚠ Note: Note: If the off-grid solar inverter doesn't work properly, the LCD display or indicator light is abnormal, refer to Section 6 to remove the fault.

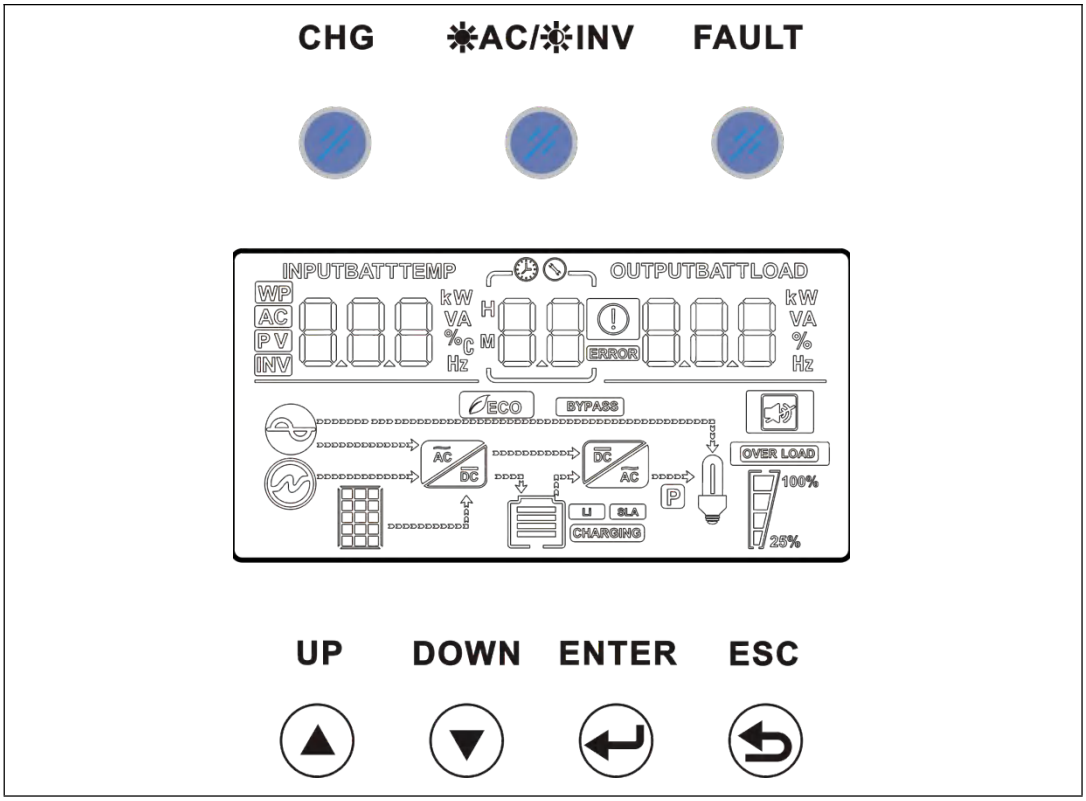
⚠ Note: If you need to charge the battery with the power grid, the start button must be pressed first, and the inverter is in operating mode.

⚠ Note: Power grid on the equipment can directly bypass work

Chapter 3 The LCD screen operating instructions

3.1.Operation and display panels

The operation and display panel is shown below, including 1 LCD screen, 3 indicators and 4 operation keys.



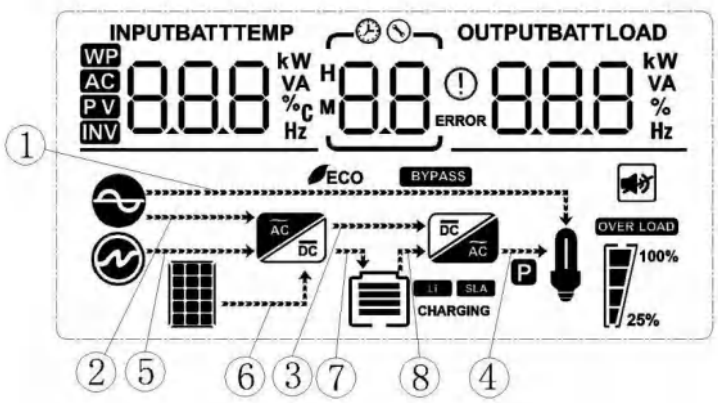
Introduction to operation keys

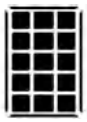
Function key	Description
UP	Last choice
DOWN	Next choice
ENTER	Under the Settings menu, determine / enter the options
ESC	Enter / Exit Setup Menu

Instruction lamp introduction

Instruction lamp	Pigment	Description
CHG	Green	Flashing: The battery is charging
		Constant brightness: Charging is complete
AC/INV	Yellow	Constant brightness: utility power output
		Flashing: Inverter output
FAULT	Red	Constant brightness: Fault status

LCD Screen Introduction



Icon	Function	Icon	Function
	Indicates that the AC input side is connected to the AC input source		Indicates that the inverter discharge circuit is working
	The icon indicates a wide voltage AC input Mode (APL mode)		Indicates that the machine is in the mains power bypass (Bypass) Working mode
	Indicates that the PV input is connected to the solar energy Panel		Indicates that the AC output is in an overloaded state
	Indicates that the machine is connected to the storage battery,  Represents the battery remaining power of 0% to 24%,  Represents the battery remaining power of25% to 49%,  Represents the battery remaining power of 50% to 74%  Represents the battery remaining power of 75%～100%		Indicates the percentage of the AC output load,  Represents the load percentage of 0% to 24%,  Represents the load percentage of 25% to 49%,  Represents the load percentage of 50% to 74%,  Represents the load percentage of 75%—100%

Li	Indicates that the current battery type is lithium pool		Indicates that the buzzer is not enabled
SLA	Indicates that the current type of battery is lead acid cell		Indicates a machine alarm occurrence
CHARGING	Indicates that the battery is in a charging state	ERROR	Indicates that the machine is in a fault state
AC DC	Indicates that the AC / DC charging circuit is working		Indicates that the machine is in the setting mode
	Indicates an AC voltage output at the AC output end		Middle-screen parameters display: 1. In non-set mode, display the alarm or fault code; 2. In setting mode, display shows the parameter item code of the current setting
	Display the current icon when the factory setting is restored normally		
Top left parameters of the screen display: input parameters			
AC	Indicates the AC input		
PV	Indicates the PV input		
INV	Indicate the inverter circuit		
INPUTBATTTEMP WP AC PV INV kW VA %C Hz	Display battery voltage, total battery charge current, mains charge power, AC input voltage, AC input frequency, PV Input voltage, the internal radiator temperature		
Top right side parameters of the screen display: output parameters			
OUTPUTBATTLOAD kW VA % Hz	Indicate the output voltage, output current, output active power, output dependent power, and battery discharge current; in setting mode, display the current set parameters under the code of parameter items		
Arrow line shows			
①	Indicates the grid to supply power directly to the load	⑤	Indicates the wide voltage power generation equipment to supply power to the system

②	Indicate the grid to power the system	⑥	Indicate the PV to charge the battery
③	Blank	⑦	Indicates the battery charging circuit
④	Indicates the inverter to power the load	⑧	Indicates the battery discharge circuit

3.2. Description of setting parameters

Key operation instructions: Please press the "ESC" key to enter the Settings menu, enter the setting menu and exit and press the "ESC" key. After entering the Settings menu, press UP and DOWN to select the parameter item code to be set. Then press "ENTER" key to enter the parameter editing state, adjust the setting parameters through "UP" and "DOWN" keys, press "ENTER" key, press "ESC" key to exit the setting.

Pressing "UP" and "DOWN" keys together, and a flashing box appears on the 3S screen, the device needs to restart the factory setting. It is recommended to modify the corresponding parameters and start the machine.

Parameter number	The parameter name	Setting options	Explain
00	Enter / Exit	[00] ESC	Enter / Exit Setup Menu
01	Output-priority mode	[01] SOL	Photovoltaic priority mode, switch to the municipal power supply when the photovoltaic energy is insufficient or the battery voltage is lower than the set value of the parameter [20].
		[01] UTI default	City power priority mode, only when the city is abnormal, switch to solar energy and battery inverter to supply the load power.
		[01] SBU	In the inverter priority mode, the solar energy and the battery have the priority to inverter to supply power to the load, and only when the battery is under voltage or lower than the set value of the parameter [20].
02	Charging priority mode	[02] CSO	PV is preferred to charge batteries, and mains is started only when pv is not available.
		[02] CUB	Mains gives priority to charging the battery, and the photovoltaic is started to charge the battery only when the mains is not available.
		[02] SNU default	Photovoltaic and mains mixed charging, priority photovoltaic to charge batteries, photovoltaic energy is insufficient, mains charging supplement. When the photovoltaic energy is sufficient, the mains power stops charging.
			Note: Only the city power bypass output with the load time volt and the mains can be charged at the same time. When the inverter is working, the battery can only be charged by photovoltaic.

		[02] OSO	Whether the mains power is available or not, only solar power can charge the battery.
03	Battery type	[03] USE	User custom, can set all battery parameters.
		[03] GEL default	For colloidal lead-acid batteries, the average charging voltage and the floating charging voltage can be adjusted to adjust the parameter number [8] and the parameter number [11] according to the actual parameters of the battery.
		[03] SLD	For sealed lead-acid batteries, the average charging voltage and floating charging voltage can be adjusted to the parameter number [8] and parameter number [11] according to the actual parameters of the battery.
		[03] FLD	For the open lead-acid battery, the average charging voltage and the floating charging voltage can be adjusted to the parameter number [8] and the parameter number [11] according to the actual parameters of the battery.
		[03]L7/L8/L9	Lithium iron phosphate battery L7/ L8 / L9, corresponding to 7,8,9 lithium iron phosphate battery, corresponding to the pressure charging voltage 24.8V、28.4V、31.8V.
		[03]N7/N8	Ternary lithium battery N7 / N8, corresponding to the lithium iron phosphate battery 7 string and 8 string, corresponding to the balance pressure charging voltage 28.8V，31.6V.
04	BMS protocol	[04] PYL default	PYL: PYLONTECH
05	Maximum charging current	[05] 30A default	Set range 0~100A, step 5A (photovoltaic charging + city power charging current)
06	Maximum photovoltaic charging current	[06] 30A default	PV maximum charging current setting 0~100A, step 5A
07	Maximum current of the mains power charge	[07] 30A default	Set the maximum charge current of the mains power charge 0~60A, step into 5A
08	Constant voltage charging voltage	[08] Default voltage 28.2V	Constant voltage charging voltage setting 24V~29.0V, Step in step 0.2V
09	Maximum time for constant charging voltage	[09] 120 default	The maximum time setting of constant voltage charging refers to the maximum charging time of the set voltage, with the setting range of 5min～900min,and step for 5 minutes
10	Constant voltage charge return voltage	[10] Default voltage 26V	After the battery is charged, the inverter stops charging. When the battery voltage is lower than this voltage value, the charging will be resumed.

			Set the range of 22V~26.8V, and step into 0.2V
11	Floating charge voltage	[11] Default voltage 27V	Floating charge voltage 24V~29V, step into 0.2V
12	Equalizing charge	[12] DIS default	Balanced charging is prohibited
		[12] ENA	Enables balanced charging, only (SLD / FLD / USE) lead-acid battery is effective
13	Balanced charging voltage	[11] Default voltage 28V	Equalized charging voltage, valid only for (SLD / FLD / USE) lead-acid battery, set according to battery type 24V~29V, step into 0.2V
14	Balanced charging time	[14] 120 default	Balanced charging time, set the range of 5min～900min, step for 5 minutes, only (SLD / FLD / USE) lead-acid battery is effective
15	Balanced charging delay	[15] 120 default	Balanced charging delay, set the range of 5min～900min, step for 5 minutes, only (SLD / FLD / USE) lead-acid battery is effective
16	Equalize the charging interval cycle	[16] 30 default	Equalized charging interval period, 0~90days, 1 step day, only (SLD / FLD / USE) lead acid battery effective
17	Balanced Charging enables	[17] DIS default	Stop the balanced charging immediately.
		[17] ENA	Start balanced charge immediately, only (SLD / FLD / USE) lead acid battery
18	Output frequency	[18] 50.0	When the first power is turned on, the output Frequency is automatically adapted according to the mains frequency, and the default 230V model is 50Hz, and the default 120V model is 60Hz.
		[18] 60.0	
19	The AC-input voltage range	[19] APL	The mains power input voltage range of 230V model is 90～280V. The mains input voltage range of 120V model is 90～140V.
		[19] The UPS default	The mains input voltage range of 230V model is 170～280 V The mains input voltage range of 120V model is 90～140V
20	Battery to market electricity	[20] Default voltage 22.0V	When the parameter [1] is SOL or SBU, and when the battery voltage is lower than the set value, the output switches from inverter to mains. The battery discharge voltage needs to be changed according to the actual battery parameters. Set the range 20V~25.8V, step 0.2V

21	Market electricity to battery	[21] Default voltage 28.2V	When the parameter [01] is SOL or SBU, the battery voltage is higher than the set value, and the output switches from mains to inverter. The battery discharge voltage needs to be changed according to the actual battery parameters. Set the range 24V~28.8V, step 0.2V
22	Battery under-voltage alarm voltage	[22] Default voltage 21.4V	The battery under-voltage alarm point, the battery voltage is lower than the judgment point, report the under-voltage alarm, the output is not off, the setting range is 40V~52V, step 0.2V. Set the range 20V~25.8V, step 0.2V
23	Battery discharge termination voltage	[23] Default voltage 20.0V	When the over-discharge voltage and the battery voltage is lower than the minimum battery discharge voltage, stop the inverter output immediately. Set the range of 20V~25.8V, step into 0.2V
24	Battery over-discharge to return voltage	[24] Default voltage 25.0V	When the battery under-voltage alarm, the battery voltage should be greater than this set value to restore the battery inverter AC output, and the recovery value is set according to the battery type. Set the range of 20V~25.8V, and step into 0.2V
25	Battery time-delay shutdown voltage	[25] Default voltage 21.0V	When the battery voltage reaches the parameter setting point, the delayed shutdown time is set at [26]. Set the range 20V~23.8V, step 0.2V
26	Battery over-discharge delay time	[26] 5S default	When the delay time is over-put, and the battery voltage is lower than the parameter [25], close the inverter output according to the delay set time, set the range of 0S~50S, and step into 5S
27	Photovoltaic grid-connected power generation function	[27] DIS default	This function is prohibited
		[27] TOG	When the battery is filled or not connected to the cell, the photovoltaic energy of the excess local load is fed to the grid.
		[27] TOL	The load power is provided by the PV and the city.
28	Energy saving mode	[28] DIS default	The energy saving mode is prohibited, and the output on / off state of the inverter is not affected by the load.
		[28] ENA	If enabled, the output of the inverter is closed when the connected load is very low or not detected
29	Overload auto-restart	[29] DIS	Overload automatic restart is prohibited. If the overload inverter turns off the output, the machine will no longer resume the inverter boot.
		[29] ENA default	Overload automatically restart. If the overload inverter shutdown output occurs, the machine will restart the output after a delay of 2 minutes. After

			5 times, the inverter boot is no longer resumed.
30	Over-temperature will automatically restart	[30] DIS	Over-temperature automatic restart is prohibited. If over temperature inverter closes the output, the machine will no longer open the inverter output.
		[30] ENA default	The over-temperature automatically starts. If the over-temperature inverter occurs, the inverter output will be restarted after the temperature drops.
31	Inverse overload to bypass	[31] DIS	Automatic switching to mains is prohibited during inverter overload
		[31] ENA default	(102% <load <110%) ± 10%: close output after error and 5 minutes; (110% <load <150%) ± 10%: close output after error and 10 seconds; load> 150% ± 10%: close output after error and 5 seconds.
32	Main power supply interruption alarm	[32] DIS	Don't give an alarm warning when the state of the main power supply changes
		[32] ENA default	To enable an alarm prompt when the state of the main power supply changes
33	The buzzer alarm	[33] DIS	No alarm
		[33] ENA default	Make the alarm
36	The RS485 operating mode	[36] SLA default	BMS communication is Forbid
		[36] BMS	BMS communication is Enabled
38	Hi-Power	[38] DIS	The Hi-Power output function is prohibited
		[38] ENA default	The Hi-Power output function is turned on
39	AC output voltage gear setting	[39] Standard model default 230 Vac;	Standard model: 190 / 200 / 208 / 220 / 230 / 240 / 277 Vac,Default is 230 Vac. AC output power = rated power * (set voltage / 230)
			American standard model: 100 / 105 / 110 / 120 / 127 Vac can be set, the default 120 Vac. AC output power = rated power * (set voltage / 120)

3.3. Battery type parameter table

Lead-acid battery:

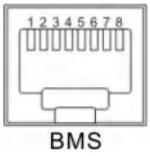
Battery type / Parameter	Sealed lead acid (SLD)	Colloidal lead-based acid (GEL)	Open-mouth lead acid (FLD)	Customization (USE)
Over-voltage off voltage	30V	30V	31V	18～30V
Balanced charging voltage 13	29.2V	-	29.6V	18～30V
Constant voltage charging voltage 08	28.8V	28.2V	29.2V	18～30V (Adjustable)
Floating charge voltage 11	27.6V	27.6V	27.6V	18～30V (Adjustable)
Over-pressure alarm voltage 22	22V	22V	22V	18～30V (Adjustable)
Time-lapse shutdown voltage 25	21V	21V	21V	18～30V(Adjustable)
Discharging final voltage 23	20V	20V	20V	18～30V (Adjustable)
Over time delay time 26	0s	0s	0s	0~50s (Adjustable)
Balanced duration	120 Minutes	-	120 Minutes	5~900 Minutes (Adjustable)
Balanced charging interval	30 Days	-	30 Days	0~90 Days (Adjustable)
Constant pressure charge duration	240 Minutes	-	240 Minutes	5~900 Minutes (Adjustable)

Lithium battery:

Battery type / Parameter	**Ternary lithium (N7)**	**Ternary lithium (N8)**	**Lithium iron phosphate (L7)**	**Lithium iron phosphate (L8)**	**Lithium iron phosphate (L9)**
Over-voltage off voltage	31.6V	33V	30V	30V	33V
Floating charge voltage 11	28.8V (Adjustable)	31.6V (Adjustable)	24.6V (Adjustable)	28.4V (Adjustable)	31.6V (Adjustable)
Constant voltage charging voltage 08	28.8V (Adjustable)	31.6V (Adjustable)	24.6V (Adjustable)	28.4V (Adjustable)	31.6V (Adjustable)
Over-pressure alarm voltage 22	23.4V (Adjustable)	26.8V (Adjustable)	21.6V (Adjustable)	24.8V (Adjustable)	27.8V (Adjustable)
Time-lapse shutdown voltage 25	21V (Adjustable)	21V (Adjustable)	21V (Adjustable)	21V (Adjustable)	21V (Adjustable)
Discharging final voltage 23	20V	20V	20V	20V	20V
Over time delay time 26	5s (Adjustable)	5s (Adjustable)	5s (Adjustable)	5s (Adjustable)	5s (Adjustable)
Constant voltage charging duration	-	-	-	-	-
Remark	The table only recommended values, because the battery parameters of each manufacturer are inconsistent, they should be modified according to the battery management parameters.				

3.4.Other functions

3.4.1. The BMS communication function

BMS function: battery management, pin definition, as shown in the figure: 7 feet is RS485-A2; 8 feet is RS485-B2;	

3.4.2. The RS485 communication function

The communication port of RS485 is the communication module interface. After connecting with the communication module selected by our company, you can check the operating parameters and status of the off-grid solar inverter through the mobile phone APP.

Pin definition, as shown below: 2 feet RS485-B1; 3 feet RS485-A1; 5 feet GND; 7 feet RS485-A1; 8 feet RS485-B1; 9 feet 5V power supply;	

Chapter 4 Protection

4.1 With the protection function

Order number	Protection classification	Defensive function
1	PV protect	PV current-limiting protection
2	AC input / output protection	Power grid over-voltage / under-voltage protection
		Exchange anti-irrigation protection
		Over-under-frequency protection
3	Battery protection	Battery over-voltage / under-voltage protection
		Charging short circuit protection
4	Output protection	Load output for short-circuit protection
		Overload protection
		Next to the flow protection
5	Temperature protection	Battery over-temperature, inverter over-temperature, PV over-temperature, transformer over-temperature protection

4.2 Fault code meaning

Fault code	Explain	Fault type
【01】	Battery voltage is low alarm	Report an emergency
【03】	The Battery is not connected to the alarm	Report an emergency
【04】	Battery voltage low stop discharge alarm	Report an emergency
【06】	Charge over-pressure protection	Hitch
【07】	Battery capacity rate below 10% alarm (set up BMS to enable） effective)	Report an emergency
【08】	Battery capacity rate below 5% alarm (set BMS to enable effective)	Report an emergency
【09】	Battery low capacity shutdown(set BMS to enable effective)	Hitch
【12】	PV insulation impedance failure	Hitch
【16】	Bus short circuit	Hitch
【17】	Solar energy input voltage overvoltage protection	Hitch
【32】	Charge too warm	Hitch
【33】	Bypass AC output for overload protection	Hitch

【34】	Inverter AC output for overload protection	Report an emergency
【35】	PV radiator for over-temperature protection	Hitch
【36】	Inter radiator over temperature protection	Hitch
【38】	Fan to block turn or failure fault	Hitch
【59】	BMS communication failure	Report an emergency

4.3 Partial troubleshooting measures

Hitch	Countermeasure
No response after boot	Check whether the power grid wiring, battery wiring and photovoltaic wiring are normal, and whether the corresponding switch is closed; In the battery-only case, press the ON / OFF key on the panel to the ON state before the display screen and the indicator light can illuminate
Battery charge over-voltage protection	Check whether the charging current, average charging voltage, and floating charging voltage set in the panel match the battery
Battery under-pressure protection	Above the battery charging to low voltage off recovery voltage.
Fan fault	Check the fan for blocking the rotation.
Bypass output overload or inverter	Reduce electrical equipment
Inverse short circuit protection	Check the output load for a short circuit
PV over-voltage	Use a multi-meter to check whether the PV input voltage is above the maximum allowable input voltage.
PV insulation impedance failure	Check PV cable for ground
The battery is not connected to the alarm	Check that the battery line and the external battery circuit breaker are not connected properly
Over-temperature protection	Check whether the inlet and outlet are closed for gambling
Over-output under-pressure	Measure the normal output voltage with a multi-meter
The APL mode is recommended under the unstable power grid or the weak power grid, and the equipment operates stably;	

Note: If there are still errors after troubleshooting according to the above troubleshooting table, please send this equipment back to the local dealer or service center for maintenance.

4.4 Off-grid solar energy system maintenance

In order to make the off-grid solar system more safe, stable and efficient in operation, customers shall conduct the following maintenance of the off-grid solar inverter, which is recommended to be no less than twice a year:

1. Check whether the inverter grounding is good;

2. Ensure that the air inlet and outlet of the off-grid solar inverter are not covered and keep well ventilated; remove the dust of the air inlet, outlet and fan regularly;

3. Check whether the AC input and output lines are tight and in good contact; whether the AC input and output lines are aging; if any, it shall be handled in time;

4. Test whether the photovoltaic modules are damaged, hot spots, pollution, and keep the surface of the photovoltaic modules clean and complete.

5. Check whether the joints and cables are aging and broken; if any, they shall be repaired in time;

6. Check whether the battery terminal is pressed and well contact; whether the battery wire is aging; if any, it should be handled in time;

Note: When checking the system, please ensure that the power supply is disconnected, pay attention to safety and discharge the capacitor completely, and then conduct the corresponding inspection or operation, otherwise there is a danger of electric shock.

The Company shall not be liable for any damage caused by:

- Incorrect installation, modification, or use
- Operating beyond the very harsh environment described in this manual
- Machine failure or damage caused by unauthorized installation, repair, change or disassembly
- Any installation and use beyond specified in the relevant international standards
- Improper use or misuse of equipment, insufficient ventilation
- Effect of foreign matter and force manure factors (lightning strike, power grid over-pressure,inclement weather, fire, etc.)

Chapter 5 Technical parameter

Model	HS1033EH 24L	HS1033EN 24L	HS1030EH 24L	HS1030EN 24L	HS1022EH 24L	HS1033EN 24L
AC output (inverter)						
Rated output voltage (V)	230 (Deviation ± 4%)					
Rated output power (VA)	3600		3300		2400	
Rated output power (W)	3300		3000		2200	
Peak power (VA)	6600		6000		4400	
Frequency (Hz)	50 / 60 (Deviation ± 0.3) automatic detection					
Discharge waveform	Pure sine wave					
Overload capacity	(102% <load <110%) ± 10%: close output after error reporting and 5 minutes; (110% <load <150%) ± 10%: Close output after 10 seconds; load> 150% ± 10%: close output after error declaration and 5 seconds;					
Power supply mode switching time	⩽10ms (Typical value)					
Battery (lead-acid or lithium battery)						
voltage range (V)	20.0~30.0					
Rated voltage (V)	24					
Maximum battery charging current (A)	100±5A	60±5A	100±5A	60±5A	80±5A	40±5A
PV maximum current (A)	100±5A	\	100±5A	\	80±5A	\
AC max. charging current (A)	60±5A		60±5A		30±5A	
Maximum inverter conversion efficiency	93.5%		93.5%		93.5%	
Lithium-ion battery charging strategy	Follow the BMS instruction					
Lead-acid battery charging strategy	Three stops					
Battery over-voltage protection	Yes					
Photovoltaic input						

Maximum PV input open circuit voltage (V)	500					
MPPT, voltage range (V)	90~450					
Maximum PV input (W)	3600	0	3600	0	2400	0
Maximum PV input current (A)	25	0	25	0	25	0
AC input (mains or generator)						
Rated voltage (V)	230 V					
Frequency (Hz)	50 / 60 (Automatic detection)					
Over-voltage protection (V)	(170~280) ± 4% (Out of range transfer inverter output)					
Over-frequency protection (Hz)	(47-55) ± 0.3 / (57-65) ± 0.3 is not to set, adaptive (Out of range transfer inverter output)					
Over-current protection (A)	30 (Circuit protection)					
Exchange anti-irrigation protection	Have					
Conventional parameters						
Product size (mm)	Length 372 * Wide 269 * Deep 100					
Net weight (kg)	6.7	6.5	6.7	6.5	6.5	6.3
Protection level / noise	IP20 (Forced air cooling, adjustable wind speed) / <60 db					
Working altitude (m)	<2000					
Operating temperature / humidity	-10℃~55℃ (-20℃ ~60℃ Storage temperature) / 5% -95% (No condensation)					
Display mode:	LCD+LED					
Communication interface	RS485, optional WIFI / 4G					
Standard	IEC/EN62109-1/2；IEC/EN61000-6-1/3					
Certificate	CE-LVD；CE-EMC					