USER MANUAL

1.5KVA-10KVA OGM Series
Hybrid Inverter

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ABOUT THIS MANUAL

Purpose

The purpose of this manual is to provide explanations and procedures for installing, operating and troubleshooting for the unit. This manual should be read carefully before installations and operations. Please retain this manual for future reference.

Scope

This document defines the functional requirements of the unit, intended for worldwide use in electronic processing equipment. All manuals are applicable under all operating conditions when installed in the End Use system, unless otherwise stated.

IMPORTANT SAFETY INSTRUCTIONS

⚠️ **WARNING: This chapter contains important safety and operating instructions. Read and keep this User Guide for future reference.**

General Precautions

1. Before using the unit, read all instructions and cautionary marking:

   (1) The unit (2) the batteries (3) all appropriate sections of this manual.

2. **CAUTION** --To reduce risk of injury, charge only deep-cycle lead acid type rechargeable batteries. Other types of batteries may burst, causing personal injury and damage.

3. Do not expose the unit to rain, snow or liquids of any type. The unit is designed for indoor use only. Protect the unit from splashing if used in vehicle applications.

4. Do not disassemble the unit. Take it to a qualified service center when service or repair is required. Incorrect re-assembly may result in a risk of electric shock or fire.

5. To reduce risk of electric shock, disconnect all wiring before attempting any maintenance or cleaning. Turning off the unit will not reduce this risk.

6. **CAUTION** --Battery are not already installed by the supplier only a qualified professional (e.g. service person) may install the Inverter.

7. **WARNING: WORKING IN VICINITY OF A LEAD ACID BATTERY ISDANGEROUS.**

   BATTERIES GENERATE EXPLOSIVE GASES DURING NORMAL OPERATION. Provide ventilation to outdoors from the battery compartment. The battery enclosure should be designed to prevent accumulation and concentration of hydrogen gas in "pockets" at the top of the compartment. Vent the battery compartment from the highest point. A sloped lid can also be used to direct the flow to the vent opening location.

8. **NEVER** charge a frozen battery.

9. No terminals or lugs are required for hook-up of the AC wiring. AC wiring must be no less than 8 AWG gauge copper wire. Battery cables must be rated for 35mm or higher and should be no less than table 1. Crimped and sealed copper ring terminal lugs with a HRNB38-8 hole should be used to connect the battery cables to the DC terminals of the unit. Soldered cable lugs are also acceptable.

10. Be extra cautious when working with metal tools on, or around batteries. The potential exists to drop a tool and short-circuit the batteries or other electrical parts resulting in sparks that could cause an explosion.

11. No AC or DC disconnects are provided as an integral part of this unit. Both AC and DC disconnects must be provided as part of the system installation. See INSTALLATION section of this manual.

12. Fuses are provided as the over current protection of the battery supply.

13. When PV module or panel is exposed to light, it starts to supply high DC voltage, be sure to turn off DC switch before commencing the maintenance, and make sure the cables from PV panel are properly sealed after disconnection.

14. GROUNDING INSTRUCTIONS -This battery charger should be connected to a grounded permanent wiring system. For most installations, the Ground Lug should be bonded to the grounding system at one (and only one point) in the system. All installations should comply with all national and local codes and ordinances.

15. **AVOID** AC output short-circuit; avoid DC input short-circuit and not connect the mains while DC input short-circuit

16. **Warning:** The maintenance information is only to service persons, If the product is used in a manner which is not covered by the scope of warranty, the protection provided by the product maybe impaired.

Personal Precautions

1. Someone should be within range of your voice to come to your aid when you work near batteries.

2. Have plenty of fresh water and soap nearby in case battery acid contacts skin, clothing, or eyes.

3. Wear complete eye protection and clothing protection. Avoid touching eyes while working near batteries. Wash your hands when done.

4. If battery acid contacts skin or clothing, wash immediately with soap and water. If acid enters eyes, immediately flood eyes with running cool water for at least 15 minutes and get medical attention immediately.

5. Baking soda neutralizes lead acid battery electrolyte. Keep a supply on hand in the area of the batteries.

6. NEVER smoke or allow a spark or flame in vicinity of a battery or generator.

7. Be extra cautious when working with metal tools on, and around batteries. Potential exists to short-circuit the batteries or other electrical parts which may result in a spark which could cause an explosion.

8. Remove personal metal items such as rings, bracelets, necklaces, and watches when working with battery. Battery can produce short-circuit current high enough to weld a ring, or the like, to metal causing severe burns.

9. If a remote or automatic generator start system is used, disable the automatic starting circuit and/or disconnect the generator from its starting battery while servicing to prevent accidental starting during servicing.

INSTALLATION

Unpacking and Inspection

Carefully unpack the inverter/charger from its shipping carton.

Verify all of items list below are present. Please call customer service if any items are missing.

- The unit

- 1 user manual

Basic Configuration

1.5KVA-10KVA OGM Series hybrid Inverter is designed to serve as a backup power supply for AC loads. The input power of 1.5KVA-10KVA OGM Series hybrid Inverter comes from PV system and AC grid which not only supply power to AC loads but also charge the battery bank when the power from AC grid or AC generator is present (also known as Line Mode).

In the event of AC grid (or AC generator) outage, the AC loads can be alternatively powered by PV system (if the illumination is sufficient) and battery bank.

The following illustrations show basic applications for 1.5KVA-10KVA OGM Series hybrid Inverter.

Figure 1. Typical Application of 1.5KVA-10KVA OGM series

hybrid Inverter

PV System

AC Generator

Note: Appliances like Air conditioner needs at least 3 minutes to restart in case of a power shortage occurs in a way that the power turns off then back on again rapidly (time is required to balance the refrigerant gas in inside circuit); so in order to protect your Air conditioner, please consult the Air conditioner manufacturer whether they have already provided time delay function before installing. Otherwise, Inverter will trig overload fault and shut off its output to protect your appliance but sometimes it is not enough and your Air conditioner can be damaged internally beyond repair.

Batteries

The unit support 12volt,24volt or 48vlot battery bank. Please wire battery correctly. Before proceeding, ensure you have appropriate size batteries for this inverter. The unit can use flooded lead-acid, or sealed GEL/AGM lead-acid batteries so ensure that your batteries are in one of these categories. 1.5KVA-10KVA OGM inverter with built-in MPPT solar controller, for the battery and solar panel connection please refer to figure 2, figure3 and figure4. If with the built-in 48 MPPT 40A solar charge controller, then please configure solar panels more than 2350W, otherwise it can not reach the maximum charge current, if with the built-in48MPPT60A solar charge controller, then please configure solar panels more than 3500W, otherwise it can not reach the maximum charge current.

Note: If you are using a gel battery or a deep cycle battery, please do not use ordinary lead-acid batteries for use in solar energy systems. This is likely to damage the lead acid battery or to reach the desired effect.The battery must be wired to match with the DC input voltage. Recommend to use battery capacity more than 200AH .
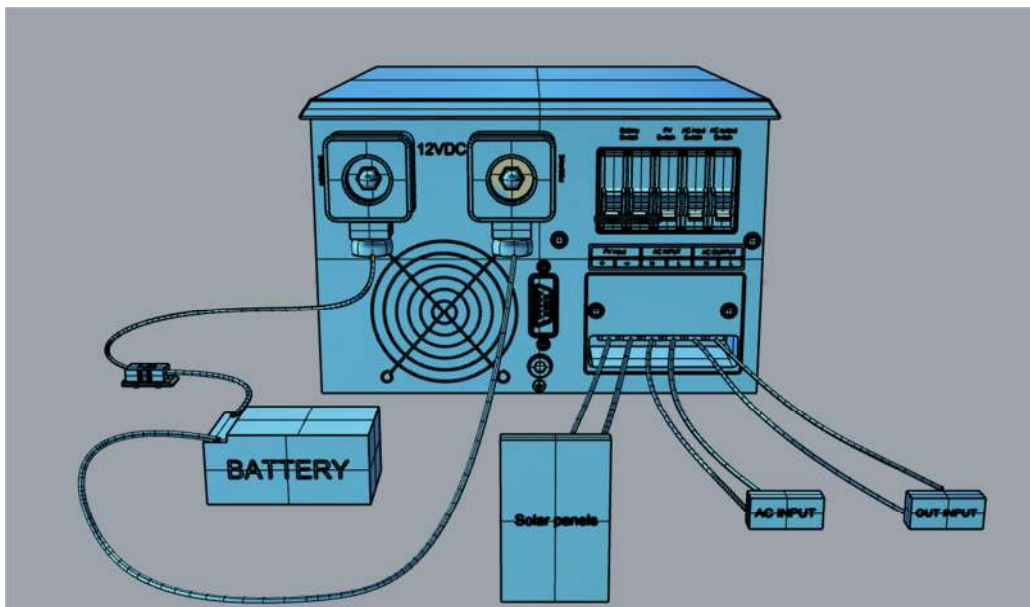

Figure 2. 1.5KVA OGM 12V solar inverter system- the connection diagram of solar panel and batter
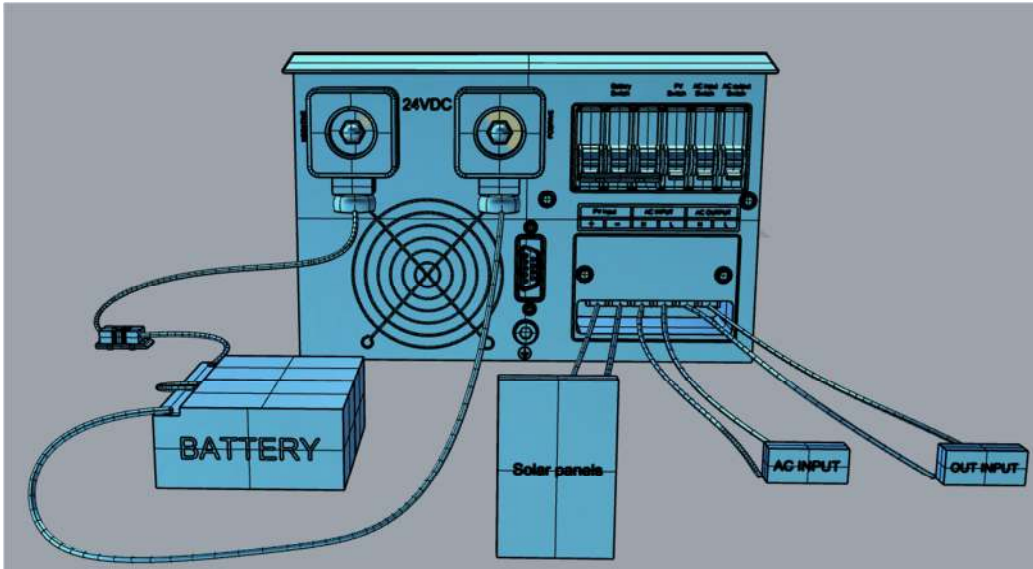
Figure3. 2.5-3.5KVA OGM 24Vsolarinvertersystem-theconnectiondiagram of solar panel and battery
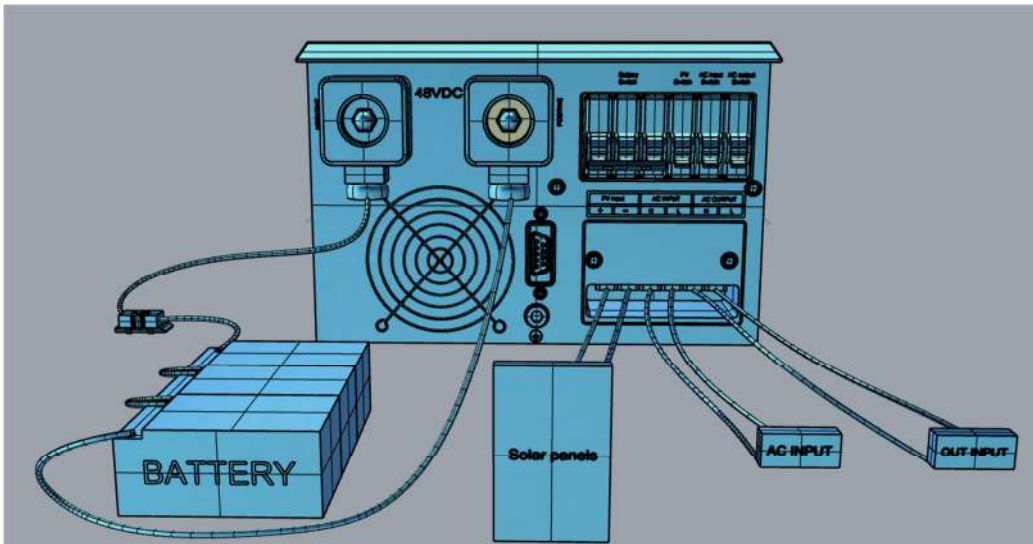

Figure4. 6-10KVA OGM 48Vsolarinvertersystem-theconnectiondiagram of solar panel and battery

Battery Cable Size

Below table 1 you can find information for recommended battery cable and terminal.

Table 1. Recommended battery cable and terminal size

Model	DC	Typical	Battery	1~3 m	0.5 m	Cable Terminal

Number	Voltage	Amperage	Capacity	one-way	one-way	
1.5KVA	12V	100A	200AH	25mm^2	25mm^2	RNBS16-8
2.5KVA	24V	100A	400AH	25mm^2	25mm^2	RNBS16-8
3.5KVA	24V	150A	400AH	35mm^2	35mm^2	RNBS16-8
6KVA	48V	125A	800AH	35mm^2	35mm^2	RNBS16-8
10KVA	48V	200A	800AH	50mm^2	50mm^2	RNBS25-8
						RNBS25-8

DC Disconnect and Over-Current Protection

For safety and to comply with regulations, battery over-current protection and disconnect devices are required. Fuses and disconnects must be sized to protect the DC cables is used, and must be rated for DC operation. Do not use devices rated only for AC service – they will not function properly.

Note that some installation requirements may not require a disconnect device, although over-current protection is still required.

Battery Cable Connection

Observe Battery Polarity! Place the ring terminal of DC cable over the bolt and directly against the unit's battery terminal. Tighten the M8 screw with 6-10 Nm. Do not place anything between the flat part of the Backup System terminal and the battery cable ring terminal or overheating may occur.

DONOTAPPLYANYTYPEOFANTI-OXIDANTPASTETOTERMINALSUNTILAFTERTHEBATTERY CABLE WIRING ISTORQUED!!

WARNING: Shock Hazard

Installation must be performed with care for the high battery voltage in series.

⚠️**Caution!!** Do NOT place anything between battery cable ring terminals and terminals on the inverter. The terminal screw is not designed to carry current.

Apply Anti-oxidant paste to terminals AFTER terminals have been screwed.

Verify that cable lugs are flush with the battery terminals. Tighten battery cables to terminals (6-10 Nm).

AC Cable Size

Before wiring the input and output of inverter, refer to table 2 for minimum recommended cable size and torque value

Table 2. Recommended cable size and torque value for AC wire

Model Number	Typical	AC Input	AC Output	Torque value

	Amperage			
1.5KVA OGM 230Vac	10A	12AWG	14AWG	1.5~2.0 Nm
2.5KVA OGM 230Vac	15A	12AWG	12AWG	1.5~2.0 Nm
3.5KVA OGM 230Vac	20A	12AWG	12AWG	1.5~2.0 Nm
6KVA OGM 230Vac	40A	12AWG	12AWG	1.5~2.0 Nm
10KVA OGM 230Vac	60A	10AWG	10 AWG	2.0~2.5 Nm

AC Connections

Installation should be done by a qualified electrician. Consult local code for the proper wire sizes, connectors and conduit requirements.

On the left of the AC hard wire cover.Two three-station terminal block is provided to make the AC connections. The terminal block is used to hard wire the AC input, AC output, and ground. The National Electrical Code requires that an external disconnect switch be used in the AC input wiring circuit. The AC breakers in a sub panel will meet this requirement.
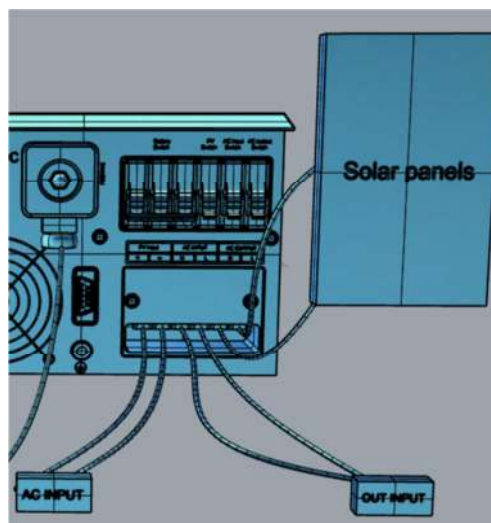

Figure 5. AC Cable Connect to unit

Step 1: Disconnect the unit from the battery by removing the battery cables. Turning off the unit before disconnect from the battery.

Step2: Following the wiring guide located in the AC input wiring compartment as figure5, connect the GND (green/yellow), Line (brown), and neutral (blue) wires from the AC input (utility, generator etc) to the terminal block.

⚠ **Caution!!** Be sure that AC source is disconnected before attempting to hardwire it to the unit.

Step 3: Connect the AC Line output wiring to the terminal marked AC Line (output), following the wiring guide inside the compartment. Torque the wires into the terminal block.

Step 4: Lock the AC covers.
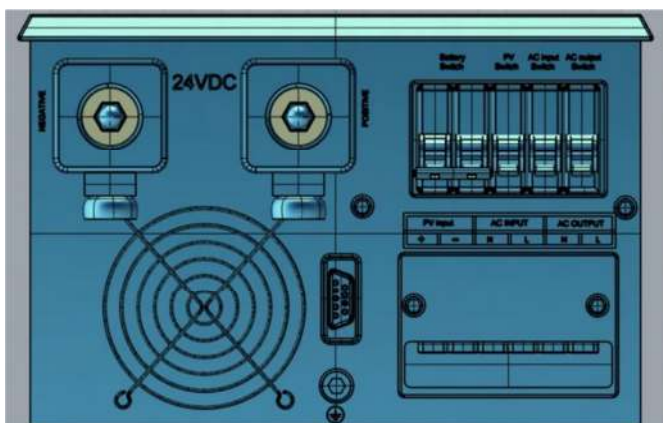
Machine panel introduction
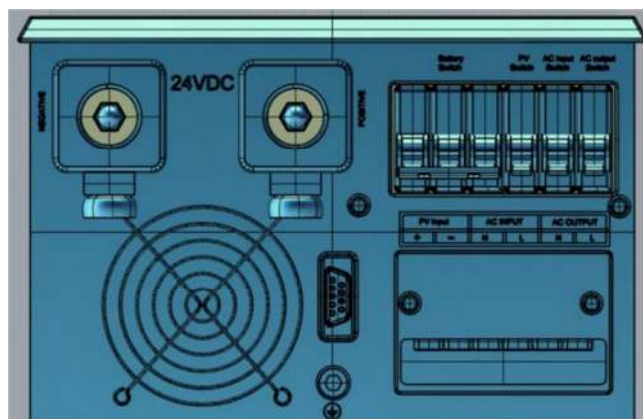

Figure 6. 1.5KVA Front panel   Figure 7. 2.5-10KVAFront panel

OPERATION
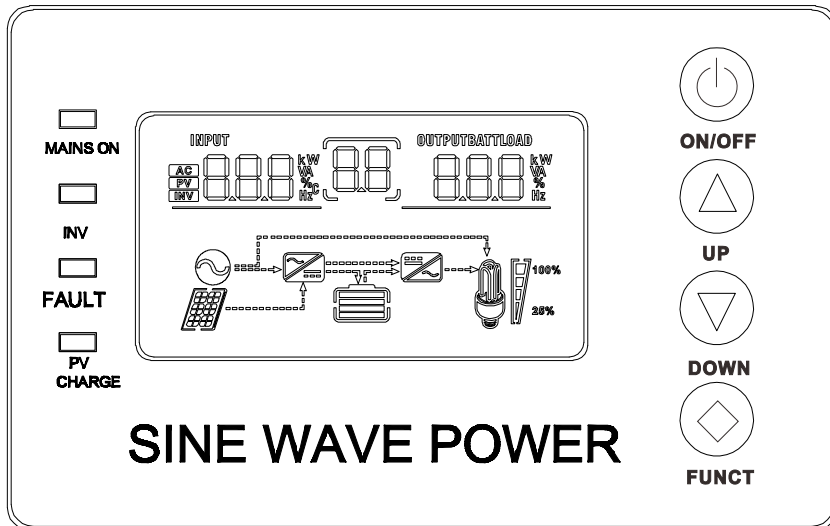
Table 3. configuration button function

Switch	Description
ON/Off	Long press 3 seconds to hear a beep to turn on, press 5 seconds to turn off
UP	Page up, data increment
DOWN	Page down, data is decreasing
FUNCT	Function setting

LED Indicator	
LED	**Description**
MAINS ON	Mains input indication, the inverter is working in bypass, and the mains is charging the battery
INV	Battery inverter status indication
FAULT	Inverter overload indication
PV CHARGE	PV Input and charging indication

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1. Charging voltage regulation   2. Charging current regulation
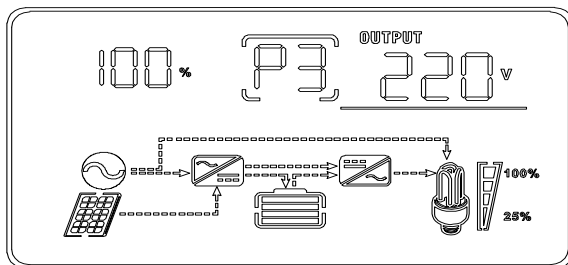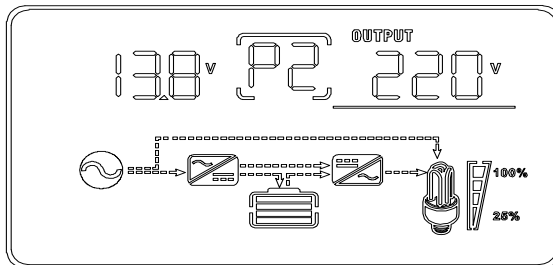
3. Buzzer on & off   4. Mode selection
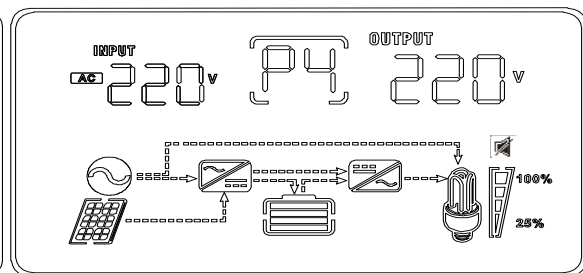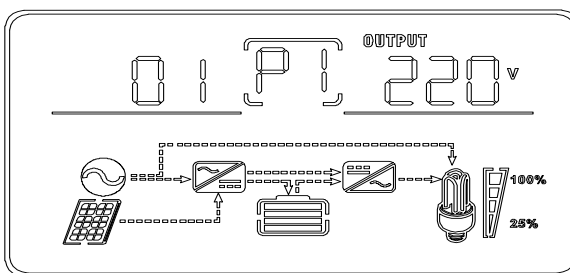
5. DC/AC/ Intelligent mode selection setting
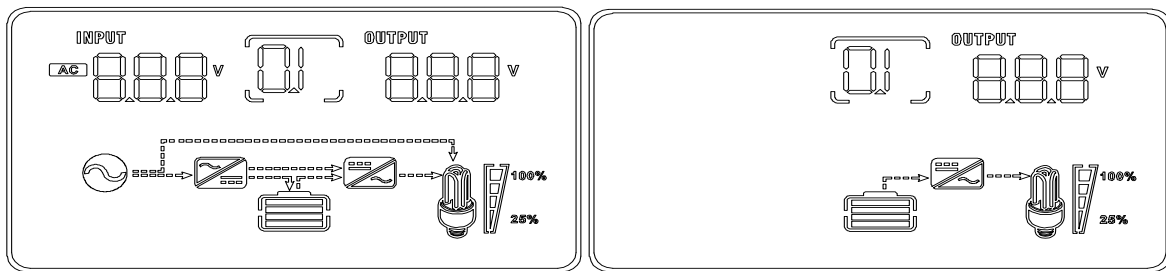
6.AC mode priority   DC mode priority
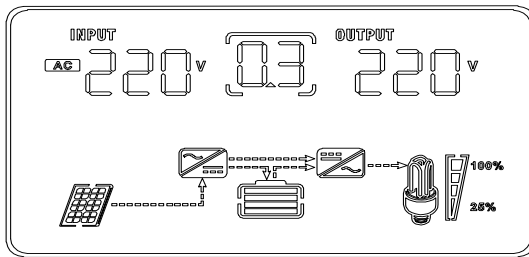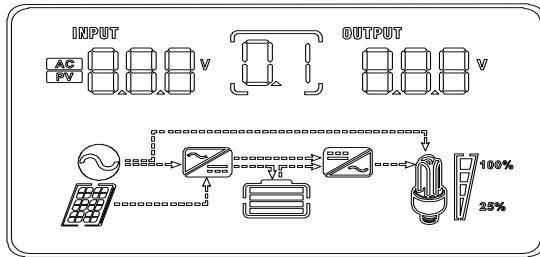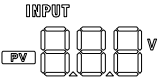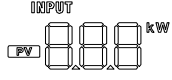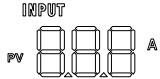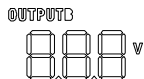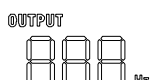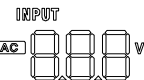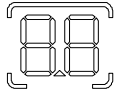
Intelligent mode

LCD display meaning

Table 5. display meaning

	Grid input icon
	AC-DC icon
	DC-AC icon
	PV -icon
	Bypass Icon
	AC Voltage and Frequency display
	The load icon and level bar indicates the loading level (0~100%), Loading display

	Level of remaining battery capacity, Battery voltage
INPUT PV 8.8.8 V	PV (Solar system)
INPUT PV 8.8.8 kW	PV (Solar system) power generation display
INPUT PV 8.8.8 A	Pv charging current
OUTPUT 8.8.8 V	Ouput voltage
OUTPUT 8.8.8 Hz	Output frequency
INPUT AC 8.8.8 V	AC input voltage
🔇	Light on - prohibit the buzzer, light off – allow the buzzer tweets
8.8.	inverter working mode selection: 01 mains priority, 02 energy saving mode, 03 battery priority

Inverter working mode LCD setting instructions ：

Long press the function key for 5 seconds ◈ , the inverter enters the function

parameter setting state, P0 Flashing, press ▲/▼ key respectively

P0, P1, P2, P3, P4 flashing,

P1-P4 represent the four functional parameters of the inverter, and they are set as follows :

Display code	Description
P0	Exit settings ; After setting the required parameters, press ▲/▼ to P0 flashing, press ◇, P0 no flashing, press ◇ again to exit settings
P1	Long press the function key for 5 seconds ◇ enter setting state, press ◇ to P1 flashing, press ◇ again 01、02、03 flashing, press ▲/▼ can choose, 01 Mains priority, 02 is energy saving mode, 03 is battery priority mode
P2	Long press the function key for 5 seconds ◇ enter setting state, press ▲/▼ to p2 flashing, press ◇ again, has a value representing the charging voltage flashing, press ▲/▼ can choose the required charging voltage.
P3	Long press the function key for 5 seconds ◇ enter setting state, press ▲/▼ to p3 flashing, press ◇ again, 20%、40%、60%、80%、100% flashing, Each percentage corresponds to 10A、15A、20A, 25A、30A charging current, press ▲/▼ can choose the required charging current.

P 4	Long press the function key for 5 seconds ◇ enter setting state, press ▲/▼ to p 4 flashing, press ▲/▼ can choose "ON" icon 🔇 slake, Buzzer on, N icon 🔇 light one, Buzzer off

Description of Buzzer alarm

Inverter is operating normally	Buzzer prohibited	By default, the buzzer does not sound
	Buzzer on	The buzzer beeps 4 times every 15 seconds to indicate that the inverter is in the battery - inverter state
Battery high voltage alarm	The buzzer beeps 4 times per second, indicating that the battery voltage is too high	
Battery low voltage alarm	The buzzer beeps twice per second to indicate that the battery voltage is too low	
Over temperature alarm	Buzzer beeps for 2 seconds, stop for 1 second	

Operating Indicators

DC Mode:

Voltage and Frequency exchange every5seconds.

every 5seconds.

PV Mode:

Voltage and Frequency exchange
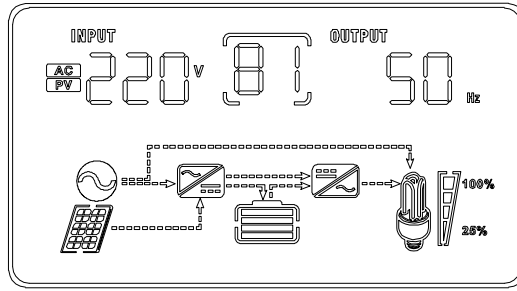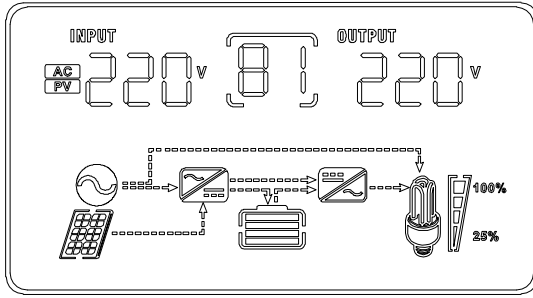
Fault Mode:

The upper left corner of the LCD shows the fault code and buzzer ringing.
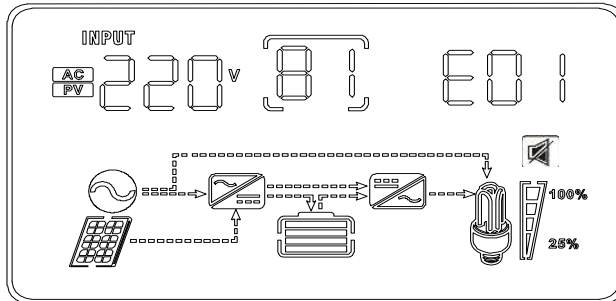
E01	E02	E03	E04
Power tube over current	Output short circuit	Overload	Over temperature
E05	E06	E07	E08
Battery voltage too high	Battery voltage too low	The power amplifier wire is reversed	Output voltage is too low

SPECIFICATIONS

Table 7. Line Mode Specifications

Model	1.5KVA OGM	2.5KVA OGM	3.5KVA OGM	6KVA OGM	10KVA OGM
Rated power	**1KW**	**2KW**	**3KW**	**5KW**	**8KW**
Input Voltage Waveform	Sine wave(Utility or Generator)				
Nominal Input Voltage	220Vac				
Low Line Disconnect	176Vac±4%(NOR)				
	130Vac±4%(WID)				
Low Line Re-connect	185Vac±4%(NOR)				
	138Vac±4%(WID)				
	Note: 1.NOR setting can be used for general electrical appliance 2. WID setting can be used only for some special load, Such as lamp, fan.				

High Line Disconnect	251Vac±4%(NOR)
	251Vac±4%(WID)
High Line Re-connect	242Vac±4%(NOR)
	242Vac±4%(WID)
Max AC Input Voltage	258VAC
Nominal Input Frequency	50Hz / 60Hz (Auto detection)
Low Line Frequency Disconnect	40+0.3Hz for 50Hz, 50+0.3Hz for 60Hz
Low Line Frequency Re-connect	41+0.3Hz for 50Hz, 51+0.3Hz for 60Hz
High Line Frequency Disconnect	55+0.3Hz for 50Hz, 65+0.3Hz for 60Hz
High Line Frequency Re-connect	54+0.3Hz for 50Hz, 64+0.3Hz for 60Hz
Output Voltage Waveform	As same as Input Waveform
Output Short Circuit Protection	Air switch
Efficiency (Line Mode)	>97%
Transfer Time	15ms (typical) 20ms max(WID)
Bypass charger enable in off mode	Yes

Note: NOR – Normal range; WID-Wide range

Table 8. Invert Mode Specifications

Model	1.5KVA OGM	2.5KVA OGM	3.5KVA OGM	6KVA OGM	10KVA OGM

Output Voltage Waveform	Pure Sine Wave
Rated Output Power	1 ~ 8KW(220VAC)
Power Factor	0.9 - 1.0
Nominal Output voltage	220Vac
Minimum Peak Output Voltage at Rated Power	>191V
Output Frequency (Hz)	50Hz / 60Hz ± 0.3Hz
Output Voltage Regulation	±10%
Nominal Efficiency	>87% (@Normal DC Input; >60% R load)
Over-Load Protection	105% <load<150%, beeps 0.5s every 1s, and Fault after 60s. Load>150%, beeps 0.5s every 1s, and Fault after 20s.
Capable of starting electric motor	YES
Output Short Circuit Protection	Current limit (Fault after 10s), Air switch
Power saver	Load ☐25 ±5W (Enabled on "P/S auto" setting of Remote control

DC voltage			
Nominal DC Input Voltage	12VDC	24VDC	48VDC
Min DC start voltage	10.5Vdc	21Vdc	42Vdc
Low DC Alarm	10.5Vdc ± 0.2Vdc	21Vdc ± 0.4Vdc	42.0 ± 0.8Vdc
Low DC Shut-down	10.5Vdc ± 0.2Vdc	20Vdc ± 0.4Vdc	40.0 ± 0.8Vdc
High DC Shut-down	16.0Vdc ±	32Vdc ± 0.4Vdc	64.0 ± 0.8Vdc

	0.2Vdc		
High DC Shut-down Recovery	15.5Vdc ± 0.2Vdc	31Vdc ± 0.4Vdc	62.0 ± 0.8Vdc

Table 9. AC Charger Mode specification:

Nominal Input Voltage	220Vac
Input Voltage Range	185V -242Vac(NOR) 153V -242Vac(WID)
High Voltage Disconnect	242Vac±4%(NOR) 242Vac±4%(WID)
High Line Re-connect	237Vac±4%(NOR) 237Vac±4%(WID)
Low Voltage Disconnect	185Vac±4%(NOR) 153Vac±4%(WID)
Low Line Re-connect	191Vac±4%(NOR) 157Vac±4%(WID)
Nominal Output Voltage	According to the battery type
	12VDC model: Max 20A
	24VDC model: Max 20A
	48VDC model: Max 20A

Nominal Charge Current	96VDC model: Max 20A
Charge current tolerance	±1A
Charge Algorithm	**Three stage:** **Boost CC** (constantcurrentstage) **Boost CV** (constant voltage stage) **Float** (constant voltagestage)

Note: NOR – Normal range;

WID-Widerange

Rated Battery voltage	12VDC	24VDC	48VDC	96VDC
Rated charge current	30A	50A	60A	60A
Input voltage range	18-150Vdc	34-150Vdc	65-150Vdc	144-180Vdc
Max. PV open circuit array voltage	170Vdc	170Vdc	170Vdc	234Vdc
Max. recommended input power (W)	360W	1200W	2880W	4800W

Table 10. Solar Charger Mode Specifications

Table 11. General Specifications

MODEL	1.5KVA OGM	2.5KVA OGM	3.5KVA OGM	6KVA OGM	10KVA OGM

Indicators	LED+LCD Display				
Protections	Low battery, over charging, over load , over temp.				
Remote control	YES				
Operating Temperature Range	0°C ~ 40°C				
Storage temperature	-15ºC ~ 60ºC				
Operation humidity	5% ~ 95% (non-condensing)				
Earthing(ABYC standard)	Follow customer requirement: Inverter mode: the neutral and the earth joined ; Line mode: the neutral and the earth separated. Use a Relay to realize the function.				
Audible Noise	65dB max				
Cooling	Forced air, variable speed fan				
Size (L*W*H mm)	370*310*150	485*350*170			
MODEL	1.5KVA OGM	2.5KVA OGM	3.5KVA OGM	6KVA OGM	10KVA OGM
Net weight (Kg)					

Product specifications are subject to change without further notice

APPENDIX A

How to Select and Configure PV Panels

The following parameters can be found in each PV panel's specification:

- P_{max}: Max output power(W)
- V_{mp}: max power voltage(V)
- V_{oc}: open-circuit voltage(V)
- I_{mp}: max power current(A)
- I_{sc}: short-circuit current(A)

PV panels can be connected in series or parallel in order to obtain the desired output voltage and current which meets the inverter's allowed range.

When connecting PV panels in series, the max voltage and current of the string is

$$V_{string} = V_1+V_2+V_3+V_4\ldots$$
$$I_{string} = I_1=I_2=I_3=I_4$$

When connecting the above PV string in parallel, the max voltage and current of the total string is

$$V_{total} = V_{string1}=V_{string2}=V_{string3}=V_{string4}\ldots$$
$$I_{total} = I_{string1}+I_{string2}+I_{string3}+I_{string4}$$
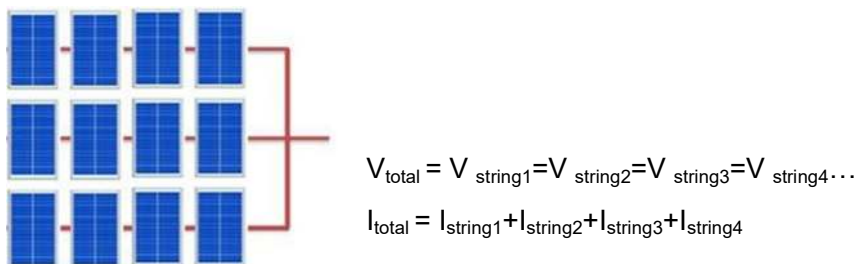
In either case, the total output power is $P_{total} = P_{panel}$ X Number of PV panel The guideline to select and configure PV string is

- P_{total} shall be equal or slightly larger than the max. capacity of solar battery charger (900W for 3000VA

  model and 2600W for 5000VA model). Surplus capacity of PV string does not help the solar charger's capacity and only result in higher installation cost.

- Total V_{mp} of the string shall be within the operating voltage range of solar battery charger (60~72V for 3000VA model and 120~144V for 5000VA model are recommended).

- Total I_{mp} of the string shall be less than the max. input charging current of the solar battery charger (20A for 3000VA and 30A for 5000VAmodel)

- Total V_{oc} of the string shall be less than the max. PV input voltage of the solar battery charger (75V for 3000VA and 150V for 5000VAmodel).

Example 1 - How to connect 4000VAmodel to PV panels with the following parameters?

- P_{max}:260W
- V_{mp}:30.9V
- V_{oc}:37.7V
- I_{mp}:8.42A
- I_{sc}:8.89A

(1) The max. PV input power for 3500VA model is1200W,

1200W / 260W =4⇒min. 4 PV panels shall be connected.

(2) Best Operating Voltage Range is 60~72

72V/30.9V = 2.33 ⇒max. number of PV panel in series is 2.

(3) Max. input charging current is20A,

20A/8.42A=2.37　⇒max. number of PV panel in parallel is2.

(4) Taking (1)~(3) into consideration, the optimized configuration is 2 PV panels in series　and 2 strings in parallel, as shown below.
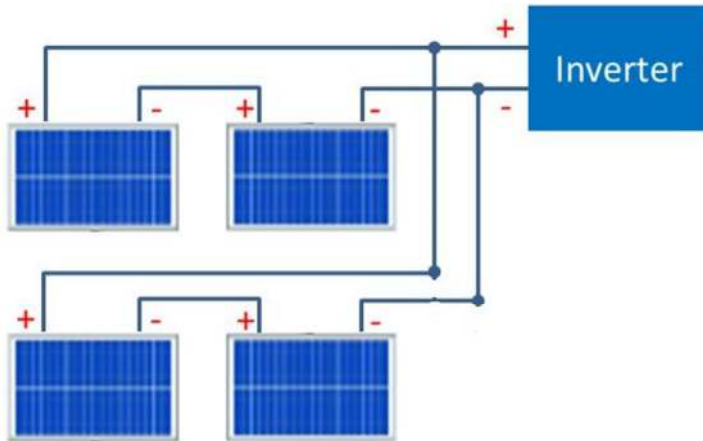
(5) Check again the V_{oc} and I_{sc} of PV string,

   V_{oc} of string is 61.8V < 75V (Max. PV Input Voltage) ⇒OK

   I_{sc} of string is 2 x 8.89A = 17.78A < 20A (Max. PV Input Current) ⇒OK

Example 2 - How to connect 5000VA **model to PV panels with the following parameters?**

- P_{max}:260W
- V_{mp}:30.9V
- V_{oc}:37.7V
- I_{mp}:8.42A
- I_{sc}:8.89A

(1) The max. PV input power for 5000VA

   model is 2600W, 2600W / 260W =

   10⇒min. 10 PV panels shall be

   connected.

(2) Best Operating Voltage Range is110~144V,

   144V/30.9V = 4.66 ⇒max. number of PV panel in series is 4.

(3) Max. input charging current is30A,

   30A/8.42A=3.56   ⇒max. number of PV panel in parallel is3.

(4) Taking (1)~(3) into consideration,theoptimizedconfigurationis4PVpanelsinseriesasastring,and3 strings in parallel (as shown below).
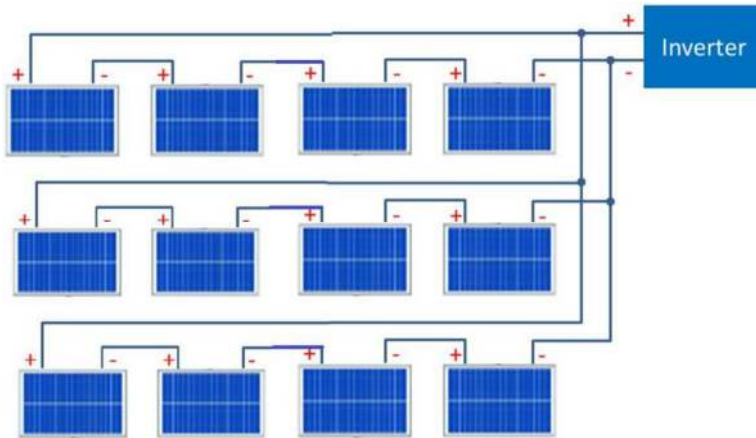
(5) Check again the V_{oc} and I_{sc} of PVstring,

V_{oc} of string is 4 x 30.9V = 123.6V < 150V (Max. PV Input Voltage) $\Rightarrow$ OK

I_{sc} of string is 3 x 8.89A = 26.67A < 30A (Max. PV Input Current) $\Rightarrow$ OK

DISPOSAL

In the event the product reaches the end of its service life, please contact the local dealer for disposal instructions.

 The product must not be disposed of with the household waste.

Disposal of the product at the end of its service life shall be done in accordance with applicable disposal regulations for electronic waste.

PSC Solar UK

Physical Office/Warehouse: 41B, Olutoye Cres/Adeniyi Jones, Ikeja, Lagos State,Nigeria
Phone No.: +2348120855444, +2348123655444

Website: www.pscsolaruk.com

Email Address: info@pscsolaruk.com

Error code	Fault code description	Maintenance instructions
1	Low voltage of battery	Check external batteries
2	Output short circuit	Disconnect the load and check the AC output line and load
3	Output high and low voltage	Disconnect the load and check whether the alarm persists when there is no load. If there is a need to repair the main-board, check whether there is no load
4	Overload	Disconnect the load and check the AC output line and load
5	Overheat	Check whether the machine fan is damaged or the temperature control cable
6	Manual shutdown	Check whether the switch button is unpressed
7	Fan failure	Check whether the machine fan is damaged
8	Output Current Excessive Shutdown	Disconnect the load and check whether the AC output line and load are short-circuited or overloaded
9	DC high voltage	Check the battery voltage and bus capacitance
10	Manual restart	Indicates that the machine has manual press on/off button restart operation
11	Input abnormal (battery voltage is incorrect)	Check whether the external battery has a high or low voltage
12	Abnormal voltage reference	Check the battery voltage detection circuit on the main-board
13	Driver board protection	Check the driving circuit and the corresponding power tube
14	Standby energy saving	The machine is in energy-saving standby mode
15	Battery priority, no mains standby after low voltage transfer to mains	Check whether the battery voltage and AC input are normal
17	Battery high temperature protection	Check external batteries
18	Overheating　The radiator is normally closed at 80 degrees	The same with 5
19	Bus current software protection	Restart the machine. If the fault persists, replace the main-board
20	Bus current hardware protection	Restart the machine. If the fault persists, replace the main-board

OGM HYBRID INVERTERS

Off Grid inverter MODBUS Communication Protocol

（2022-05-03 V1.0 ）

Revision History

Date	Versions	Description	Author	Review
	V1.0	2022-05-03 V1.0		

1. Overview

This protocol is used for the communication between the company's inverter and the background PC software. The protocol refers to the implementation of MODBUS standard on TCP/IP, and improves the communication mechanism and communication management.

1.1. References

GB/T 19582-1 2008 《Industrial automation network Specification based on Modbus protocol -- Part 1: Modbus application protocol》

GB/T 19582-2 2008 《Specification for industrial automation networks based on Modbus protocol -- Part 3: Guidelines for Modbus protocol implementation over serial links》

1.2. Abbreviations

UPS: uninterruptible power supply system

EPS: Emergency power supply system

INV: inverter

2. Communication mode

2.1. Physical layer interfaces

RS485 communication. Baud rate 9600bps, 1 start bit, 1 stop bit, 2 bit CRC verification.

2.2. Communication mechanism

The device adopts serial MODBUS RTU communication mode, and the device serves as a service (slave).

3. Information type and structure

3.1. Data types

Table 3-1 Data type table

Data types	Symbol	Describe
8bit Unsigned integer	BYTE	0~255
16bit Unsigned integer	UINT16	0~65535
16bit Signed integer	INT16	-32768~32767
32bit Floating-point	FLOAT	IEEE754
32bit Unsigned integer	UINT32	
32bit Signed integer	INT32	
64bit Unsigned integer	UINT64	
64bit Signed integer	INT64	
[N Byte] String	String[N]	
[N Byte] An array of bytes	BYTEA[N]	
BOOL	BOOL	There are only 0 and 1 states. Used only for discrete input registers.

3.2. Command structure

Table 3-2 Command structure table

Types	The number of bytes	Describe
Address	1	BYTE data, the address of the object. The range of 0 ~ 247. 0 indicates the broadcast address. 247 is a generic point-to-point communication address (applicable only to point-to-point communication links).
Function Code	1	BYTE data. See command parsing. In normal cases, the sending and replying codes are the same. In abnormal cases, see "Abnormal Reply Mechanism".
Data	N	See Command parsing.
Check	2	It adopts MODBUS CRC16 verification, and the high byte is the first

3.3. Data storage and transmission sequence

3.3.1 16-bit integer type byte storage and transfer order

For 16-bit integers, transfer high bytes, then low bytes. For example, 3A56H, transmit 3AH and then 56H.

Both the input and hold registers are 16bit addressed registers. It can be considered that the bit storage order of a single register is also high byte first and low sub byte after.

3.3.2 32-b i t integer type word storage and transfer order

For 32-bit integers, transfer low 16bit high, then 16bit high. For example, 8DF377A2H data, first transmit 77A2H, and then transmit 8DF3H.

3.3.3 Floating-point number storage and transmission sequence

Floating point number adopts IEEE32 bit standard floating point number format (standard C format), 32bits in length, storage format of four bytes, as shown in the table below.

D31	D30-D23	D22-D16	D15-D8	D7-D0
Floating point number symbol 'S'	the order code	The end of the high	The end of the median	The end of the low

If the order code is E and the mantissa is M, the floating point value = $\pm (1 + M \cdot 2^{-23}) \cdot 2^{E-127}$

The positive and negative floating point number depends on the value of the symbol bit S, S=1 means that the floating point number is negative, and S=0 means that the floating point number is positive.

For example, when the 32-bit floating point number is 40H, A0H, 00H, 00H, namely S=0, E=81H=129, M=200000H=2^{21}: Floating-point value = $(1 + 2^{21} \cdot 2^{-23}) \cdot 2^{129-127} = 5.0$.

When sending, send 4 bytes in the order of symbol bit and order code, mantissa high, mantissa median and mantissa low.

4. Command parsing

Only the 03H and 06H function codes are used for this protocol.

4.1 Read the hold register '03H'

This protocol 03 function code starts at address 0.

Host command format:

Definition	Address	Function code	Register start address	Number of registers	CRC verification
Data	ADDR	03H	sREG	nREG	CRC 16
Bytes	1	1	2	2	2

From the machine response format:

Definition	Address	Function code	Register start address	Number of registers	CRC verification
Data	ADDR	03H	X	DATA	CRC 16
Bytes	1	1	1	X	2

4.2. Write a single hold register of '06H'

This protocol 06 function code starts at address 100.

Host command format:

Definition	Address	Function code	Register start address	Number of registers	CRC verification
Data	ADDR	06H	sREG	DATA	CRC 16
Bytes	1	1	2	2	2

From the machine response format:

Definition	Address	Function code	Register start address	Number of registers	CRC verification
Data	ADDR	06H	sREG	DATA	CRC 16
Bytes	1	1	2	2	2

5. Register definition

5.1 '03' Functional code to read the information quantity

Register definition

Register address	Register name	data type	read-write	unit	coefficient	instruction
0	Used voltage	UINT16	R	V	0.1	Grid Voltage
01	Output voltage	UINT16	R	V	0.1	Inverter output voltage
02	Grid frequency	UINT16	R	HZ	0.1	
03	Inverter output	UINT16	R	HZ	0.1	

	frequency					
04	Inverter output power	UINT16	R	W	1	
05	Output the load ratio	UINT16	R	%	1	
06	Battery type	UINT16	R		1	0=铅酸电池。1=锂电。2=用户自定义
07	Battery voltage value	UINT16	R	V	0.1	
08	Grid charging current	UINT16	R	A	0.1	
09	The inveter operating temperature	UINT16	R	C	1	
10	Bulk voltage	UINT16	R	V	0.1	The average charge voltage of Grid
11	Floating voltage	UINT16	R	V	0.1	Grid floating charging voltage
12	MPPT input voltage	UINT16	R	V	1	MPPT input voltage
13	MPPT input current on	UINT16	R	A	1	MPPT input current on
14	MPPT interior input power	UINT16	R	W	1	MPPT interior input power
15	MPPT output current	UINT16	R	A	1	MPPT output current
16	MPPT running temperature	UINT16	R	C	1	MPPT module running temperature
17	MPPT floating charge voltage value	UINT16	R	V	0.1	MPPT floating charge voltage value
18	MPPT all-charge voltage value	UINT16	R	V	0.1	MPPT all-charge voltage value
19	MPPT fault code	UINT16	R		1	MPPT fault code
20	MPPT charging status code	UINT16	R		1	0 = Stop the charging. 1= Fast charging mode. 2= All charge mode. 3= Floating charge mode. 4= In the M P P T tracking. 5= Flow-limiting mode.
21	Inverter operating state	UINT16	R		1	0= Grid power output, 1= battery inverter output
22	Inverter operating mode	UINT16	R		1	0= Grid priority. 1= Battery priority
23	Inverter fault	UINT16	R		1	

	code				
24	The inverter charging status code	UINT16	R		1	0= Stop the charging. 1= Fast charging mode. 2= Mean charging mode. 3= Floating charging mode
25	low-voltage protection value	UINT16	R	V	0.1	Inverter low-voltage protection value
26	Inverter HVR value	UINT16	R	V	0.1	When the battery voltage recovers the HVR value from the low voltage, turn to the inverter output
27	Inverter LVD1	UINT16	R	V	0.1	When battery priority mode, if the battery voltage drops to LVD1, the machine switches to the Grid output
28	Inverter LVD2	UINT16	R	V	0.1	When battery priority mode, if the battery voltage drops to LVD2 and there is no power grid input, the machine cut off.
29	Inverter low-voltage alarm value	UINT16	R	V	0.1	
30	Inverter high-voltage protection value	UINT16	R	V	0.1	
31	Inverter high-voltage alarm value	UINT16	R	V	0.1	
32	Inverter high pressure recovery value	UINT16	R	V	0.1	
33	Inverter low-voltage recovery value	UINT16	R	V	0.1	
34	Inverter low-voltage alarm value	UINT16	R	V	0.1	
35	Inverter low voltage shutdown system	UINT16	R	V	0.1	

5.2 '06' Functional code to write the information quantity(set up parameters)

Register address	Register name	data type	read-write	unit	coefficient	instruction
100	Save the parameters	UINT16	W			Write to 0xbe and save the parameters
101	Set priority mode	UINT16	W			Write 0x01 set AC priority. Write 0x02 set DC priority
102	Set the average charging voltage	UINT16	W	V	0.1	
103	Set the floating charge voltage	UINT16	W	V	0.1	
104	Set Grid max Charging current	UINT16	W	A	0.1	0= Turn off the charge. 1=5A, 2=10A, 3=15A, 4=20A
105	Set the HVR value	UINT16	W	V	0.1	
106	Set the LVD1 value	UINT16	W	V	0.1	
107	Set the LVD2 value	UINT16	W	V	0.1	
108	obligate	UINT16				
109	Turn off the buzzer	UINT16	W			1; = Silencing. 2; = Restore the alarm
110	Battery high-voltage protection value	UINT16	W	V	0.1	
111	Battery high-voltage recovery value	UINT16	W	V	0.1	
112	Battery high-voltage alarm value	UINT16	W	V	0.1	
113	Battery low-voltage recovery value	UINT16	W	V	0.1	
114	Battery low-voltage alarm value	UINT16	W	V	0.1	
115	turn off the machine	UINT16	W			Write the power off, after you need to manually open

5.3 Inverter fault code:

Error code	Fault code description	Maintenance instructions
1	Low voltage of battery	Check external batteries
1	Charging voltage is high voltage	Check external batteries
2	Output short circuit	Disconnect the load and check the
2	Output short circuit	Disconnect the load and check the AC output line and load
3	Output high and low voltage	Disconnect the load and check whether the alarm persists when there is no load. If there is a need to repair the mainboard, check whether there is no load
4	Overload	Disconnect the load and check the AC output line and load
5	Overheat	Check whether the machine fan is damaged or the temperature control cable
6	Manual shutdown	Check whether the switch button is unpressed
7	Fan failure	Check whether the machine fan is damaged
8	Output Current Excessive Shutdown	Disconnect the load and check whether the AC output line and load are short-circuited or overloaded
9	DC high voltage	Check the battery voltage and bus capacitance
10	Manual restart	Indicates that the machine has manual press on/off button restart operation
11	Input abnormal (battery voltage is incorrect)	Check whether the external battery has a high or low voltage
12	Abnormal voltage reference	Check the battery voltage detection circuit on the mainboard
13	Driver board protection	Check the driving circuit and the corresponding power tube
14	Standby energy saving	The machine is in energy-saving standby mode
15	Battery priority, no mains standby after low voltage transfer to mains	Check whether the battery voltage and AC input are normal
17	Battery high temperature protection	Check external batteries
18	Overheating The radiator is normally closed at 80 degrees	With 5
19	Bus current software protection	Restart the machine. If the fault persists, replace the mainboard
20	Bus current hardware protection	Restart the machine. If the fault persists, replace the mainboard

5.4	3	PV input overvoltage	Disconnect the load and check whether the alarm persists when there is no load. If there is a need to repair the mainboard, check whether there is no load	MPPT
			AC output line and load	
	4	Pv input is low voltage	Disconnect the load and check the AC output line and load	
	5	Overheat	Check whether the machine fan is damaged or the temperature control cable	
	6	Input and output voltage difference protection	Check whether the switch button is unpressed	
	7	MOS pipe over temperature protection		
	8	Hardware over-current protection		
	9	system reset		
	10	The output voltage is too high		
	11	The output voltage is too low		

Controller Fault Code:

Note: This version needs to remotely control the inverter to turn off, and write the 06 function code to the register 115 with a shutdown value to make the machine shut down. Do not write the save settings in register 100.