Hybrid Inverter

User manual

1-3KW pure sine wave hybrid inverter

Dear customers, thank you for using our R & D and production of solar hybrid inverter, we sincerely hope that this product can meet your satisfaction, while expect that you can make additional comments on the product's performance and functionality. We will continue to improve, and improve product quality.

Read this manual and other related documents carefully before any work on the inverter. Documents must be stored carefully and available at all time.

The contents of this manual will be periodically updated or revised if necessary. However discrepancies cannot be excluded. Please make the object as standard or ask the latest version of manual from distribution channel.

Content

1 Summary

1.1 Product Overview:

This series product is developed by R&D experts of our company based on their decades of the research experience in the solar power system characteristics, MPPT, combined with household equipment electricity requirements. It is a set of PV power generation, energy storage, load shifting adjustment and other functions in one of the hybrid inverter.

This system can realize solar MPPT, power shifting, load shifting and uninterrupted power supply.

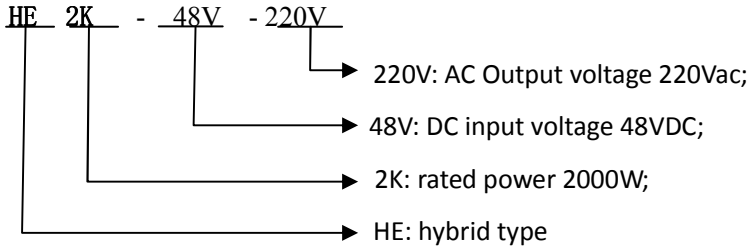
The system is equipped with high speed digital DSP core control devices, combined with the SVPWM control technology. Under high speed DSP control, the system can track generating and using electricity speedily, so that can adjust stored energy or supply power fast.

Application:

Home; Villa; Hotel; Security and protection and other solar generating and storing system

1.2 Denomination for Product

For example:



1.3 Safety Notice:

- Keep above 50cm away from display, TV while installing the product.
- It is normal that the case surface temperature go up to 50℃ during using;
- Do not use inverter with overload;
- Do not open inverter cover in case danger of electric shock, maintenance should be handled by technicians;
- Inverter inner short circuit will cause electric shock or fire danger. Do not put any liquid vessel on inverter.
- Cut off power rapidly if inverter work abnormal, and contact with local dealers or EAST Service office.
- Make sure not to keep or use the product in following environment

- No good air circulation
- Place having flammable gas corrosive material or lot of dust
- Place under abnormal high or low temperature(above 40℃ or below 0℃), or high humidity(above 90%)
- Place where with direct sunlight or near the heating appliance
- Place where violent vibration
- Outdoor

➢ In case of fire, please use the surrounding dry powder fire extinguisher. The use of liquid fire extinguisher has lead to danger of electric shock.

➢ Please install small breaker in the input terminal, so that in emergency situation the socket can be pulled out and cut the power supply.

Warning ！

◆ The equipment must connect to the ground, when connect to AC, make sure the ground connection is reliable.

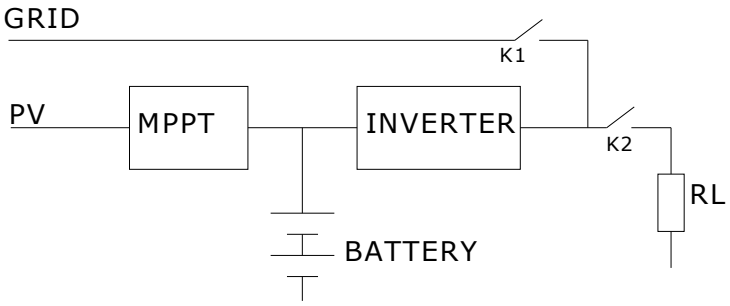
◆ Loss of abnormal operating is enormous; please do the operation according to the specifications of the user manual.

2 Product brief

2.1 Solar system composition

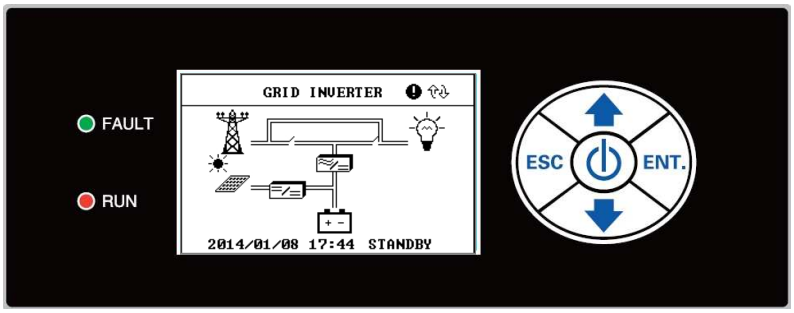
This hybrid solar system consists of combiner box, hybrid solar inverter, battery and load from the user. Electrical energy of PV go to the DC input terminal of inverter through combiner box, by the inverter DC-AC, the AC output supply power to the load or back to the grid.

2.2 System Principle

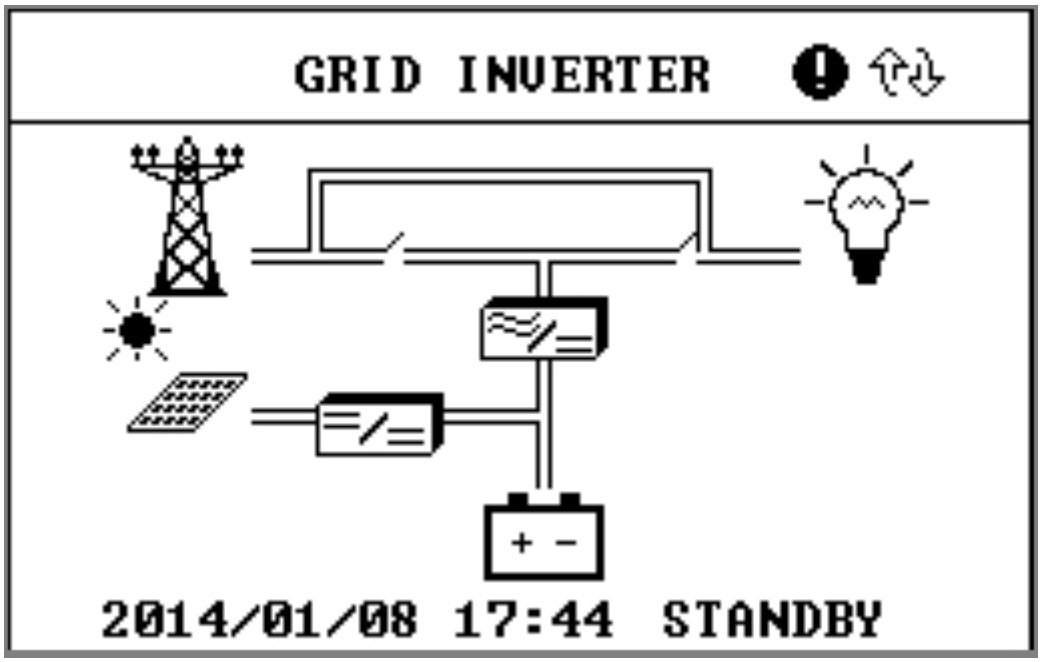


2.3 Product control description:

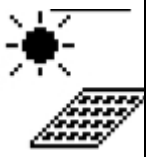
2.3.1 Control panel:



2.3.2 Main interface:



- Press “↑、↓” to select”  、  、  、  “icon, press “ENT “ to check the information of “grid、battery、output、MPPT”.

Menu icons	Manu name	Manu items	Interpretation
	Grid parameters	Voltage (V)	Grid input voltage
		Frequency (Hz)	Grid input frequency
		Current (A)	Load current
		Power (W)	Power (charger power +load power)
		Status :	AC input running status
	Output parameters	Output voltage(V)	Inverter output voltage
		Output frequency(Hz)	Inverter output frequency
		Load current(A)	Inverter output current
		Load power(W)	Inverter output power
		Load percent(%)	System load percent
	Battery specification	BUS voltage(V)	Battery voltage
		Battery current (A)	System charging/discharging current,”-”means discharge，”+”means charge
		Battery temperature(℃)	Battery running temperature(optional)
		Battery status ：	Battery running status “float charging/under voltage/over voltage”
	MPPT parameters	Voltage (V)	PV input voltage
		Current (A)	Output current
		Power (W)	Output power
		Voltage difference(V)	PV BUS voltage difference
2014-07	System date	System date	System date
17：44	System time	System time	System time
System standby	Running state of the system	Running state of the system	State of the system

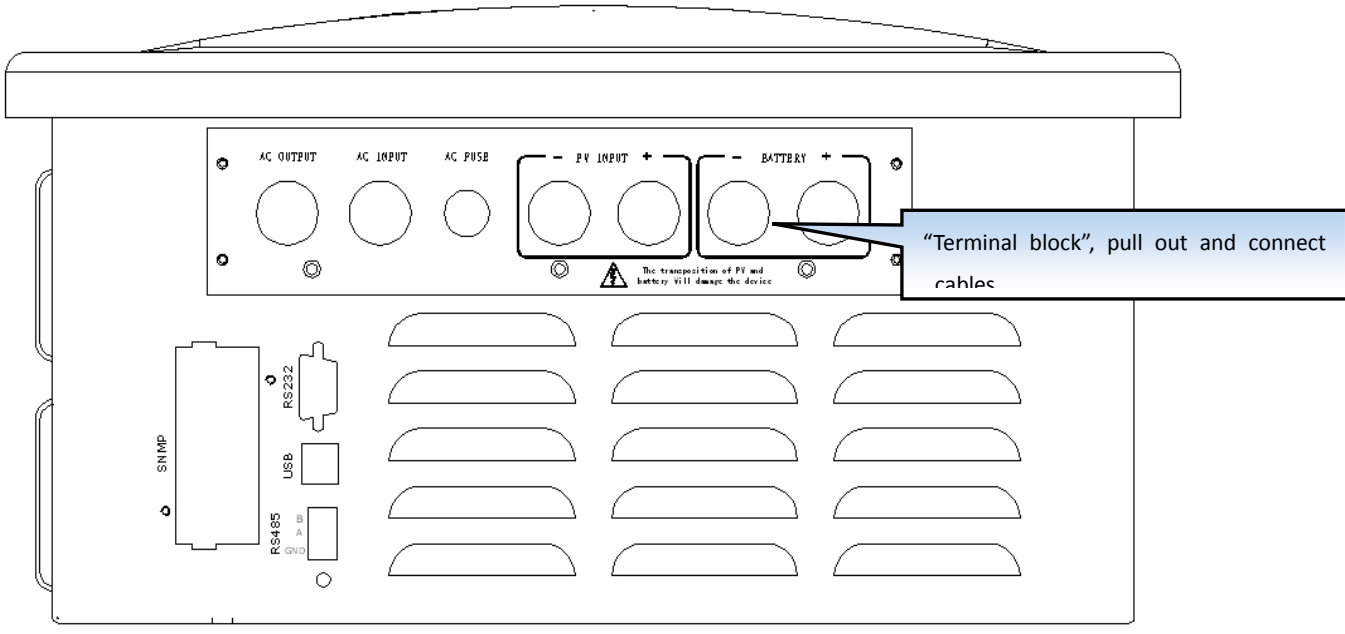
2.3.3 Button Description:

Symbol	Name	Function
	On /off button	Press and hold for 3 s, ON/OFF order
	Down	Press and hold for 0.5s， down to select menu or number
	Up	Press and hold for 0.5s, up to select menu or number
ESC	Escape button	Press this button to go back, press this button in main interface , is to clear the warning of the system
ENT.	Enter button	Press this button to confirm the operation

2.3.4 Indicator LED and Warning:

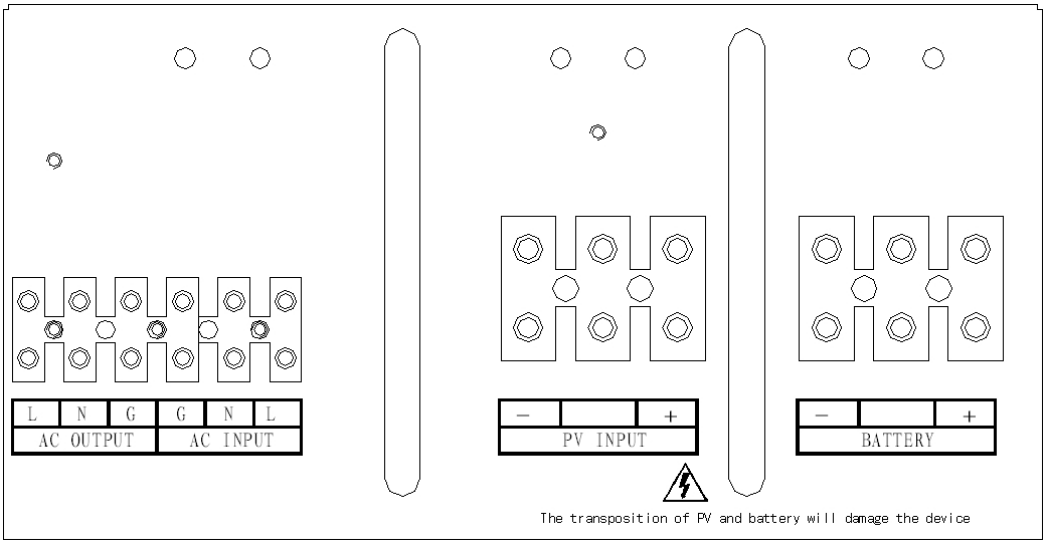
Indicator LED		Function description	Buzzer state
FAULT (red)	**Red on**	● Output over current、short circuit protection ● Over temperature protection ● System over voltage protection	Once /2 seconds warning
	Once /2 seconds flash	Over load、low battery	Once /2 seconds warning
RUN(green)	Once /6 seconds flash	Grid abnormal	Once /6 seconds beeping
		PV abnormal	

2.3.5 Schematic diagram of back plate



	Use
AC OUTPUT	load” L(live), N(neutral),G(ground)” connect to the hole;
AC INPUT	Grid “L(live), N(neutral), G(ground)” connect to the hole;
AC FUSE	Inverter AC input fuse;
PV INPUT “+”	PV “positive(+)” connect to the hole;
PV INPUT “-”	PV “negative(-)” connect to the hole;
BATTERY”+ “	Battery bank input “positive(+)”connect to the hole;
BATTERY”-”	Battery bank “negative(-)” connect to the hole;
RS485	RS485 communication input
RS232	RS232 communication input
USB	USB communication input
SNMP	Remote monitoring SNMP card input

2.3.6 Terminal Block Description



Mark		Use
AC OUTPUT	“L”	Load output “L(live)”
	“N”	Load output “N(neutral)”
	“G”	Load output “G(ground)”
AC INPUT	“G”	Grid input “G(ground)”

	“N”	Grid output “N(neutral)”
	“L”	Grid output “G(ground)”
PV INPUT	“+”	PV input terminal “+”
	“-”	PV input terminal “-”
BATTERY	“+”	Battery input terminal “+”
	“-”	Battery input terminal “-”

2.4 Technical specification:

Model		HE1K-48V-230V	HE2K-48V-230V	HE3K-48V-230V
Rated power [KW]		1	2	3
Output PF		1.0		
DC voltage		48Vdc		
Piece/cell		4*12V/24*2V		
Working mode		Grid-tie mode / anti-flow back can be set		
Time control		Energy Saving Priority/power supply priority/AC charging time can be controlled		
PV input	Max input voltage	150Vdc		
	Optimum operating voltage	65-120Vdc		
	The maximum conversion efficiency	≥97%		
	Max charging current	25A	50A	62A
	Recommended maximum PV power	1500W	3000W	3500W
AC input	Input voltage range	Single phase 230V±15%		
	Rated frequency	50/60Hz		
	Frequency range	50/60Hz ±5%		
	Power factor	≥0.98		
	Max charging current	20A	45A	60A
Inverter	Inverter voltage	230V(220V/240V can set)		

	Output voltage accuracy	±3% grid off，±10%(grid tied)
	Transient recovery time	≤60ms
	Fixed frequency	Automatically be the same frequency as the grid input
	Crest factor	3 : 1(Ipeak/Irms)
	Wave	Pure sine wave
	THD liner load	≤3%
	Overload	≥110%/125%/150%/180%/200%:4mins /1min/5s/20ms/0.5sreansfer to bypass or shutdown(shutdown when AC not available)
	0.1s short circuit current	3times rated current
	Max efficiency %	≥85%
Battery management	Battery type setting	Lithium /lead acid battery can be set by customer
	Battery setting	Battery number can be set
	Discharge depth setting	Yes
	Float charging voltage	56 Vdc
	End of discharge	42Vdc
	Charging current	Lead acid battery ：0.05 C——0.3 C；lithium battery ：0.1 C——1.0 C；can set
	Battery intelligent management	Battery bank automatically float charging, automatically temperature compensation
Transfer time	Power off mode—grid off mode	≤2s
	Grid off mode—grid tied mode	≤10ms
	Grid tied mode—grid off mode	≤10ms
Communication	Remote control	Transfer to bypass, transfer to inverter, shut down
	Computer interface	RS232/RS485/USB/SNMP(optional)
Environment	Operating temperature	0 — 45℃
	Max relative	95%(non condensed)

	humidity	
	Height	1000m, rated power (100m higher,1% derated)Max4000m
Others	Cooling	Forced cooling (fans speed change with load level)
	Noise	≤50 dB(1 m varies with load and temperature)
	(MTBF)	200,000 hours
	IP class (EN60529)	IP21

2.5 Working principle:

2.5.1 Description:

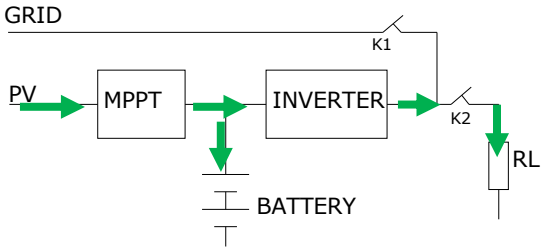
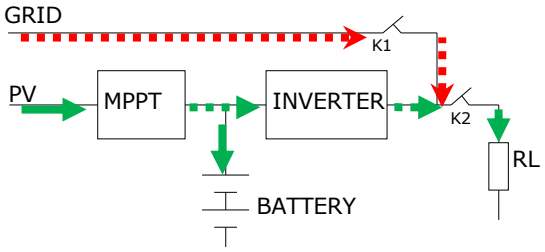
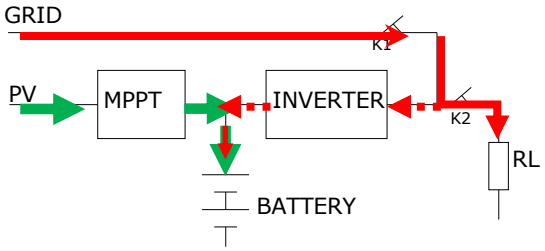
" ▪▪▶ ": dotted line: AC left or supplying energy;

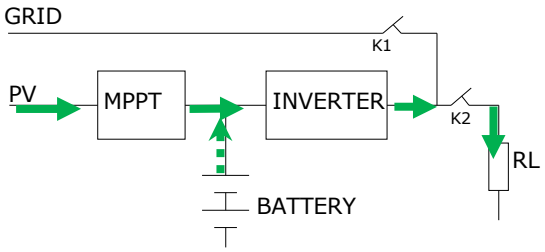
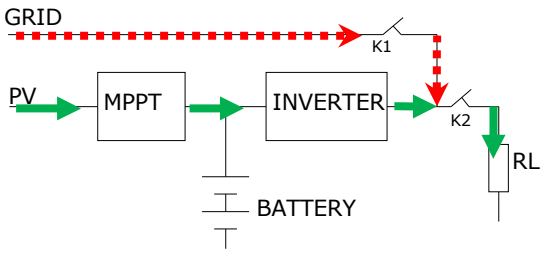
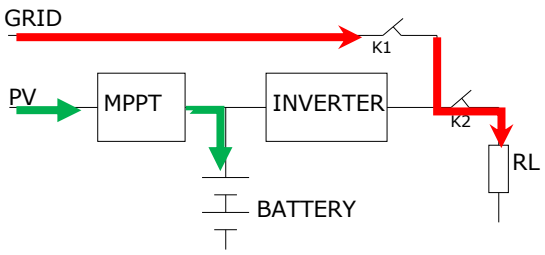
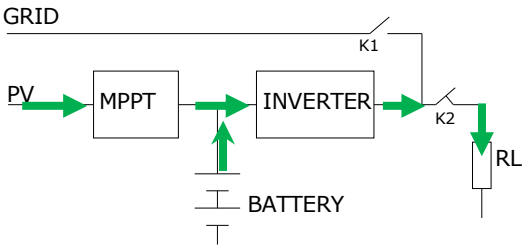
" ▪▪▶ ": dotted line: PV/BAT left or supplying energy;

" ▶ ": full line: AC full load energy;

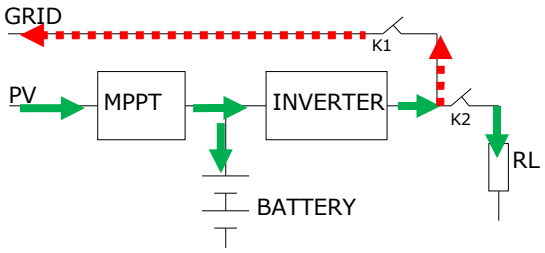
" ▶ ": full line: PV full load energy;

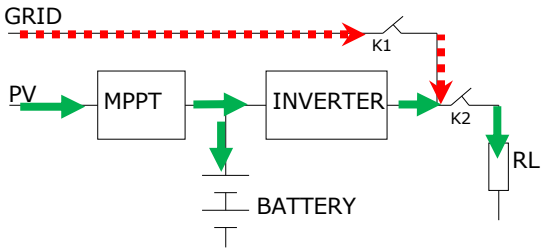
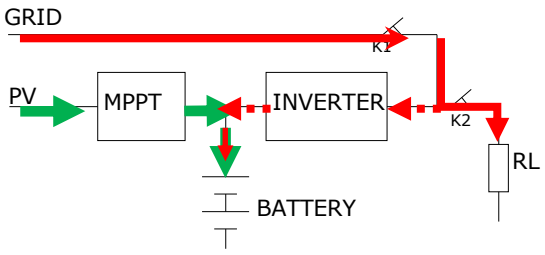
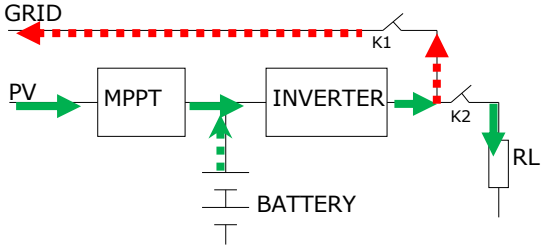
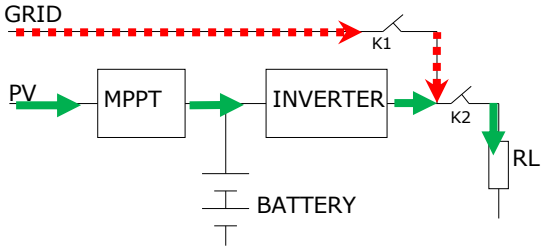
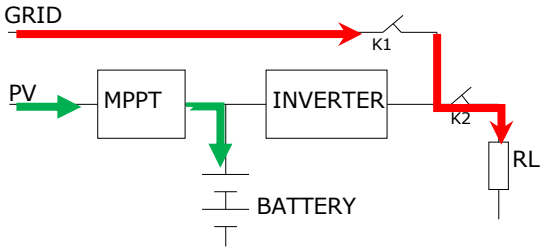
2.5.2 "ANTI- FLOW BACK mode":

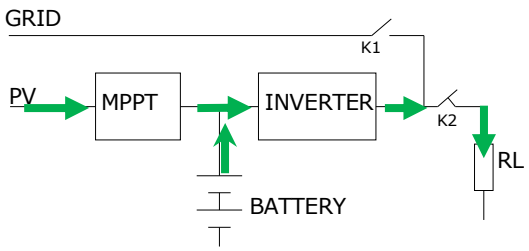
	When AC is normal, PV is sufficient, system charge the battery first and excess power takes the load.
	On "Energy Saving Priority" mode: When PV is insufficient, PV charges the battery first, the excess energy will support load together with AC. Inverter and AC power support the load at the same time.
	On "Energy Saving Priority" mode: When PV is insufficient and less than the power battery requires, the system turns on AC charger and charge the battery with PV and the load will be supplied by grid.

	On “Energy Saving Priority” mode: When PV is insufficient and less than the power battery requires, the system turns on AC charger and charge the battery with PV and the load will be supplied by grid.
	On” Energy Generating Priority” mode: during the user setting time, when PV is insufficient, and battery discharge to the setting point, the system let PV and AC support the load at the same time. Battery is on the status of being charged.
	Set the “AC charging close” mode: during the user setting time, system only let PV charge the battery, forbid AC to charge the battery. And load is supported by the AC.
	When AC is abnormal, system use PV and battery power to support the load at the same time.

2.5.3 Grid tied Mode

	When AC is normal, PV is sufficient, system charge the battery first and excess power takes the load and feed back into the grid. System is on the status of generating power

	On “Energy Saving Priority” mode: When PV is insufficient, PV charges the battery first, the excess energy will support load together with AC. Inverter and AC power support the load at the same time.
	On “Energy Saving Priority” mode: When PV power is insufficient and less than the power battery requires, the system turns on AC charger and charge the battery with PV at the same time and the load will be supplied by grid.
	On” Energy Generating Priority” mode: during the user setting time, the inverter is under the rated output power, when PV is insufficient, PV and battery power support the load at the same time. Battery is on the status of discharging.
	On” Energy Generating Priority” mode: during the user setting time, when PV is insufficient, and battery discharge to the setting point, the system let PV and AC support the load at the same time. Battery is on the status of being charged.
	Set the “AC charging close” mode: during the user setting time, system only let PV charge the battery, forbid AC to charge the battery. And load is supported by the AC.

	When AC absents, battery and PV will supply the load together.

3 Product storage and installation

3.1 Product storage:

If the machine won't be installed immediately, please store the inverter vertically according to the package instruction, and in the dry place where can avoid direct sunshine, dust and high temperature.

3.2 Installation

Here introduce the requirements while choosing the installation site and doing wiring.

As every site has its specificity, here we do not cover the detailed installation steps, but offer general guidance and methods so that installer can handle in different situations.

Note:

- Installation site must be guided by the licensed professional engineer authorized by the company;
- Whiling doing the electrical connection, first connect the grounding and ensure all switches are open before the connection is unfinished;
- Inverter should be installed according to the instruction and local standards;
- When connecting the battery, please remove the rings, bracelets, watches, bracelets and other metal objects. In case of electrolyte leakage or damage to the battery, you must replace the battery, and put it into sulfuric acid corrosion resistant containers and disposed of in accordance with local regulations. If skin touches the electrolyte, please immediately wash with water.

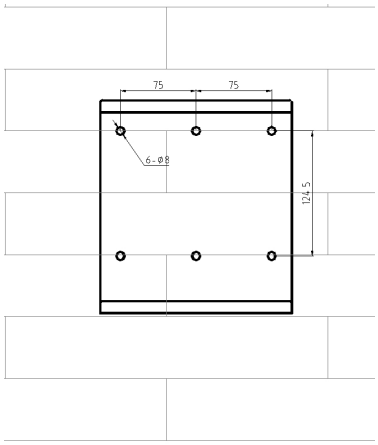
Warning!

To ensure the safety of device and people, please let professionals do the installation.

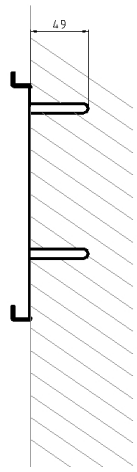
3.3 Installation site

When selecting an inverter installation space, you should note the following requirements:

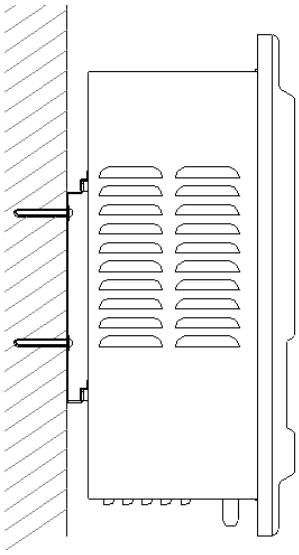
1) Put the inverter in the suitable position with good ventilation, at least 150mm ambient space around the vent and fan;
2) The inverter needs to be put in the clean and dry indoor room (Environment temperature:0-40 degree; Relative humidity: 5%~90%; ideal operating temperature is 25 degree). If room temperature reaches 40 degree, it's suggested to add air-conditioner or other ventilation device;
3) If altitude is more than 1000m, please use it with less power (de-rating);
4) The system shall be installed in a suitable location which indoor walls meet the load-bearing capacity (according to the convenience of the user and should ≥1.6 m), like the installation space dimensions.



Mounting hole dimensions



Fixed hole depth drawings



Product installation drawings

3.4 Cable connections

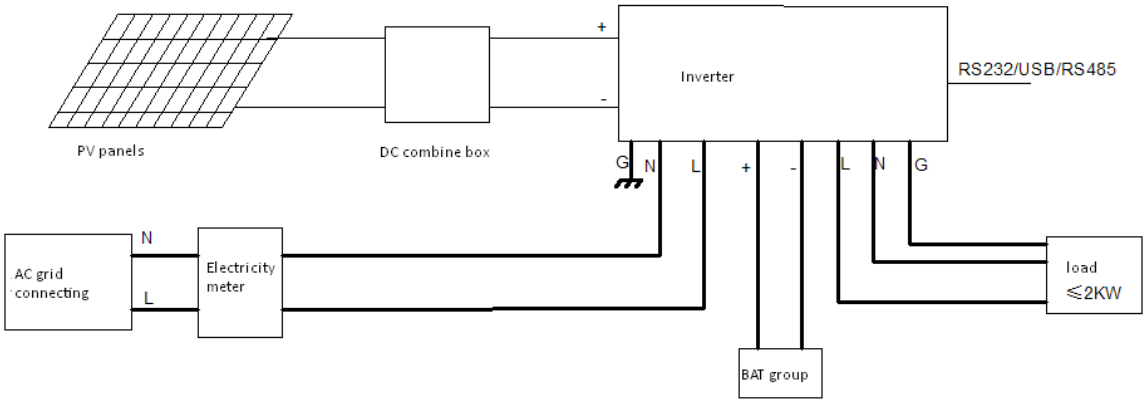
When selecting external wiring cables, cable current capacity and system overload capacity should be considered, as well as environment temperature and physics support. The following table is a proposal to cable selected, engineer should refer to the relevant local standards and under table to make a comprehensive selection. The length of the

connecting cable is generally 2 to 10 meters; long cable will cause the voltage decrease, the corresponding cable cross-sectional area size should be increased.

Item	Rate power / Cable number	1K	2K	3K	Remark
Load output"L+N+G "	GB(mm^2)	≥0.75	≥1.0	≥1.5	
	ANSI(AWG)	≥16	≥14	≥12	
Grid input"L+N+G "	GB(mm^2)	≥0.75	≥1.0	≥1.5	
	ANSI(AWG)	≥16	≥14	≥12	
Battery input"+, -"	GB(mm^2)	≥4	≥10	≥16	
	ANSI(AWG)	≥10	≥6	≥4	
PV input"+, -"	GB(mm^2)	≥2.5	≥6	≥12	
	ANSI(AWG)	≥12	≥8	≥6	

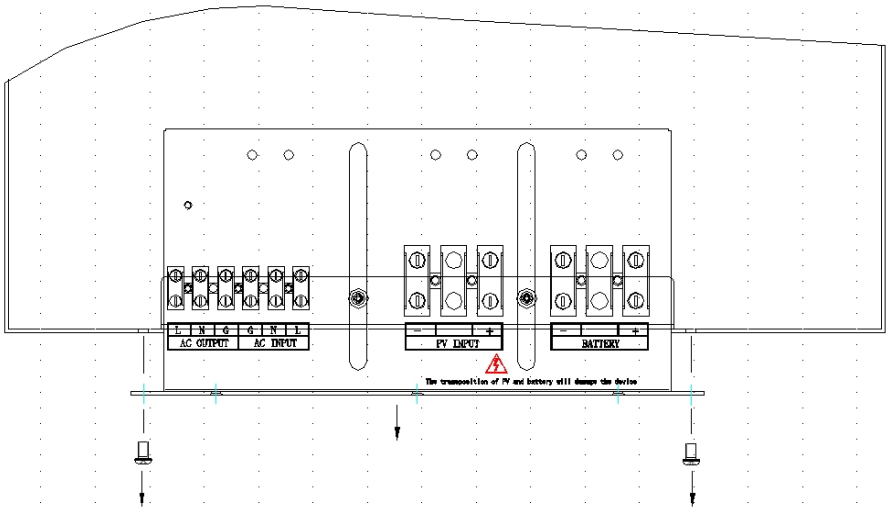
3.5 System connection:

3.5.1 System cables connection

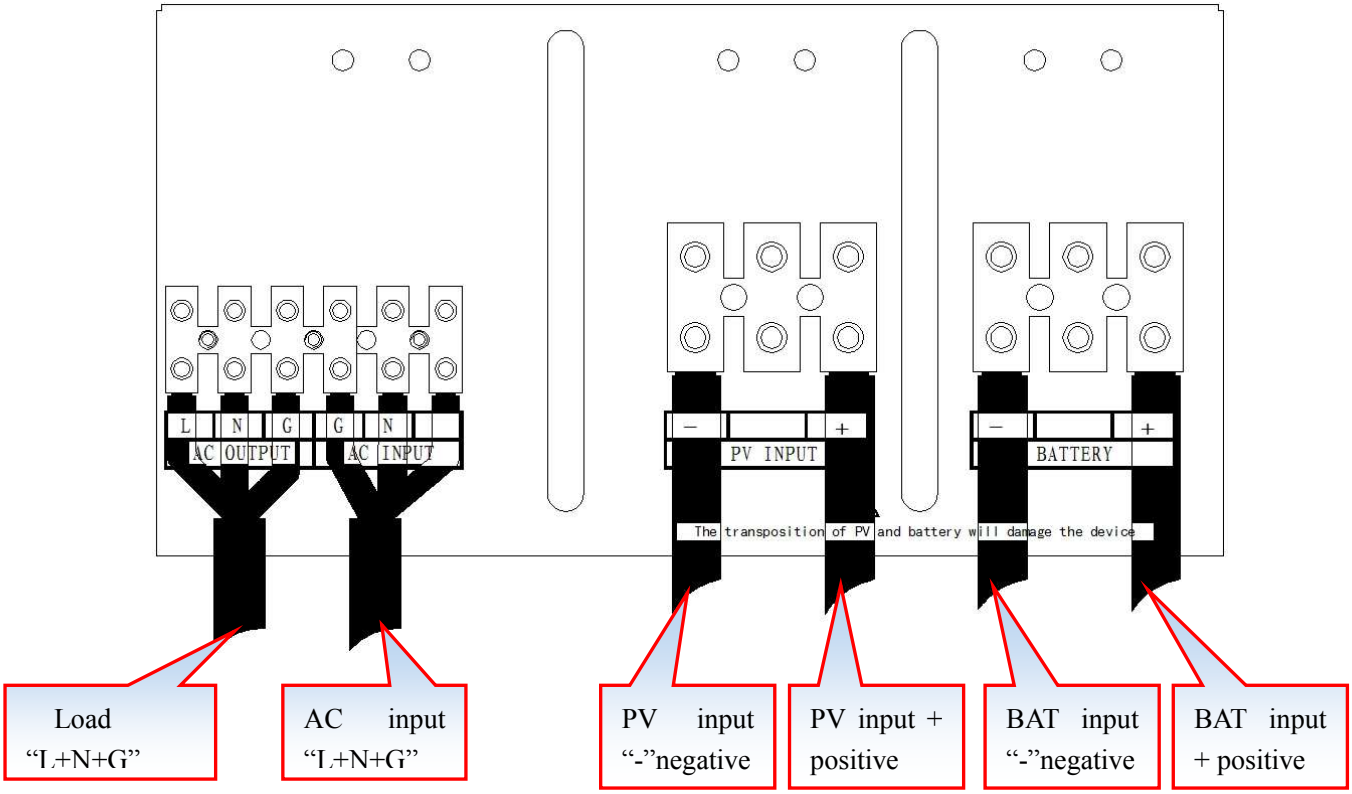


3.5.2 Inverter cables connection diagram:

1) Remove the inverter bottom side "cables connection terminal panel" screws and take out the cables connection terminal panel.



2) According to the identification and connect the cables



4 Operation Description

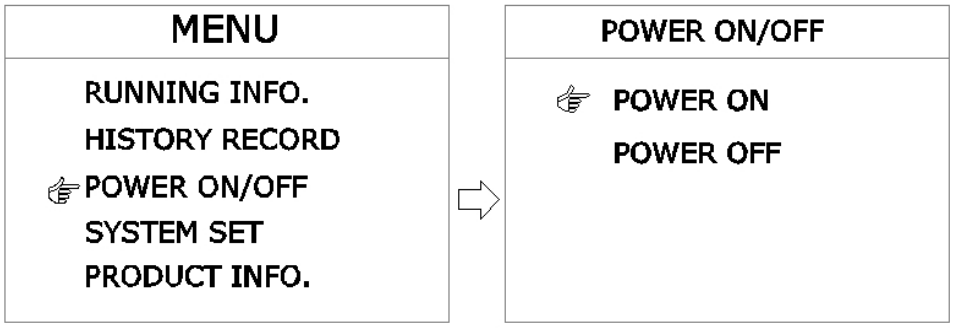
4.1 Daily switching on/off:

1) Battery cold start： press the panel on/off button"⏻"for 3 seconds，the system on， after 15 seconds the inverter will turn to power supply.

2) Daily switching on：press the panel on/off button"⏻"for 3 seconds，the system on， after 15 seconds the inverter will turn to power supply.

3) Daily switch off： press the panel on/off button"⏻"for 3 seconds， the system switch off. At this moment, the system is at the standby mode.

4) In the case of having AC， press "ENT." button， then press " ↓ ↑ " choose "power on/off"， press " ↓ ↑ " choose "power on" or "power off", then press "ENT." button to execution:



Remark: After system unattended function being enable, the system will depend on the inverter AC input and battery status, switching on/off automatically.

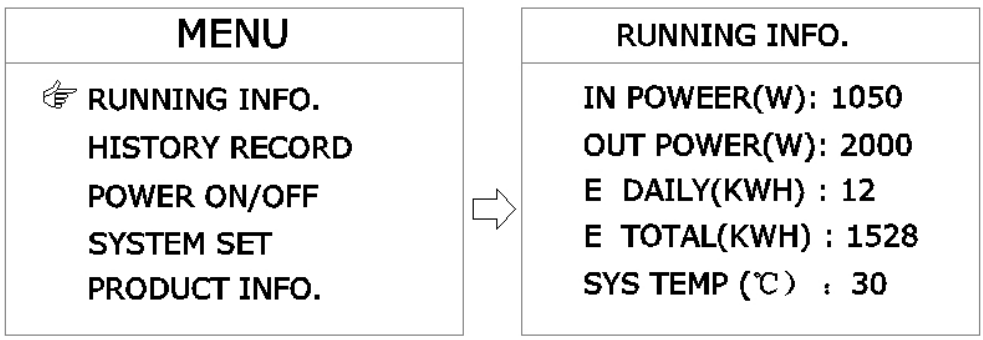
4.2 For long time not using, switching on/off operation:

1) If more than 7 days not using the inverter, press the panel switch on/off button "⏻"**for 3 seconds,** after switching off the inverter, then switch off the AC input, battery input breaker.

2) If more than 3 months not using, please switch on the AC input breaker, and switch on the system to charge the battery more than 12 hours.

4.3 System information inquiry

Press "ENT." button go to the menu，press "↓↑" choose "RUNING INFO." Press "ENT." to confirm:

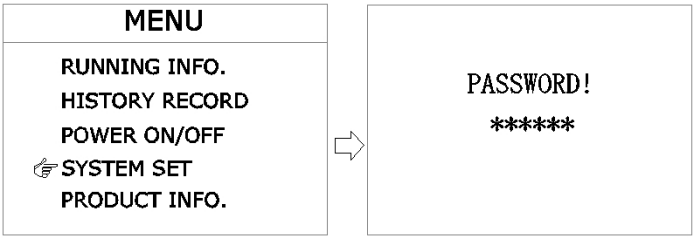


Display	Interpretation
IN POWER(W)	System present input power

OUT POWER(W)	System present output power
E DAILY(KWH)	Daily generated power
E TOTAL(KWH)	Total generated power
SYS TEMP(℃)	System temperature

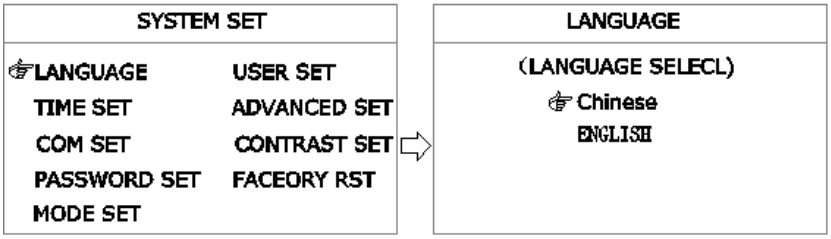
5 SYSTEM SET

Press “ENT” button and go to the menu; press “↓↑” choose “RUNING INFO.” Press “ENT” to confirm input the password（the system default password is “000000” press “ENT” go to the “SYSTEM INFO.”



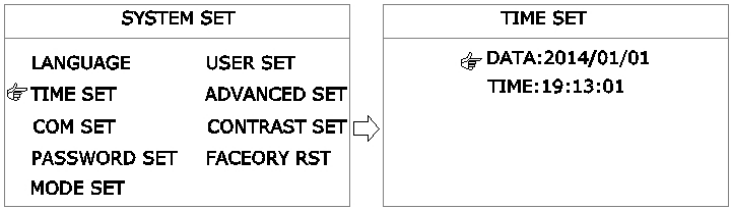
5.1 LANGUAGE：

Press “ ↓ ↑ ”to choose the item，press “ENT.” to choose；press “ ↓ ↑ ” to choose the language， press “ENT.” to confirm. At last press”ESC” to return.



5.2 TIME SET

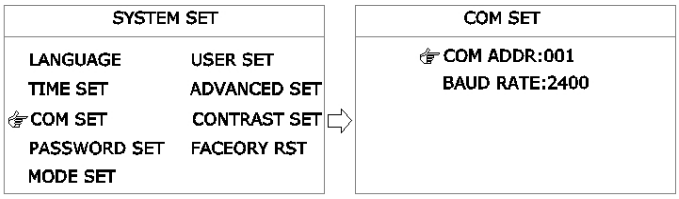
Press “ ↓ ↑ ” to choose， then press “ENT.” to confirm； press “ ↓ ↑ ” to modify the number, press “ENT.” to confirm； Press “ESC” to return.



5.3 COM SET

Press “ ↓ ↑ ” to choose， press “ENT.” to confirm； press “ ↓ ↑ ” to modify the

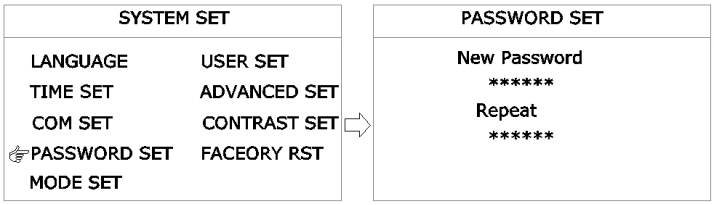
number， press “ENT.” to confirm; Press “ESC” to return.



Wrong settings will lead to the inverter communication abnormal, must be set by the professional person, the highest communication baud rate shall below 9600bps.

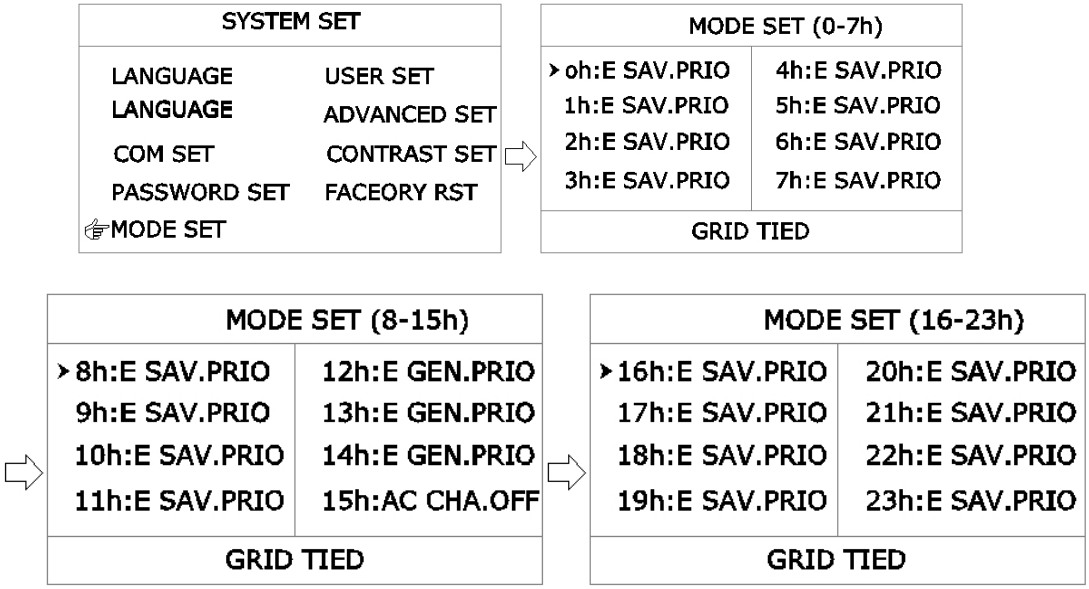
5.4 PASSWORD SET

Press “ ↓ ↑ ” to choose, press “ENT.” to confirm; press “ ↓ ↑ ” to modify the number, press “ENT.” to confirm; press “ESC” to return.



5.5 MODE SET

Press“↓↑”to choose， press “ENT.” to confirm； press“↓↑”to modify the number， press “ENT.” to confirm; Press “ESC” to return.



Remark:

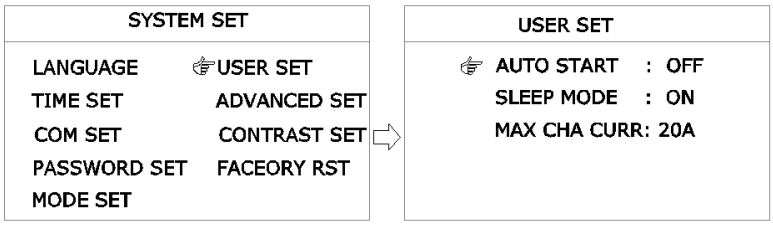
1) ANTI-TIED: System works in grid tie mode, but doesn’t deliver the power to the grid.
2) GRID-TIED: system works in grid tie mode, and deliver all the power to the grid.

3) The mode set is the system working mode at different time, the user shall depend on the local electricity policy and the system PV panel configuration, user power consumption to set, totally have three kinds of mode:

- E SAV.PRIO： it means within the system setting time, make sure to charge the battery Priority, the excess energy will supply the power to the load or supply to the grid, make sure the battery with full energy, applicable to the area of power shortage.
- E.GEN.PRIO： It means within the system setting time, the PV energy will supply the power to the load or to the grid priority, the excess energy will charge the battery group. If the PV energy is not enough, the battery group will compensate, when reach to the DOD(settable), the inverter will active the AC power supply function, within the setting time, the system will go to the AC charge off mode, applicable to the area which have the Sectional power pricing.
- AC CHA.OFF: It means during the system setting time shut down the AC charge, not allow the AC to charge the battery.

5.6 USER SET

Press "↓↑" to choose, press "ENT." to confirm; press "↓↑" to modify the number, press "ENT." to confirm; press "ESC" to return.



Remark:

- Unattended function: When it enable, the system will power on automatically, when disable, the system need to switch on/off.
- Sleeping mode set: when power on, the system supply the power by the battery, when the load low than 3%, the system will go to the energy saving mode to reduce the empty load power consumption, when adding load high up to 5%, the system will automatically running.
- Maximum charge current: The setting value we suggest lower than the 25% battery group capacity.

Warning: If the maximum charging current is set incorrectly, it will cause damage to the battery pack and the system, please follow the battery technology required to set parameters.

5.7 ADVANCED SET

Press "↓↑" to select SET, press "ENT." to enter, than press "↓↑"to select

Digital/Command, press “ENT.” finished selection, press “ESC” return.

Description

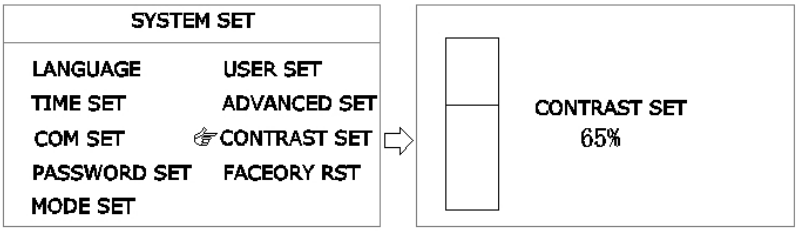
1) ANTI-TIED: System works in grid tie mode, but doesn’t deliver the power to the grid.

2) GRID-TIED: system works in grid tie mode, and deliver all the power to the grid.

Warning: If this selection is set incorrectly, it will cause violation of local electricity regulation and give users unnecessary economic losses .Must be operated by the manufacturers of professional and technical personnel, if necessary, please contact your local authority.

5.8 CONTRAST SET

Press “↓↑” to select, press “ENT.” to enter, than press “↓↑” to select Digital/Command, press “ENT.” finished selection, press “ESC” return.



5.9 FACEORY RSTET

Press “↓↑” to select, press “ENT.” to enter, than press “↓↑” to select Digital/Command, press “ENT.” finished selection, press “ESC” return.

Warning: If this selection is set incorrectly, it will cause damage to the system, must be operated by the manufacturers of professional and technical personnel, if necessary, please contact your local authority.

6 Maintenance

6.1 Preventive Maintenance

To ensure the reliability and long service for the inverter system, do following checks each month:

1. Shutdown the inverter (Check the operation step);
2. Check the ventilation holes are not blocked;
3. Check the cover of machine whether there is too much dust cover;
4. Ensure the product don't be damp;
5. Turn on the machine (product on / off).

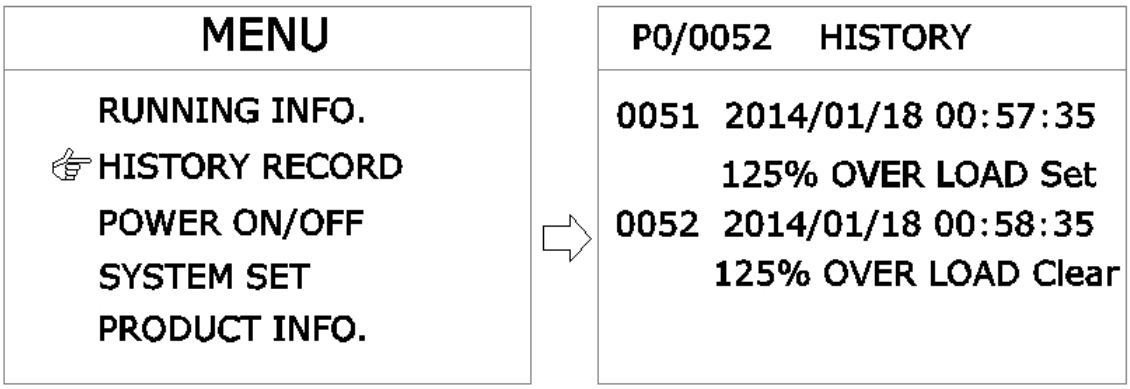
6.2 Battery maintenance

The using life of battery will depend on the using environment, battery discharge times and temperature. So we recommend reducing battery discharge times and depth of discharge:

- Remove dust and dirt on the battery;
- Check whether all the battery internal connection loose or corrosion, if necessary must be replaced and repaired;
- Ensure the battery and battery terminal tightened.

6.3 History records check and common problems solve

Press "ENT."to enter main menu ,press "↓"to chose "History record", press "ENT." finished selection, press "ESC"return.



Common alarm information and exception resolution:

<table>
<tr><th>Alarm information</th><th></th><th>Description</th><th>Treatment</th></tr>
<tr><td>AC abnormal</td><td rowspan="3">Green LED 1/6S times flashes, the buzzer 1/6S alarm</td><td>Range voltage exceeds the rated value ± 18% of utility grid</td><td rowspan="2">● Automatic censored after 40 s .
● Adjust the system input power, or waiting for recovery.</td></tr>
<tr><td>AC frequency abnormal</td><td>Range frequency exceeds the rated value ±5Hz of utility grid</td></tr>
<tr><td>PV abnormal</td><td>PV input voltage gauge or abnormal</td><td>● Check the solar panels whether receive the sunlight, if not please ensure after there have sunlight.
● Check the connection cable of solar panel whether disconnect or connect abnormal, return to normal connection.</td></tr>
<tr><td rowspan="4">Output overload</td><td rowspan="4">Red LED 1/4S times flashes, the buzzer 1/2S alarm. Derating or shutdown after stopping</td><td>125%≥load≥110%，4 min</td><td rowspan="4">Turn on the inverter after shedding <100% or load shedding</td></tr>
<tr><td>150%≥load≥125%，1 min</td></tr>
<tr><td>180%≥load≥150%， 5 S</td></tr>
<tr><td>Load≥180%，20 MS</td></tr>
<tr><td>Output over current</td><td rowspan="2">Red LED bright, Buzzer 1 time / 1 second, the output over current.</td><td rowspan="2">The load overload or short circuit.</td><td rowspan="2">● Press “ESC” to silence
● Check whether overload or short circuit.</td></tr>
<tr><td>Output short circuit</td></tr>
<tr><td>System over temperature</td><td>Red LED bright, Buzzer 1 time / 1 second</td><td>Heat sink or transformer over temperature</td><td>● Press “ESC” to silence
● Check whether the load is more than 100% to run for a long time
● Check whether the cooling air duct blockage.
● Let the professional maintenance engineer to check</td></tr>
<tr><td>Battery low voltage</td><td>Red Led 1/2S times flashes, the buzzer alarm</td><td>Utility grid abnormal, the battery enter the discharge production mode</td><td>Press “ESC” to silence, after waiting for the mains to recharge.</td></tr>
<tr><td>Bus over-voltage protection</td><td>Red LED bright, Buzzer 1 time / 1 second</td><td>The voltage of Utility Grid was too high or system abnormalities</td><td>Let the professional maintenance engineer to check</td></tr>
</table>

7 Appendix

1) Option

- SNMP card (optional): remote wireless communications operations.
- RS485 interface (optional): remote wireless communications operations.

2) Packing List

- 1 * Inverter
- 1* User manual
- 1* Ac insurance tube
- 1* Warranty card