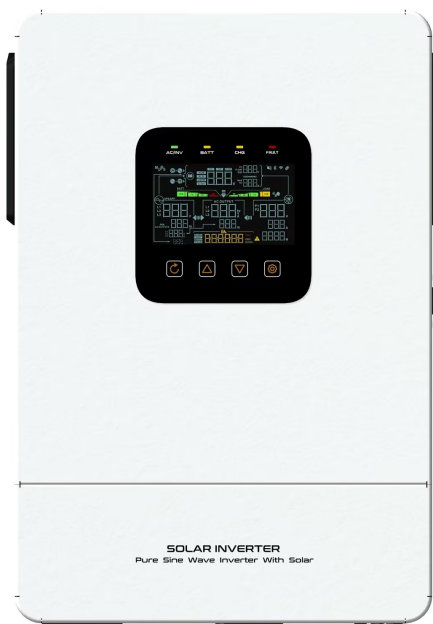


Magic-Kepler Series

Hybrid solar inverter with charger



MKH5000-22
MKH6500-42
MKH6500-42P

User Manual

User Manual_Magic-Kepler series_QB
CE, RoHS, ISO9001:2015
Subject to change without notice!

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Dear Clients,

Thank you very much for choosing the Magic-Kepler series hybrid solar inverter with charger. This product manual provides important recommendations related to the Magic-Kepler integrated inverter-controller, including installation, operation, precautions, and more. Please read this manual carefully before using the product.

1. Safety instructions and waiver of liability

1.1 Safety instructions

Please reserve this manual for future review.

The following symbols are used throughout this manual to indicate potentially dangerous conditions or mark important safety instructions. Please take care when meeting these symbols.



WARNING: Indicates a potentially dangerous condition. Use extreme caution when performing this task.



CAUTION: Indicates a critical procedure for safe and proper operation of the inverter.



WARNING:

- (1) There are no user-serviceable parts inside the all-in-one unit. Do not disassemble or attempt to repair the inverter.
- (2) Install the inverter/charger all-in-one unit in a well-ventilated area. The heat sink can become very hot during operation.
- (3) Keep children away from batteries and the inverter.

1.2 Liability exclusion

The manufacturer shall not be liable for damages, especially on the battery, caused by use other than as intended or as mentioned in this manual or if the recommendations of the battery manufacturer are neglected. The manufacturer shall not be liable if there has been service or repair carried out by any unauthorized person, unusual use, wrong installation, or bad system design.

1.3 Safety precautions

After receiving the inverter, please check the product condition first, if there is any damage occurred during shipping, please contact the transportation company or us in time.



CAUTION: The installation of the entire system must be carried out by qualified technical personnel!



CAUTION: The casing of the all-in-one unit generates significant heat and becomes very hot during operation. Do not touch and keep away from materials or equipment that could be affected by high temperatures.



CAUTION: When installing the all-in-one unit, the work area must be assessed for potential arc flash hazards.



CAUTION: The all-in-one unit must be connected to a battery for operation. It is recommended that the minimum battery capacity (Ah) be at least five times the unit's rated output power divided by the battery voltage.



CAUTION: It is recommended to install a suitable fuse or circuit breaker externally for the all-in-one unit.



CAUTION: Before installing or adjusting the wiring of the all-in-one unit, always disconnect the fuse or circuit breaker near the PV array, AC mains, and battery terminals.



CAUTION: After installation, check all wiring connections to ensure they are tight and secure to avoid the risk of heat buildup due to loose connections.



WARNING: When the all-in-one unit is operating, the AC output carries high voltage. Do not touch the wiring terminals to prevent electric shock.



WARNING: Do not open the casing for operation while the all-in-one unit is running.



WARNING: The following operations may cause hazardous situations inside the all-in-one unit, such as arcing, fire, or explosion. In the event of an accident, it must be handled by qualified technical personnel; improper handling could lead to more serious incidents.

- Touching uninsulated ends of cables that may be live;
- Touching terminals or internal components that may be live;
- Loose power cable connections;
- Accidentally dropping screws or other parts into the interior of the all-in-one unit;
- Incorrect operation by untrained, non-professional personnel.

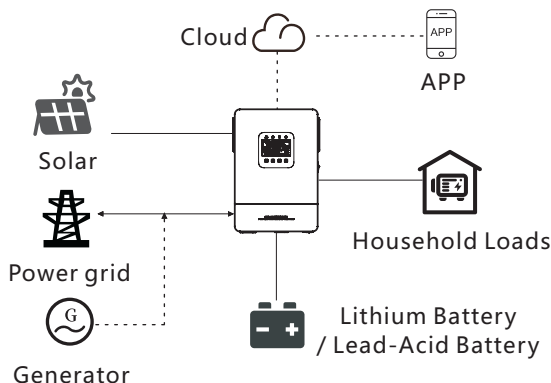


WARNING: Do not touch or open the casing for maintenance to prevent danger!

- Only restart the inverter after clearing faults that affect the safety performance of the all-in-one unit;
- The all-in-one unit contains no internal serviceable parts. For any repair services needed, please contact after-sales product support.

2. Overview

This is a multifunctional solar inverter that integrates an MPPT solar charge controller, a high-frequency pure sine wave inverter, and a UPS function module into one unit. It can also operate without a battery configured.



Hybrid Solar Storage System

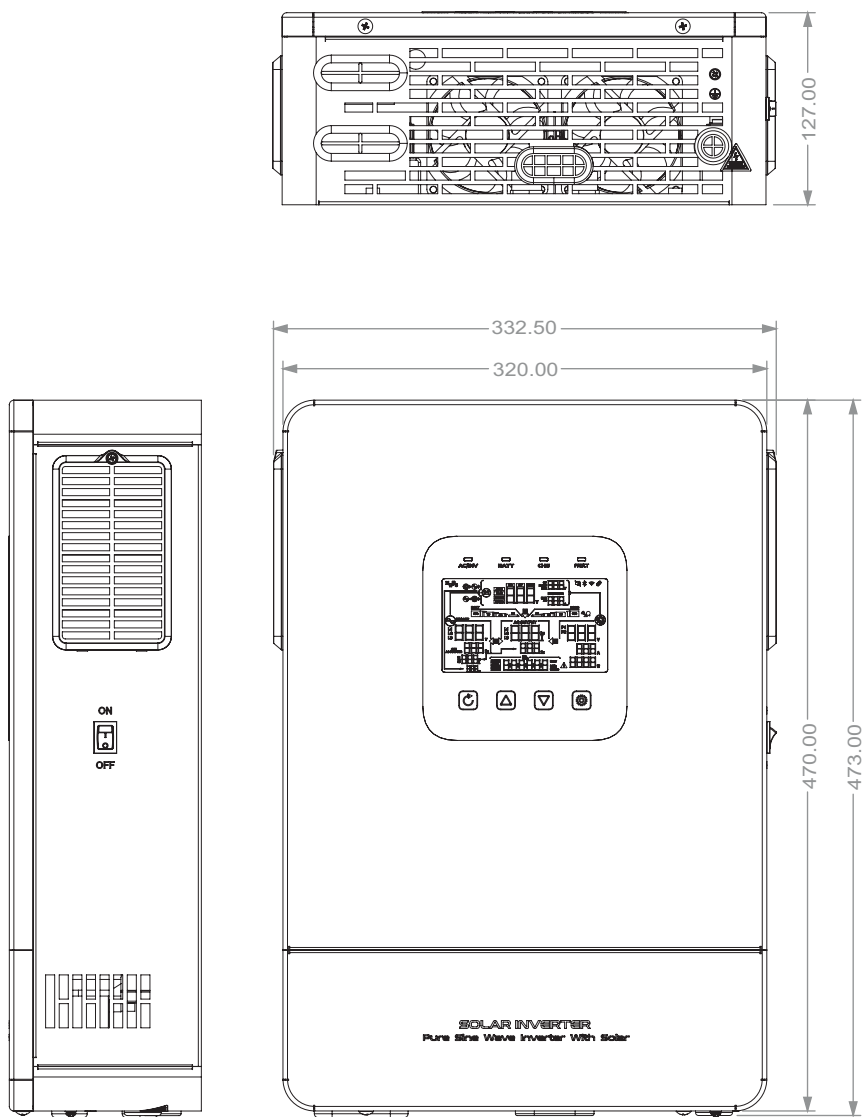
This equipment, along with other power supply equipment such as photovoltaic modules, generators, utility mains, and storage batteries, constitutes an electrical system. Please consult your system integrator regarding other possible system architectures based on your requirements. The WiFi/GPRS module is a plug-and-play monitoring device that can be installed on the inverter. Using this device, users can monitor the status of the photovoltaic system anytime, anywhere via a mobile website.

2.1 Characteristic

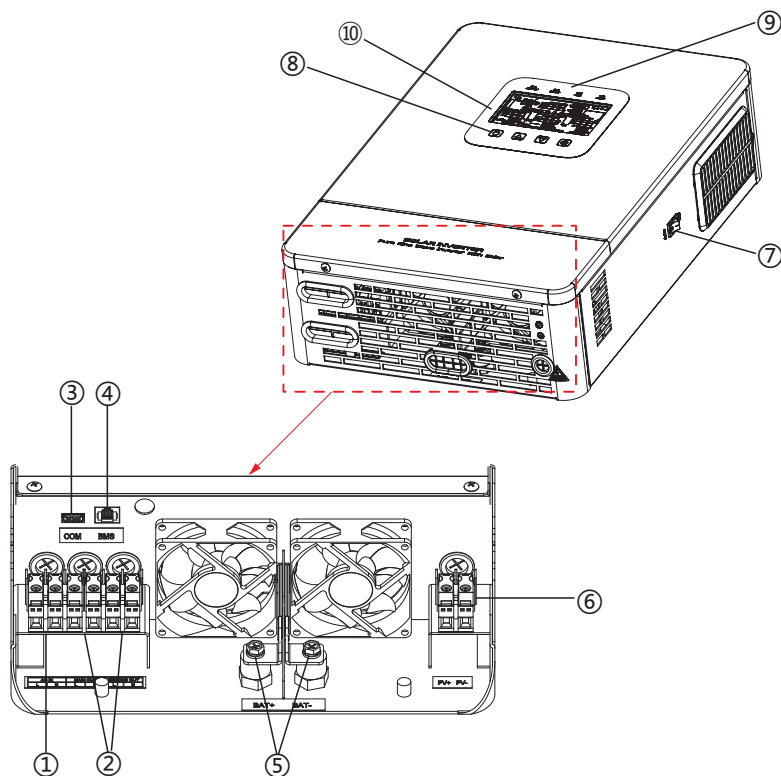
- PV, utility mains, and the battery can power the load simultaneously.
- MPPT range: 60V~450VDC.
- After configuring the WiFi module, operating parameters can be monitored remotely.
- Primary and secondary AC outputs, allowing differentiation based on the importance of the electrical loads.
- Equipped with CAN/RS485 for BMS communication, facilitating storage battery management.
- High-frequency inverter: compact size, lightweight.
- Pure sine wave AC output.
- Can operate without batteries.
- MKH6500-42P inverter: 9 units for parallel operation.

3. Dimensions(Unit:mm)

■ MKH5000-22/MKH6500-42



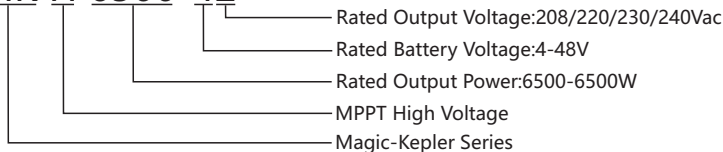
4.Appearance introduction



①	AC Input	⑥	PV Port
②	AC Output	⑦	Power switch
③	USB Communication port	⑧	Key
④	BMS communication port	⑨	Indicator light
⑤	Battery Terminal(Positive/Negative)	⑩	LCD panel

5.Desinations of models

MK H 6500-42



MPPT:Maximum Power Point Tracking;
UPS:Uninterruptible Power Supply;
WiFi/GPRS:Wireless Fidelity/General Packet Radio Service;
BMS:Battery Management System;
AGM:Lead-Acid Battery;
FLD:Fluoride Ion Battery;
LIB:Ternary Lithium Battery;
FEL:Lithium Iron Phosphate Battery;
CUS:Customer Setting Types;
APP:Client Application Software;
GEN:Generator;
PV:Photovoltaic;
SOC:State of Charge;
EEPROM:Electrically Erasable Programmable Read-Only Memory.

6.Installation

6.1 Unpacking and Inspection

6.1.1 Unpacking and Inspection

All products undergo rigorous testing before leaving the factory. Please inspect the goods before signing for receipt. If the product is damaged, please contact your local dealer.

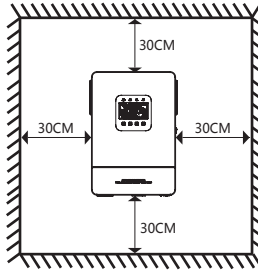
6.1.2 Installation tools

Tools	Multimeter 	Protective Gloves 	Insulated Safety Toe Shoes 
	Safety Glasses 	Anti-Static Wrist Strap 	Hammer Drill 
	Electric Screwdriver 	Phillips Screwdriver 	Rubber Mallet 
	Spirit Level 	Wire Cutter / Wire Stripper 	Terminal Crimping Tool 

6.1.3 Packing List

Num	Item	Quantity	Description	Remarks
1	Inverter	1		
2	Accessory Mounting Kit	1		
3	User Manual	1		
4	Ethernet Cable	1		MKH6500-42P

6.2 Installation



Before choosing an installation location, please consider the following points:

- Do not install the inverter on flammable building materials.
- Do not install the inverter on a solid surface.
- To ensure optimal operation, the ambient temperature should be between -10°C and 60°C .
- The recommended installation position is vertically mounted on the wall.
- Always maintain clearances from other objects and surfaces as shown in the diagram above to ensure adequate heat dissipation and sufficient space for wiring access.
- Ensure the installation location prevents water ingress.



WARNING!

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

Inverter installation steps:

1) Back-Mount Installation

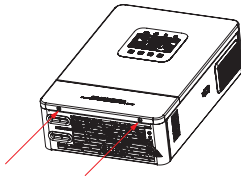
1. Take the relevant accessories from the accessory box. Use M5 screws to secure the spring hook and plastic sleeve to the back of the enclosure;
2. Secure the mounting bracket to the installation wall using expansion screws and wall plugs. Then, hang the inverter onto the bracket. Finally, use a screwdriver from the top to tighten the screw at the top of the spring hook.

2) Suspended mounting installation

1. Use M5 screws to secure the round hole end of the hanging bracket to the upper part of the back of the enclosure and tighten;
2. After the hanging bracket is installed, secure the inverter in the installation position.

6.3 Inverter connection:

Before connecting all wiring, first remove the two screws on the bottom cover and open the top cover. As shown in the figure below:



Note!

Before connecting to the AC input power source, install a separate AC circuit breaker between the inverter and the AC input power source. This will ensure the inverter can be safely disconnected during maintenance and provide protection against AC input overcurrent. The recommended specification for the AC circuit breaker for the MKH5000-22 and MKH6500-42 series inverters is 40A.

**Note!**

Ensure that the AC input live and neutral wires are connected correctly. If the live (L) and neutral (N) wires are reversed, it may cause a short circuit in the power supply when the inverters are operating in parallel.

**Note!**

Before connecting the photovoltaic (PV) array, install a separate DC circuit breaker between the inverter and the PV array.

**Note!**

For safe operation and regulatory compliance, a separate DC overcurrent protector or disconnection device is required between the battery and the inverter. A disconnection device may not be required in some applications, but overcurrent protection installation is still mandatory. The recommended size for the protector or disconnection device is 150A.

**WARNING!**

Do not ground the positive or negative terminal of the PV array. Failure to comply may result in severe damage to the inverter.

**WARNING!**

Sunlight generates lethal high voltage within PV strings. Therefore, strictly adhere to the safety precautions listed for PV strings and in related documents.

**WARNING!**

Ensure that the PV input wiring is connected to the correct terminals on the inverter; reversing the polarity may damage the inverter.

**WARNING! Risk of electric shock**

Due to the high voltage of batteries connected in series, installation must be carried out with extreme caution.

**WARNING!**

All wiring must be performed by qualified personnel.

**WARNING!**

Use appropriate cables for connecting the inverter. To reduce system safety risks, please use the recommended cable sizes below.

Recommended cable sizes for connections:

Cable Type	Cable Type	MKH5000-22	MKH6500-42
AC Input Cable	American Wire Gauge	10AWG	10AWG
	Metric (mm ²)	6mm ²	6mm ²
AC Output Cable	American Wire Gauge	10AWG	10AWG
	Metric (mm ²)	6mm ²	6mm ²
PV Input Cable	American Wire Gauge	10AWG	10AWG
	Metric (mm ²)	6mm ²	6mm ²
Battery Input Cable	American Wire Gauge	1AWG	2AWG
	Metric (mm ²)	42mm ²	25mm ²

**Note!**

Before making the final DC connection or closing the DC circuit breaker/disconnect switch, ensure the positive terminal (+) is connected to the positive (+) and the negative terminal (-) is connected to the negative (-).

**WARNING!**

Do not close any AC/DC circuit breakers before completing all electrical connections. All operations during electrical connections, as well as the specifications of the cables and components used, must comply with local laws and regulations.

6.4 PV array configuration

When configuring the PV array, ensure the following inverter parameters are met:

1.The allowable input voltage range of the photovoltaic module for the inverter is 60-500Vdc;

2.The maximum allowable input current of the photovoltaic module for the inverter is 27A;

When users configure photovoltaic modules, follow the steps below:

1.Check the technical parameters of the photovoltaic modules used, such as open circuit voltage and short circuit current.

2.When configuring photovoltaic modules, it is recommended to use them in series to increase the input voltage. The total voltage after series connection should be within the range of 60-500Vdc, and some margin should be reserved to prevent overvoltage caused by voltage fluctuations. It is recommended that the maximum calculated value be 450V.

For example, if the open circuit voltage of a photovoltaic module is 40V, it is recommended to connect a maximum of 11 modules in series.

3.Check that the short circuit current of the photovoltaic module does not exceed the input current allowed by the inverter.

For example, configure photovoltaic modules for the MKH6500-42 inverter: Photovoltaic module parameters: Maximum power: 670W; Maximum voltage: 40.6Vdc; Maximum current: 17.49A; Open circuit voltage: 41.7Vdc; Short circuit current: 18.57A.

It is recommended to connect a maximum of 11 photovoltaic panels in series! Do not connect them in parallel!

6.5 Battery connection

6.5.1 Lead-acid battery connection

MHK5000-22 inverter: Users can choose a lead-acid battery with an appropriate capacity and a rated voltage of 24V.

MHK6500-42 series inverter: Users can choose a lead-acid battery with an appropriate capacity and a rated voltage of 48V.

Additionally, you need to select the battery type as "AGM (Lead-Acid Battery) or FLD (Fluoride Ion Battery)".

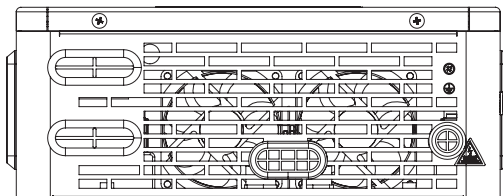
Note: For lead-acid batteries, the recommended charging current is 0.3C ($C \leq$ battery capacity). Connect all battery banks according to the device requirements. It is recommended to connect batteries with a capacity of at least 200Ah.

6.5.2 Lithium battery connection

If you choose a lithium battery for the inverter, first check the compatibility of the protocol. Please follow the steps below for lithium battery connection:

1.First, connect the power cable.

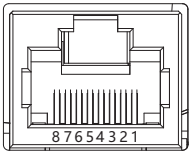
2.Connect the BMS/RS485 port of the battery pack to the BMS port of the inverter. The communication protocol is RS485 or CAN.



Note: If you choose a lithium battery, when setting up the inverter, you need to select the battery type as "Lib (Ternary Lithium Battery)" or "FEL (Lithium Iron Phosphate Battery)".

Lithium battery communication and settings:
Ensure that the connection between the lithium battery BMS port and the inverter is Pin to Pin. The pin assignment of the inverter BMS port is shown in the figure below:

NO	BMS port
1	RS485B
2	RS485A
3	/
4	CANH
5	CANL
6	/
7	/
8	/

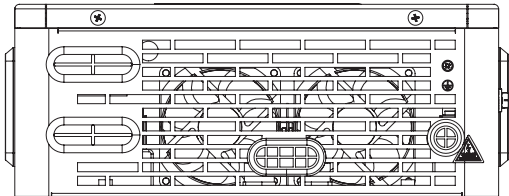


6.6 AC dual output recommendations

- 1.AC main output: It is recommended that important electrical equipment be connected to the main output port during use.
- 2.AC secondary output: It is recommended that non-critical electrical equipment be connected to the secondary output port during use.
- 3.When the battery level is low, in order to extend the usage time, the secondary output is cut off to prolong the operation of the main output.

6.7 WiFi communication module connection(optional component)

The WiFi communication module is used to connect to the cloud platform, enabling remote monitoring of inverter parameters. Please insert the WiFi communication module into the COM port. Scan the QR code on the WiFi packaging box with your mobile phone to download the APP. Open the APP, register an account, use the APP to scan the QR code on the WiFi communication module, add the device, and configure the network via Bluetooth.



7.Label description

	Warning: Do not disconnect under load!
	Danger: High voltage! Danger: Risk of electric shock!
	Disconnect the inverter from all external power sources for at least 5 minutes before starting maintenance on the inverter.
	Before performing any operation on the inverter, please read the operation manual carefully.

	Grounding. For the safety of operators, the inverter must be strictly grounded.
 Warning	Highly potential danger, which may result in death or serious injury if not avoided.
 Warning	Potential hazard of moderate or low level, which may cause moderate or minor injury to personnel if not avoided, and may lead to death or serious injury in severe cases.



Warning!

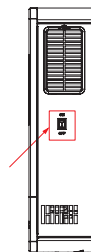
This document contains important safety and operating instructions. Read and keep this manual for reference.

1. Please clearly identify which battery system you want, a lithium battery system or a lead-acid battery system. If you choose the wrong system, the energy storage system will not function properly.
2. Before using the unit, read all instructions and cautionary markings on this equipment, the battery, and all appropriate sections of this manual. The company is not liable for quality assurance and will not cover equipment damage if installation is not carried out in accordance with the instructions in this manual.
3. All operations and connections should be performed by a professional electrical or mechanical engineer.
4. All electrical installations must comply with local electrical safety standards.
5. When installing photovoltaic modules during the day, installers should cover the modules with opaque materials. Otherwise, the high terminal voltage of the modules in sunlight can be dangerous.
6. Note: To reduce the risk of injury, charge only deep-cycle lead-acid rechargeable batteries and lithium batteries. Other types of batteries may burst, causing personal injury and damage.
7. Do not disassemble the unit. Take it to a qualified service center when service or repair is required. Incorrect reassembly may result in a risk of electric shock or fire.
8. To reduce the risk of electric shock, disconnect all wiring before attempting any maintenance or cleaning. Turning off the unit will not reduce this risk.
9. Never charge a frozen battery.
10. To achieve optimal operation of this inverter, select the appropriate cable size according to the required specifications. Correct operation of this inverter is very important.
11. Be very careful when using metal tools on or around batteries. Dropping a tool might result in a spark or short circuit the battery or other electrical parts and could cause an explosion.
12. When you want to disconnect the AC or DC terminals, strictly follow the installation procedures. Refer to the installation section of this manual for details.
13. Grounding instructions - This inverter should be connected to a permanent, grounded wiring system. Local requirements and regulations must be complied with when installing this inverter.
14. Never short-circuit the AC output and DC input. Do not connect to the mains when the DC input is short-circuited.
15. Ensure the inverter is fully assembled before operation.

8.Operation and Display

8.1 Power switch

After the device is correctly installed, press the ON/OFF switch (located on the housing button) to power on and run the device.



8.1 Button operation



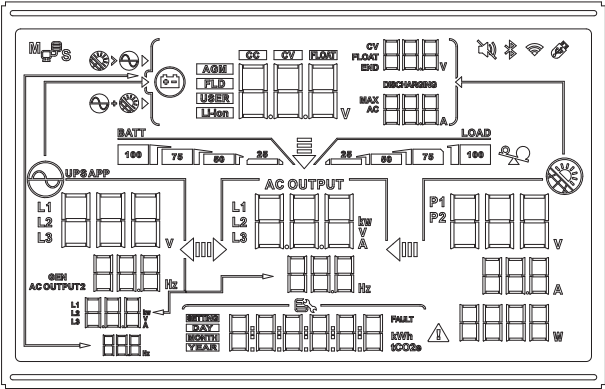
Icon	Description
	Exit or return to setting mode
	Go to the previous selection.
	Go to the next selection.
	Confirm the selection in setting mode or enter setting mode.

8.2 Indicator light introduction

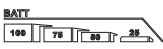


	LED indicator light	Indication information
① AC	Status indicator light (Green)	On Mains power is normal, entering mains operation.
		Flash Mains power is normal, but not entering mains operation.
		Off Mains power abnormal.
② Inverting	Inverter indicator light (Yellow)	On In battery mode, the output is powered by the battery or photovoltaic.
		Off Other status.
③ Charging	Charging indicator light (Yellow)	On The battery is in float charge state.
		Flash The battery is in constant voltage charging state.
		Off Other status.
④ Fault	Fault indicator light (Red)	On An inverter fault has occurred.
		Flash An inverter warning condition has occurred.
		Off The inverter is operating normally.

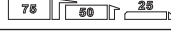
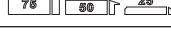
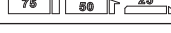
8.3 Operation interface



Display area	Icon	Description
①Battery		Battery icon
		Battery type
		Three charging cycles. The CC icon lights up during the constant current charging stage, the CV icon lights up during the constant voltage charging stage, and the FLOAT icon lights up during the float charging stage.
		Battery voltage
		Battery charging/discharging current
②AC input		AC input icon
		UPS or APP input mode, when set to GEN input, it displays as APP.
③PV input information		AC output voltage and frequency
		PV input icon
④Output information		PV power, voltage, current
		Indicates output voltage (V), apparent power (VA or KVA), and output active power (W or KW) alternately, switching every five seconds to indicate output frequency.

⑤Battery capacity		Battery capacity
⑥Load capacity		Load capacity
		Overload icon
⑦AC output 2	AC OUTPUT2	Second AC output icon
		AC output 2 voltage
⑧Parameter query / function setting / fault and alarm information		System information, function settings, fault and alarm information.
⑨Other information		Mute
		WiFi connected
		If PV + Grid, both left and right icons light up; if only PV, only the right icon lights up.
		If PV priority, both left and right icons light up.

For lead-acid batteries, the detailed description of the battery icon is as follows:

In battery mode, the battery icon can indicate the battery capacity		
Load percentage	Battery voltage	Display
Load > 50%	< 44.584 V	
	44.584 V ~ 46.74V	
	46.74V ~ 48.896V	
	> 48.896V	
50% > Load > 20%	< 47.18 V	
	47.18 V ~ 49.336V	
	49.336V ~ 51.492V	
	> 51.492V	
Load < 20%	< 48.48 V	
	48.48 V ~ 50.636V	
	50.636V ~ 52.792V	
	> 52.792V	

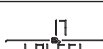
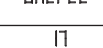
8.4 LCD setting

After pressing and holding the Enter button for 2 seconds, the unit will enter setting mode. Press the "Up" or "Down" button to select the setting program. Then press the "Enter" button to confirm the selection or the ESC button to exit. It is recommended to remove the screen protector before operation.

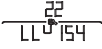
Item	Description	Setting
1	Output voltage	01 000230
		230V(default)adjustable/set values:208V,220V,230V,240V
2	Output frequency	02 00F 50
		50Hz(default)adjustable/settable frequency:50Hz,60Hz
3	Output priority	PV priority 03 00PPG6
		Solar energy is prioritized to power the load. If solar energy is sufficient, the battery will be charged using solar energy. If solar energy is insufficient to power all connected loads, the grid will simultaneously power the load. Excess electricity will charge the battery. If both solar energy and the grid are insufficient, the battery will simultaneously power the load. If solar energy, grid, and battery power are insufficient to power the load, the inverter will enter standby mode and charge the battery.
		Grid priority 03 00PPG6
		The grid is prioritized to power the load. Solar energy will charge the battery. If solar energy is insufficient to charge the battery, the grid will simultaneously charge the battery. If the grid is insufficient to power all connected loads, solar energy will simultaneously power the load. If both solar energy and the grid are insufficient, the battery will simultaneously power the load. If solar energy, grid, and battery power are insufficient to power the load, the inverter will enter standby mode and charge the battery.
		PBG priority(default) 03 00PPG6
		Solar energy is prioritized to power the load. If solar energy is sufficient, the battery will be charged using solar energy. If solar energy is insufficient to power all connected loads, the battery will simultaneously power the load. If both solar energy and the battery are insufficient, the grid will simultaneously power the load. If solar energy, grid, and battery power are insufficient to power the load, the inverter will enter standby mode and charge the battery.
		MKS 03 00PnES
		The generator is prioritized to power the load. When the generator, photovoltaic, and battery are all present, the operating mode is the same as PBG. When the generator and battery are present(no photovoltaic), the operating mode is the same as GPB. When the generator and photovoltaic are present(no battery), the operating mode is the same as GPB.

4	Input mode	APP:Device(default)	
		Applied to household appliances, typical switching time is 10 ms.	
		UPS	
		Applied to computers and other equipment, typical switching time is 10 ms.	
		GNE	
By connecting the generator using the grid input port, typical switching time is 20 ms.			
5	Charging source priority	PNG: Photovoltaic & Grid(default)	
		OPV:Photovoltaic	
		PV: Photovoltaic priority	
		There are three charging priority options. The default setting is PNG(PV and grid charging simultaneously); the second is OPV(PV only charging). Only PV charging. The third is PVF(PV priority). When both PV and grid power are present, only PV charging is performed. When only PV is present, PV charging is performed. When only grid power is present, grid charging is performed.	
6	Grid charging current		
		MKH5000-22 inverter:80A(default) Available options: 2/10/20/30/40/50/60/70/80/90/100/110/120/130/140/150/160A MKH6000-42 series inverter: 60A(default) Available options:2/10/20/30/40/50/60/70/80/90/100/110/120A	
7	Maximum charging current		
		Set the total charging current of the solar and mains chargers. MKH5000-22 inverter:Default value is 120A. Available options: 2/10/20/30/40/50/60/70/80/90/100/110/120/130/140/150/160A MKH6500-42 series inverter:Default value is 100A. Available options:2/10/20/30/40/50/60/70/80/90/100/110/120A	
8	Menu default value	PBG priority	
		When setting: If set to ON, and the current page is not the first page, the system will return to display the first page after 1 minute of inactivity. If set to OFF, and the current page is not the first page, the system will stay on the current page after 1 minute of inactivity.	
9	Auto restart upon overload	Default value is ON	
10	Auto restart upon overtemperature	Default value is ON	

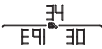
11	Main input power failure warning	
		Enable/disable mains or PV loss alarm. Default setting is ON. If main input loss is detected, the buzzer will sound for 3 seconds. When set to OFF, the buzzer will not sound after main input loss.
12	Energy saving mode	
		Default setting is OFF. When set to ON, in battery mode, if the load is below 25W, the system will stop output for a period of time and then resume. If the load is still below 25W, the system will cycle stop and then resume. If the load is above 35W, the system will resume continuous normal output.
13	Overload transfer to bypass	
		Default setting is OFF. When set to ON, in the case of PBG or MKS priority output, if there is an overload, the system will immediately transfer to bypass mode(utility power output, also known as bypass mode).
14	Mute mode setting	
		Enable/disable buzzer sound. Default setting is OFF. When set to ON, the buzzer will not sound under any circumstances, such as alarms or faults. This setting applies to all modes. Button sounds are not affected.
15	Battery return to battery voltage point	
		When the battery is set to LIB(Ternary Lithium Battery)or CUS(Customer Set Type)mode: MKH5000-22 inverter: Default is 23.8V, adjustable within the range [20, 25V]. MKH6500-42 series inverter: Default is 47.6V, adjustable within the range [40, 50V].
		When the battery is set to AGM(Lead-Acid Battery)mode or FLD(Fluoride Ion Battery)mode: MKH5000-22 inverter: Default setting is 23V, adjustable within the range [22, 26]. MKH6500-42 series inverter: Default is 46V, adjustable within the range [44, 52V].
16	Switch back to battery mode voltage point	
		When the battery is set to FEL(Lithium Iron Phosphate Battery): MKH5000-22 inverter:Default is 24.8V, adjustable within the range [20, 25]. MKH6500-42 series inverter:Default is 49.6V, adjustable within the range [40, 50V].
16	Switch back to battery mode voltage point	
		When set to FUL, the battery will charge until full before restarting in battery mode. When the battery is set to LIB(Ternary Lithium Battery)or CUS(Customer Set Type)mode: MKH5000-22 inverter:Default setting is 27.2V, voltage range [23, 29V]. MKH6500-42 series inverter:Default setting is 54.4V, voltage range [46, 58V].

		When the battery is set to AGM(Lead-Acid Battery)or FLD(Fluoride Ion Battery)mode: MKH5000-22 inverter:Default is 26V, adjustable within the range [24, 29V]. MKH6500-42 series inverter:Default is 52V, adjustable within the range [48, 58V].	
		When the battery is set to FEL(Lithium Iron Phosphate Battery): MKH5000-22 inverter:Default is 26.6V, adjustable within the range [23, 29V]. MKH6500-42 series inverter:Default is 53.2V, adjustable within the range [46, 58V].	
17	Battery type	AGM lead-acid battery(default)	
		FLD fluoride ion battery	
		LiB ternary lithium battery	
		FEL lithium iron phosphate battery	
		CUS customer set type	
18	Battery low voltage point		
		Battery low voltage alarm setting. When the battery type is set to LiB or CUS: MKH5000-22 inverter:Default setting is 23.8V. Adjustable voltage range is [20.6, 25.0V]. MKH6500-42 series inverter:Default setting is 47.6V. Adjustable voltage range is [41.2, 50V]. When the battery type is set to FEL: MKH5000-22 inverter:Default setting is 24V. Adjustable voltage range is [20.6, 25.0V]. MKH6500-42 series inverter:Default setting is 48V. Adjustable voltage range is [41.2, 50V].	
		The battery definition mode cannot be set to AGM or FLD mode. MKH5000-22 inverter:Initial default setting is 22V. MKH6500-42 series inverter:Initial default setting is 44V. When the BMS is connected and communication is successful, if the minimum discharge voltage uploaded by the BMS is lower than the current set low voltage point, the low voltage point will be changed to the minimum discharge voltage.	
19	Battery shutdown point		
		The battery low voltage shutdown point setting function is not adjustable when the battery is defined as AGM or FLD mode. MKH5000-22 inverter: Default setting is 21V. MKH6500-42 series inverter: Default setting is 42V. When the BMS is connected and communication is successful, the undervoltage point will be changed to the minimum discharge voltage uploaded by the BMS.	

		When the battery type is set to LIB or CUS, the battery shutdown point can be modified. MKH5000-22 inverter:Default is 23V, adjustable range [20, 24V]. MKH6500-42 series inverter:Default is 46V, adjustable range [40, 48V]. When the battery type is set to FEL, the battery shutdown point can be modified. MKH5000-22 inverter:Default is 21V, adjustable range [20, 24V]. MKH6500-42 series inverter:Default is 42V, adjustable range [40, 48V].
20	Constant voltage mode voltage point setting	 When the BMS is connected and communication is successful, the constant voltage point will be changed to the maximum charging voltage uploaded by the BMS. When the battery is defined as AGM or FLD mode, the voltage set point cannot be configured. MKH5000-22 inverter:Default setting for AGM mode is 28.2V, for FLD mode is 29V. MKH6500-42 series inverter:Default setting for AGM mode is 56.4V, for FLD mode is 58V. When the battery type is CUS, MKH5000-22 inverter:The constant voltage charging set point can be set within the range [24, 30V]. The default setting is 28.2V. MKH6500-42 series inverter:The constant voltage charging set point can be set within the range [48, 60V]. The default setting is 56.4V. It should be noted that the constant voltage set point voltage needs to be higher than the float charge set point voltage. When the battery type is set to LIB: MKH5000-22 inverter: Default constant voltage charging set point is 28.2V, adjustable within the range [24, 30V]. MKH6500-42 series inverter: Default constant voltage charging set point is 56.4V, adjustable within the range [48, 60V]. When the battery type is set to FEL: MKH5000-22 inverter: Default constant voltage charging set point is 27.6V, adjustable within the range [24, 30V]. MKH6500-42 series inverter: Default constant voltage charging set point is 55.2V, adjustable within the range [48, 60V].
21	Float charge mode voltage point setting	 When the battery is defined as AGM or FLD mode, the voltage set point cannot be configured. MKH5000-22 inverter: Default setting for AGM/FLD mode is 27V. When the battery type is CUS, the float charge voltage set point can be set within the range [24, 30V]. The default value is 27.6V. MKH6500-42 inverter: The voltage set point cannot be configured. Default setting for AGM/FLD mode is 54V. When the battery type is CUS, the float charge voltage set point can be set within the range [48, 60V]. The default value is 55.2V. When the battery type is LIB, MKH5000-22 inverter: The default setting for the float charge voltage set point is 27.6V. The setting range is [25, 29V]. MKH6500-42 series inverter: The default setting for the float charge voltage set point is 55.2V. The setting range is [50, 58V].

		When the battery type is FEL, MKH5000-22 inverter: The default setting for the float charge voltage set point is 27.2V. The setting range is [25, 29V]. MKH6500-42 series inverter: The default setting for the float charge voltage set point is 54.4V. The setting range is [50, 58V]. It should be noted that the constant voltage set point voltage should always be set higher than the float charge set point voltage. When the BMS is connected and communication is successful, the float charge point will be changed to the maximum charging voltage uploaded by the BMS.
22	Grid low voltage point setting	
		If the output mode is APP/GEN, the grid low voltage point can be set within the range of 90V to 154V. The default setting is 154V.
		If the output mode is UPS, the grid low voltage point can be set within the range of 170V to 200V. The default setting is 185V.
23	Grid high voltage point setting	
		If the output mode is APP/GEN, the grid high voltage point can be set within the range of 264V to 280V. The default setting is 264V.
		If the output mode is UPS, the grid high voltage point is set to 264V.
24	Automatic backlight off setting	
		Default value is ON. When this function is enabled, the backlight turns off after 1 minute of no button operation.
25	Inverter soft start	
		The default setting is OFF. If set to ON, the inverter output gradually rises from 0 to the target voltage value. If set to OFF, the inverter output rises directly from 0 to the target voltage value. Setting condition: Can be set in standalone operation mode.
26	Restore factory settings	
		Restore all settings to factory defaults. Before setting, this screen displays OFF. When set to ON, the system will restore to default settings. After the setting is completed, this screen will display OFF again. This setting can be applied immediately in mains and standby modes, but cannot be set in battery mode.
27	Parallel mode setting	
		MKH6500-42P inverter: Set parallel operation mode. Can be set to power mode and standby mode, cannot be set to battery mode. Default setting is SIG (Single Phase). When set to PAR (Parallel Mode), it is single-phase parallel operation mode. When set to 3P1 (R phase), 3P2 (S phase), or 3P3 (T phase), it operates as one phase of a three-phase system. Before using the parallel system, the system should be correctly connected, and then the parallel mode of each unit should be set. If some inverters in the parallel system are set to SIG, fault 24 will occur. If used as a three-phase system, all units should be set to one of 3P1, 3P2, 3P3. For each phase (3P1, 3P2, or 3P3), or at least one inverter should be set accordingly, otherwise fault 24 will occur.

28	Parallel identification code	28 PI IDLED	MKH6500-42P inverter: Default setting is ATO (Automatic Mode). Besides ATO, it can be set to 1-9. If set to 1-9, each inverter in a parallel system must have a unique ID from 1-9. If IDs are duplicated, fault 19 will occur.
29	Battery disconnect alarm	29 SBADOFF	Enable/disable battery disconnect alarm. Default setting is OFF. When set to OFF, no battery disconnect, low battery voltage, or battery undervoltage alarms will occur when the battery is disconnected. Can be set in standalone operation mode.
30	Photovoltaic-only parallel operation mode	30 POPOFF	MKH6500-42P inverter: Set whether the inverter can operate in parallel without a battery. The default setting is OFF. When the system is in parallel mode and there is no battery, photovoltaic and battery cannot operate; it can only run when connected to the mains.
31	Equalization voltage point setting	31 EQVSEL	MKH5000-22 inverter: The default setting for FEL battery type is 28V, with a setting range of [24, 30V]. The default setting for AGM/FLD/LIB/CUS battery types is 29.2V, with a configurable range of [24, 30V]. MKH6500-42 series inverter: The default setting for FEL battery type is 56V, with a setting range of [48, 60V]. The default setting for AGM/FLD/LIB/CUS battery types is 58.4V, with a configurable range of [48, 60V]. The equalization voltage needs to be greater than the constant voltage point voltage.
32	Equalization charging time setting	32 EQE 60	This function can be turned off or on. During the equalization stage, the controller will charge the battery as much as possible until the battery voltage rises to the equalization voltage. Then, it will use constant voltage regulation to maintain the battery voltage. The battery will remain in the equalization stage until the set equalization time ends. The default setting is 60 minutes, with a configurable range of [5, 900], increasing in increments of 5 minutes per setting. The default setting is OFF, and it will not enter equalization charging.
33	Equalization delay time setting	33 EQD 120	This function can be set to OFF or activated. During the equalization stage, if the battery equalization time expires and the battery voltage has not risen to the battery equalization voltage point, the inverter will extend the battery equalization time until the battery voltage reaches the battery equalization voltage. When the battery equalization delay setting ends and the battery voltage is still below the battery equalization voltage, the inverter will stop equalization and return to the float stage. The default setting is 120 minutes, with a configurable range of [5, 900], increasing in increments of 5 minutes per setting. Set to OFF to not enter equalization delay.

34	Setting the balanced interval time.	
		When the float charge stage detects that the battery is connected and the balancing mode is turned on, the controller will enter the balancing stage upon reaching the set balancing interval (cell balancing cycle). The default setting is 30 days, with an adjustable range of [1, 90] and an increment of 1 day per setting.
35	Enable equalization immediately	
		The default setting is Off, meaning the function is disabled. When set to On, during the float charge stage, if the balancing mode is enabled and a battery connection is detected, the equalization charge is activated immediately, and the controller will enter the equalization stage.
36	Grid-Tie Function	
		Set whether the inverter feeds power into the grid. The default setting is OFF, meaning the function is disabled. If the value is set to "INT", the inverter can feed power to the grid based on different output source priorities. In PGB mode, when the battery has sufficient power, as long as the grid is disconnected, the PV can feed as much power as possible to the grid, with the remaining PV energy charging the battery. In PBG mode, when the battery power is low, the PV will charge the battery as much as possible, with the remaining PV energy feeding into the grid. In GPB mode and PBG mode, as long as the grid is connected, the PV will charge the battery as much as possible. In MKS mode, the inverter does not feed power into the grid.
37	Maximum grid-tie power	
		For the MKH5000-22 inverter: Set the power value fed into the utility grid. The default setting is OFF, with an adjustable range of OFF and [0.5, 5.0] kW, and an increment of 0.5 kW per setting. For the MKH6500-42 series inverter: Set the power value fed into the utility grid. The default setting is OFF, with an adjustable range of OFF and [0.5, 6.0] kW, and an increment of 0.5 kW per setting.
38	Battery Dual Output Low Voltage Shutdown Point	
		When the inverter is turned on, the secondary output is enabled. In battery mode, the secondary output turns off when the battery voltage drops below the set point. When the battery voltage rises back above the set point + 1V per cell, the secondary output turns on again. For the MKH5000-22 inverter: The default setting is 24V, with a configurable range of [22, 30V]. For the MKH6500-42 series inverter: The default setting is 48V, with a configurable range of [44, 60V]. If the set point is higher than the Constant Voltage (CV) charge point per cell minus 1V, the recovery voltage is set to the Constant Voltage charge point.

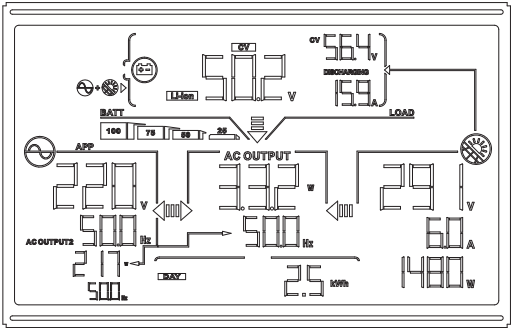
39	Battery Dual Output Duration		
			When enabled, the secondary output of the inverter is activated by default. In battery mode, when the battery discharge time reaches the set value, the auxiliary output turns off. The default setting is OFF, meaning the function is disabled. The configurable range is [5, 900] minutes. When set to FUL, the auxiliary output has an unlimited output duration.
40	Dual Output Battery Mode Exit SOC		
			When enabled, the secondary output of the inverter is activated by default. In battery mode, when the battery SOC falls below the set value, the auxiliary output turns off. When the battery voltage rises to 5% above the set value, the auxiliary output turns back on. The default setting is 20%. The adjustable range is [5, 90] and OFF.
44	BMS Communication Function		
			The default setting is OFF, meaning the function is disabled. When a specific BMS protocol is selected, the inverter communicates with the lithium battery BMS through the centralized control board and retrieves battery information. If communication fails after the function is enabled, alarm 56 will be triggered, and the inverter will not determine its operating logic based on BMS information. CVT:CVTE protocol (485) PYL:PYLON protocol (485 and CAN) GRO:GROWATT protocol (485 and CAN) VOL:VOLTRONIC protocol (485) IRF:IRON Tower protocol (485) PAC:PACE RTU protocol (485)
45	BMS ID Setting		
			Set the BMS ID number for communication. The setting value can be ATO or a numerical value in the range [0, 15], where A-F represent 10-15 respectively. The default setting is ATO (Automatic). When set to ATO, the system will automatically poll BMS IDs from the smallest to the largest. Once the system polls the first ID that responds correctly, it will only communicate with that BMS ID. If a BMS connection is lost, the BMS ID will be unlocked and the system will re-poll for the BMS ID.
46	Low SOC Shutdown		
			When the battery's State of Charge (SOC) is low, the inverter is set to shut down. The default setting is 20%, with a configurable range of [5, 50]%. When the lithium battery SOC reaches the set value in battery mode, the inverter shuts down and generates alarm 68. When the SOC recovers to the set value + 5%, alarm 68 is cleared. In standby mode, the inverter can only switch to battery mode when the SOC reaches the set value + 10%. If this threshold is not met, alarm 69 is generated. Once the function is enabled, alarm 69 is triggered when the lithium battery SOC reaches the set value + 5% and is cleared when it recovers to the set value + 10%.

		This function can be set to OFF, in which case the inverter will not shut down, start up, or generate alarms based on SOC status. If the function is enabled and a communication abnormality occurs, the inverter will no longer operate based on SOC information, and related alarms will be cleared.
47	High SOC to Battery	$\frac{47}{SEbOFF}$ Set the SOC value at which the inverter switches to battery mode. The default setting is 90%, with a configurable range of [10, 100]%. In PBG priority mode, when the lithium battery SOC reaches the set value under normal grid mode, the inverter switches to battery mode. Once enabled, the inverter will only switch to battery mode if the SOC is above the set point and the battery voltage is above the voltage point for switching back to battery mode. This function can be set to OFF, in which case the inverter will no longer switch from grid mode to battery mode based on SOC conditions. If the function is enabled and a communication abnormality occurs, the inverter will no longer operate based on SOC information, and related alarms will be cleared.
48	Low SOC to Grid	$\frac{48}{SEbOFF}$ Set the SOC value at which the inverter switches to grid mode. The default setting is 50%, with a configurable range of [10, 90]%. In PBG priority mode, when the lithium battery SOC reaches the set value in battery mode, the inverter switches to grid mode. Once enabled, the inverter will switch to grid mode when the SOC falls below the set point or the battery voltage drops below the voltage point for switching back to grid mode. This function can be set to OFF, in which case the inverter will no longer switch from battery mode to grid mode based on SOC conditions. If the function is enabled and a communication abnormality occurs, the inverter will no longer operate based on SOC information, and related alarms will be cleared. When this setting is higher than the STB (Switch to Battery) point, STB and STG will no longer take effect after the next activation.
61	Maximum Discharge Current	$\frac{61}{ndC OFF}$ The default setting is OFF. When set to OFF, the inverter does not limit the battery discharge current. When set to a numerical value, that value indicates the displayed current limit. For the MKH5000-22 inverter: The setting range is [10, 190A], with an increment of 5A per setting. For the MKH6500-42 series inverter: The setting range is [10, 140A], with an increment of 5A per setting. If the discharge current exceeds the limit, alarm 60 is triggered. If the overcurrent persists for 5 seconds, fault 14 occurs, and the inverter enters fault mode. When a BMS is connected and communication is successful, if the MDC setting is not OFF, the maximum discharge current will be changed to the maximum discharge current uploaded by the BMS.

63	Enable Battery Disconnection Detection	63 bEE ON
		For the MKH6500-42P inverter: The default setting is ON, enabling automatic battery disconnection detection/lithium battery activation. When set to OFF, the inverter keeps the battery disconnected and will no longer perform detection/lithium battery activation during operation.
64	Immediate Battery Detection/ Lithium Battery Activation	64 bE1 OFF
		For the MKH6500-42P inverter: The default setting is OFF. When set to ON, the inverter immediately performs battery disconnection detection/lithium battery activation if the execution conditions are met, and then the setting returns to OFF.

8.5 Display panel information

Pressing the "UP" or "DOWN" key will switch the LCD display information sequentially. If no operation is performed for a long time, the bottom of the screen will display the daily PV generation. For example,the following screen shows 2.5kWh.



Information	LCD Display Screen
Daily PV Generation	P1 DAY 2.5 kWh
Total PV Generation	P2 893 kWh
Lithium Battery Voltage and Current. BMS Communication Fault Code. If the BMS function is not enabled, this page will not be displayed.	P3 52.9 10.7

Lithium Battery Temperature and SOC. BMS Communication Fault Code. If the BMS function is not enabled, this page will not be displayed.	P4 24.6 51
Lithium Battery Rated Capacity and Remaining Capacity. BMS Communication Fault Code. If the BMS function is not enabled, this page will not be displayed.	P5 10050.8
Lithium Battery Maximum Charge Current and Maximum Discharge Current. BMS Communication Fault Code. If the BMS function is not enabled, this page will not be displayed.	P7 88.0 100
Lithium Battery Alarm and Fault Information. BMS Communication Fault Code. If the BMS function is not enabled, this page will not be displayed.	P8 NUL NUL
Display Inverter Firmware Version	P9 0 1 1

9.Parallel installation instructions

Fault display:

The inverters can be used in parallel in two different operating modes:

- 1.Single-phase parallel operation, with up to 9 units.
- 2.Coordinated operation with up to 9 units, supporting three-phase operation, where a maximum of 7 units can be configured per phase in a three-phase system. In a three-phase system, at least one inverter per phase must be functioning properly.Check the installation instructions in the section above. Ensure sufficient clearance is left between every two inverters. For AC/DC circuit breakers/disconnectors, refer to the recommended sizes and the number of installed inverters in the corresponding section, then select the appropriate circuit breaker/disconnector model.



Warning!

The input cables of inverters connected in parallel within the same phase must have the same conductor material, cross-sectional area, and length.

The output cables of inverters connected in parallel within the same phase must have the same conductor material, cross-sectional area, and length.



Warning!

All inverters must be connected to the same battery bank.

It is recommended to connect the battery terminals of all inverters to the same copper busbar, and then connect the battery bank to the copper busbar.

If cables are used to connect the inverters to the battery, the cable material, conductor cross-sectional area, and conductor length must be identical.



Warning!

Do not connect the same PV string to multiple inverters, as this may damage the inverters.

Each inverter must be connected to a separate PV string.



Caution!

To avoid overloading, it is recommended to ensure the entire system is operating normally before turning off the load-side circuit breaker.



Caution!

There is a transfer time in the power system. Critical equipment with high power supply requirements may experience a power interruption.



Caution!

When the parallel function is enabled, the system cannot operate in Energy Saving Mode / Inverter Soft Start Function.



Caution!

In a parallel system, the leakage current specification of the AC input circuit breaker should be selected as 300mA.

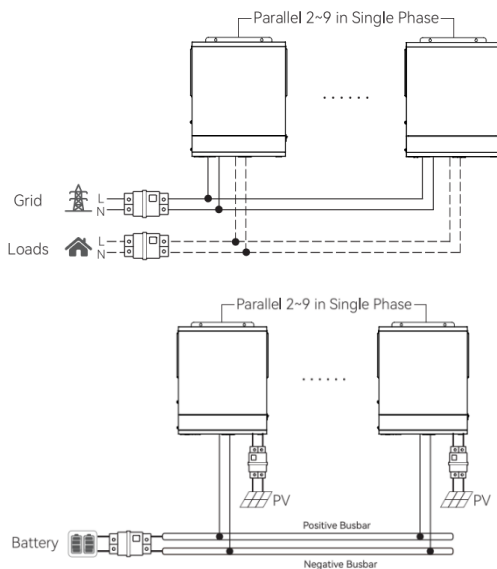


Caution!

If the secondary output of the inverters is used during parallel operation, they will be connected independently from the main output, but wired in the same way, supplying power to different loads separately.

9.1 Single-Phase parallel cable connection

Connection for a Parallel System of 2 to 9 Inverters:



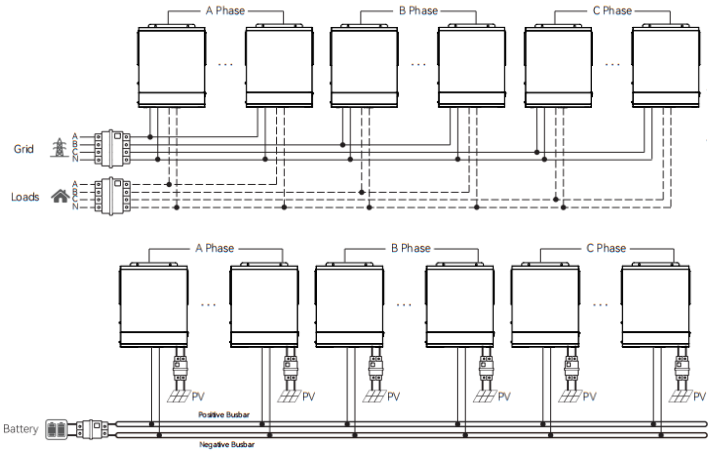
9.2 Three-Phase parallel cable connection

In a parallel system,at least one inverter per phase must be functioning properly.

Example 1:A-phase:3 inverters,B-phase:3 inverters, C-phase:3 inverters.

Example 2:A-phase:1 inverter,B-phase:1 inverter, C-phase:7 inverters.

Connection for a Parallel System of 3 to 9 Inverters:



9.3 Parallel communication cable

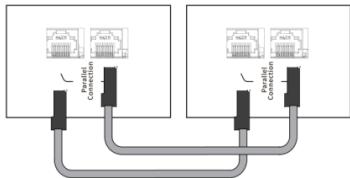
The connection of the parallel communication cable does not need to consider which phase the inverter is in, nor does it need to be distinguished in order. The communication cable can be inserted into any parallel communication interface of the inverter. A daisy-chain connection of the communication cable must be ensured.



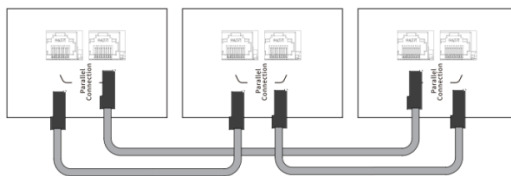
Warning!
The parallel communication cable must be routed separately from power cables to avoid communication interference. A minimum separation distance of 5 cm is recommended.

When there are a large number of inverters in a parallel system,it is recommended to connect the inverter communication cables by linking every other inverter. This allows the standard cables provided in the accessories to be used,avoiding the need for a long cable from the last inverter back to the first inverter.

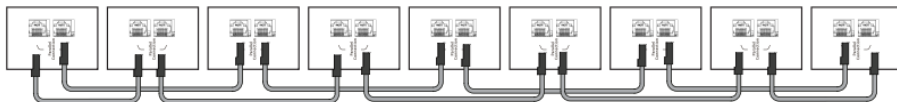
Communication connection for 2 inverters in a parallel system:



Communication Connection for 3 Inverters in a Parallel System:



Communication Connection for 9 Inverters in a Parallel System:



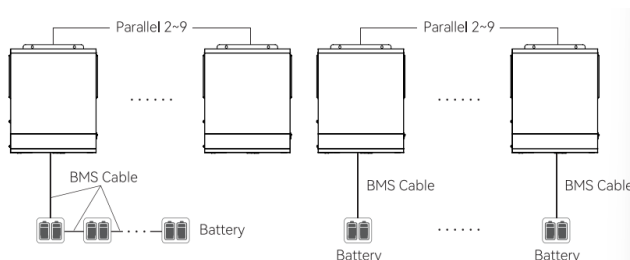
9.4 BMS parallel cable

There are two ways to connect the BMS and inverters:

All battery BMS units are interconnected and then connected to only one inverter.

If the number of inverters matches the number of batteries, each BMS can be individually connected to one inverter.

Note: All battery power cables must be connected in parallel. If the number of inverters does not match the number of batteries, a connection method must be used accordingly.



9.5 Parallel system settings

To configure the system settings, please first refer to Section 4.2.2, Procedures 27 and 28.



Caution!

If any machine in a parallel system is set to SIG, it will report fault 24.

If there are machines in the parallel system set to 3P1, 3P2, and 3P3, all machines must be set to one of these three modes, and at least one machine must be set to each mode. Otherwise, all machines set to these three modes will report fault 24.

9.5.1 Single-Phase setting

Step 1: Before setting up, check that the wiring is correct. Ensure all circuit breakers (PV input, mains input, AC output, and battery circuit breakers) are turned off, and that the neutral wires of each inverter are connected together.

Step 2: Turn the "ON/OFF" switch to "OFF" and ensure all inverters are switched off. Connect the battery circuit breaker to power the inverters.

Step 3: If power is already present in the parallel system, proceed directly to Step 4.

If there is no power in the parallel system, turn the "ON/OFF" switch to "ON" on the inverter, wait for

the LCD display to turn on, then turn the "ON/OFF" switch back to "OFF". The LCD display will remain on for a period of time.

Step 4: Set "PAR" in Program 27 on the LCD.

Step 5: Follow Steps 3 and 4 to set up all inverters in the parallel system.

Step 6: Turn the "ON/OFF" switch to "ON" on the inverters. Then connect all circuit breakers.

Notes:

1. When setting LCD programs, the "ON/OFF" switch must be turned off; otherwise, settings cannot be changed.

2. Master and slave devices are determined automatically within the system.

3. After parallel configuration, when parameters on one inverter (not related to parallel operation) are changed, the other inverters will automatically synchronize the parameters.

	The default setting of the inverter is SIG: Single Unit Mode.
	The default setting of the inverter is PAR: Single-Phase Parallel Mode.
	PID: Parallel Identification Code. The default setting is ATO (Automatic Mode), and the system will automatically assign a parallel ID.
	The parallel identification code can be set from 1 to 9. Two inverters cannot be set with the same ID.

9.5.2 Three-Phase setting

Follow the steps for single-phase setup. Most steps are the same, except for the following two differences:

The first difference is in Program 27, where the first phase is set to 3P1, the second phase to 3P2, and the third phase to 3P3.

First Phase LCD Display	Second Phase LCD Display	Third Phase LCD Display
		

The second difference is verifying that the three-phase input has the correct phase sequence. The inverter needs to be set to UPS mode. If the screen displays that the mains cannot connect to the system, the AC phase sequence of the system input needs to be adjusted. After normal grid connection, the App or UPS mode can be set according to actual needs.

9.6 Wi-Fi connection in a parallel system

There are two methods for installing a Wi-Fi data collector:

1. Install only one Wi-Fi data collector on any one inverter. The entire parallel system will upload data through this Wi-Fi data collector.

2. Install a Wi-Fi data collector on each inverter. Each inverter will upload its own individual data through its own Wi-Fi data collector.



Caution!

When Wi-Fi data collectors are installed on multiple inverters, the other inverters without a Wi-Fi data collector cannot upload data.

10.Fault description and Troubleshooting

10.1 Fault display:



Function description:

If an alarm occurs, the fault indicator flashes once per second, and the buzzer sounds for 1 minute before stopping.

If a fault occurs, the fault indicator remains constantly on, the buzzer sounds for 10 seconds, then stops. The system will attempt to restart. If the machine does not operate after six restart attempts, the machine and LCD will remain in a fault state. You need to completely shut down (turn off the screen) or wait 30 minutes before restarting the machine.

The fault LCD display is shown in the figure above. In fault mode, the fault icon remains lit; in alarm mode, the alarm icon flashes. Based on the fault information, contact the manufacturer for troubleshooting the abnormality.

Fault: The inverter enters fault mode, the red LED remains constantly on, and the LCD displays a fault code.

10.2 Fault code and Meaning

Fault code	Meaning	Action	Trigger Condition	Recovery Condition	Fault Alarm
1	Bus soft start fail	Fault mode	Bus voltage has not reached the set value for more than 30s.	Recovery after reaching the set voltage for 15s.	Fault
2	Bus high	Fault mode	Bus voltage is higher than the protection point.	Recovery after reaching the set voltage for 15s.	Fault
3	Bus low	Fault mode	Bus voltage is lower than the protection point.	Unrecoverable	Fault
4	Battery Over Current	Fault mode	Battery current is higher than the set value.	Unrecoverable	Fault
5	Over temperature	Fault mode	The temperature is higher than the over-temperature set value, or the fan is not connected.	The temperature is below the threshold, and the fan has been connected for more than 15min.	Fault
6	Battery high	Fault mode	Battery voltage is higher than the set value.	Recovery after reaching the set voltage for 15s.	Fault
7	Bus soft Fault	Fault mode	Soft start exceeds the set value, but the bus voltage has not reached the set value.	Recovery after reaching the set voltage for 15s.	Fault

8	Bus short Fault	Fault mode	During normal operation, the bus voltage momentarily drops below the set value.	Unrecoverable	Fault
9	INV soft Fault	Fault mode	Bus voltage is higher than the protection point, or the DC component is greater than 20V, or the inverter fails to complete startup within 5min.	Recovery after reaching the set voltage for 15s.	Fault
11	INV under voltage	Fault mode	In battery mode and with no short circuit fault, the inverter voltage is lower than the set value.	Recovery after reaching the set voltage for 15s.	Fault
12	INV short	Fault mode	In battery mode or standby mode, if the inverter voltage is low and the current is greater than the set value.	Recovery after reaching the set value for 15s.	Fault
13	Negative power	Fault mode	The inverter power is negative and exceeds the set value for a period of time.	Recovery after reaching the set voltage for 15s.	Fault
14	Over load fault	Fault mode	Overload exceeds the limit value.	Recovery after reaching the set voltage for 15s.	Fault
17	Program upgrade	Fault mode	Inverter Upgrade or OTA	Recovery after the upgrade is completed.	Fault
18	PV polarity reversal	Fault mode	PV Polarity Reversed	Recovery 15s after correct connection.	Fault
19	Parallel same ID	Fault mode	Identical Parallel ID in the System	Recovered when there are no identical Ids.	Fault
20	Parallel communication failure	Fault mode	When a communication abnormality occurs, the number of parallel devices is reduced to 1.	Recovery after re-establishing parallel mode or switching to single-unit mode.	Fault
21	Parallel battery differences	Fault mode	In parallel mode, the battery voltage difference between different units is too large.	Recovery after the battery voltages of all inverters in parallel operation are consistent.	Fault
22	Parallel power supply voltage is different	Fault mode	In parallel mode, the input voltage difference between different units is too large.	Recovery after the mains voltages of all inverters in parallel operation are consistent.	Fault

23	Parallel power supply with different	Fault mode	In parallel mode, the input frequency difference between different units is too large.	Recovery after the frequencies of all inverters in parallel operation are consistent.	Fault
24	Different parallel configurations	Fault mode	In three-phase parallel mode, the parallel mode settings of different units may have phase loss, or both three-phase and single-phase parallel modes may exist, or there may be single-unit mode.	Recovery after setting to single-unit operation and disconnecting the parallel communication, or after restoring the parallel operation status.	Fault
25	Parallel synchronization loss	Fault mode	In parallel mode, the output voltage detection loses synchronization.	Unable to restore in parallel mode, or restore after changing to single-unit mode.	Fault
26	BMS Fault	Fault mode	BMS Error Code Information	BMS Fault Recovery	Fault
29	Inverter load abnormality	Fault mode	Inverter load abnormality causing voltage abnormality.	Recovery 15 seconds after voltage returns to normal.	Fault

10.3 Alarm code and Meaning

The inverter does not enter fault mode, the red LED flashes, and the LCD displays an alarm code.



Alarm code	Meaning	Action	Trigger Condition	Recovery Condition	Alarm
50	Battery open	Alarm	Battery not connected within 10min.	Battery reconnected and restored after 2min of charging	Alarm
51	Battery Under	Alarm, battery low voltage shutdown or unable to start.	Battery voltage is below the BAU set value.	Battery voltage exceeds BAU set value by 2V, restored.	Alarm
52	Battery low	Alarm	Battery voltage is below the BAL set value.	Battery voltage exceeds BAL set value by 2V, restored.	Alarm
53	Battery charge short	Alarm, battery not charging.	MKH5000-22 inverter: Single battery voltage is below 12V with charging current present. MKH6500-42 series inverter: Battery voltage is below 24V with charging current present.	After the short circuit is cleared, it will be restored within a maximum of 1 min.	Alarm
56	BMS disconnected	Alarm	Communication failure after BMS communication is enabled.	Restored after communication is closed or normal.	Alarm
58	Fan lock	Alarm, fan running at full speed.	Fan speed signal lost.	Restored after fan speed signal is acquired.	Alarm
59	EEPROM fail	Alarm	EEPROM read/write error, abnormal data restored to factory settings.	Can be restored.	Alarm
60	overload warning	Alarm, battery not charging.	Utility current, battery discharge current, or load power exceeds the rated value.	Utility current, battery discharge current, and load power are all below the rated value.	Alarm
62	PV Energy Weak	Alarm, PV output to load is shut off, battery charging remains active.	When the battery is not connected, the bus voltage is below the set value.	Restored 10 minutes after battery connection, grid connection, or bus voltage exceeds the set value.	Alarm
64	Different parallel configurations	Alarm, system enters standby mode.	In standby mode, there are incompatible mode settings during parallel operation.	Restored after correctly setting the parallel operation mode.	Alarm

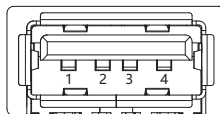
68	Battery SOC too low	Alarm, standby mode activated.	Lithium battery SOC value is below the BMS set value.	Restored after meeting any of the following three conditions: 1.Low SOC shutdown function is disabled 2.BMS communication function is disabled 3.SOC is 5% higher than the set value.	Alarm
69	SOC Low	Alarm, if in standby mode, remain in standby mode without powering on.	Lithium battery SOC is below set value +5%(in utility mode or battery mode), or below set value +10%(in standby mode).	Restored after meeting any of the following three conditions: 1.Low SOC shutdown function is disabled 2.BMS communication function is disabled 3.SOC is 5% higher than the set value.	Alarm
72	The battery cannot start	Alarm	Battery voltage has not reached the startup voltage.	Restored after battery voltage exceeds the startup voltage.	Alarm
77	Unstable mains power supply	Alarm, mains not connected.	Mains power lost 3 times within 5 minutes.	Restored after 5 min.	Alarm

11.Communication interface and Description

11.1 USB interface

Supports Wi-Fi/GPRS functions, requires an external data collector (application required) for connection. The inverter-controller integrated machine can be controlled via a mobile app.

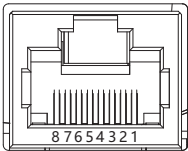
Num	Meaning	Description
1	+5V	5V serial port power supply
2	RS.232.RX	Serial Debug Interface
3	RS.232.TX	Serial Debug Clock Interface
4	GND	Ground



11.2 RJ45 interface

This interface can communicate with the lithium battery BMS via RS485. Interface definition:

Num	Meaning	Description
1	RS485B	RS485 Communication Interface
2	RS485A	RS485 Communication Interface
3	NC	/
4	CAN-BUS+	CAN Communication Interface
5	CAN-BUS-	CAN Communication Interface
6	NC	/
7	NC	/
8	NC	/



12.Battery balancing description

The balancing function is integrated into the charge controller. It reverses the accumulation of negative chemical effects, such as stratification—a condition where the acid concentration is greater at the bottom of the battery than at the top. Equalization also helps remove sulfate crystals that may build up on the plates. If left unchecked, this condition, known as sulfation, will reduce the overall capacity of the battery. Therefore, it is recommended to equalize the battery regularly.

Note: Do not activate this mode when using lithium batteries.

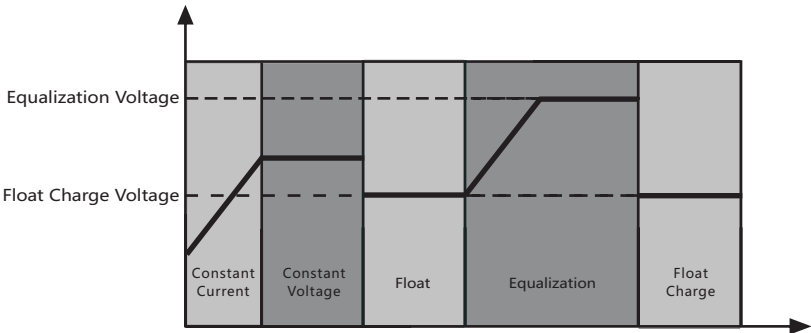
※ How to Apply the Equalization Function?

You can apply this function in the device through any of the following methods:

- 1.Set the equalization voltage point on program 31.
- 2.Set the equalization charging time on program 32.
- 3.Set the equalization delay time on program 33.
- 4.Set the equalization interval time on program 34.
- 5.Activate the equalization mode immediately on program 35.

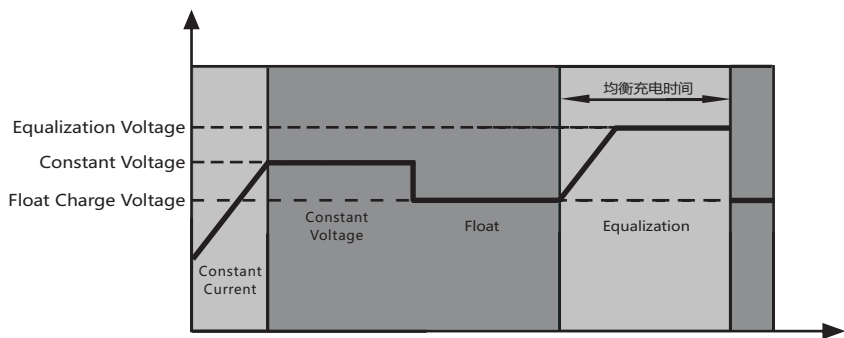
12.1 Equalization time

At a certain stage,when the set equalization interval(battery equalization cycle)is reached or immediate equalization is activated,the controller will begin to enter the equalization stage.

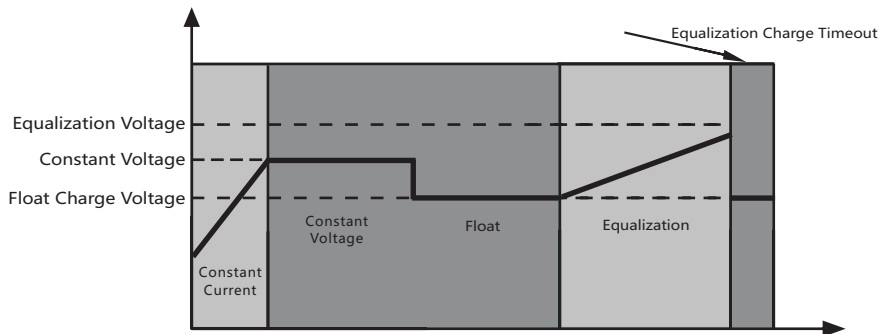


12.2 Equalization charge time and Timeout

During the equalization stage,the controller will supply as much power as possible to charge the battery until the battery voltage rises to the equalization voltage. It will then maintain the battery voltage at the equalization level using constant voltage regulation. The battery remains in the equalization stage until the set equalization time is reached.



However, during the equalization stage, if the battery equalization time expires before the battery voltage rises to the equalization voltage point, the charge controller will extend the battery equalization time until the battery voltage reaches the equalization voltage. If the battery equalization exceeds the set end time and the battery voltage is still below the battery equalization voltage, the charge controller will stop equalization and return to the float stage.



13. System maintenance

To maintain optimal long-term performance, it is recommended to inspect the following items twice a year.

- Ensure airflow around the integrated machine is not obstructed. Clean any dirt or debris from the radiator.
- Inspect all exposed wires for insulation damage caused by sunlight, friction with surrounding objects, dryness, rot, insects, or rodents. Repair or replace wires as necessary.
- Verify that indicators and displays are consistent with device operation. Note any faults or error displays and take corrective action when necessary.
- Check all wiring terminals for signs of corrosion, insulation damage, high temperature, or burning/discoloration. Tighten terminal screws.
- Inspect for dirt, nesting insects, and corrosion. Clean as required.



Warning: Electric Shock Hazard! Ensure that all power sources to the integrated machine are disconnected and that the capacitors are fully discharged before performing any inspections or operations mentioned above.

The company shall not be held liable for any damage caused under the following circumstances:

- ① Damage caused by improper use or use in an unsuitable environment.
- ② The open circuit voltage of the PV array exceeds the maximum allowable voltage.
- ③ Damage caused by the operating environment temperature exceeding the specified operating temperature range.

④Unauthorized disassembly or repair of the integrated machine.

⑤Damage caused by force majeure:Damage occurring during transportation or handling of the integrated machine.

14.Troubleshooting

Trouble	Description	Trigger Condition	Solution
LED Screen Display Fault Code 5	Over heating	1.PFC temperature exceeds the protection threshold for more than 20 seconds. 2.Alarm 58 persists for 5 seconds.	Please check if the fan is disconnected or if the wiring is loose. If the fan remains disconnected for more than 5 minutes,the machine will report fault code 5.
LED Screen Display Fault Code 12	Inverter Short Circuit	In battery mode or standby mode,if the inverter voltage drops below 80V and the inverter current exceeds 30A,a response should occur within 100-120ms.	1.Check the output terminals for short circuits(e.g.,screws piercing the locking terminal causing an L-N short circuit). 2.Check whether the inverter voltage and inverter current meet the trigger conditions.
LED Screen Display Fault Code 58	Fan Failure	Any fan rotates less than 8 times within 2s.	1.Check if the fan is connected correctly or if the connection is loose. 2.If the fan is connected correctly: (a)Check the fan detection circuit for issues, usually caused by excessive soldering under the control socket. (b)Check if the fan itself is damaged.
Unable to Start	Battery	Since starting the machine in battery mode requires a voltage of $\geq 11.5V$ per battery cell, common reasons for failure to start include improper calibration or insufficient battery voltage.	1.Check if the battery voltage sampling is normal and if the battery voltage has been calibrated. 2.Use a multimeter to measure the voltage at the battery terminals(using a DC power supply or a real battery)to see if the minimum voltage of 11.5V per battery required for startup is reached. Note: It is crucial to configure the battery voltage according to the machine model. Connecting the wrong battery voltage may cause the capacitor to explode.
/	Utility Power	/	1.Check the power terminals for short circuits (e.g., screws piercing through and causing a short circuit between the live and neutral terminals). 2.Check for wiring errors, such as incorrectly connecting the power input to the output terminals.
/	Photovoltaic (PV)	/	1.Check if the PV input voltage is too close to the critical threshold. 2.For low-voltage versions of the machine, check if the software version number of the main controller is compatible. If the software versions differ significantly, the machine may fail to start.
PV Not Charging	/	/	Connecting the wrong battery voltage may cause damage to the auxiliary power supply on the PV side, resulting in power loss and inability to communicate with the main controller.

15. Technical data

15.1 Utility power parameters

Item	Mode	MKH5000-22	MKH6500-42	Note
Input Voltage	Main Input	L+N+PE		
	Input Voltage	230Vac		Adjustable 208/220/230/240Vac
	Input Voltage Range	90~280Vac(Adjustable)		
	Input Low Loss	154Vac(Default)Adjustable:90~154Vac		APP/GEN mode
		185Vac(Default)Adjustable:170~200Vac		UPS mode
	Input Low Recovery	Low Loss Voltage +9V		
	Input High Loss	264Vac(Default)Adjustable:264~280Vac		APP/GEN mode
		264Vac		UPS mode
	Input High Recovery	High Loss Voltage -9V		
Input Frequency	Rated Frequency	50/60Hz		
	Frequency Low Loss/Recovery	40/43.5Hz@50Hz(UPS mode) 50/53.5Hz@60Hz(UPS mode) 40/43.5Hz@60Hz(APP/GEN mode)		
		60/56.5Hz@50Hz(UPS mode) 70/66.5Hz@60Hz(UPS mode) 70/69.5Hz@60Hz(APP/GEN mode)		
Input Current	Rated Current	21.7A	26A	Vrms=230V Line mode at 100% capacity. Excluding the charger.
	Max. Current	40A		Bypass Current

Note:When the external circuit breaker specification exceeds 40A,the maximum input current is 40A. When the external circuit breaker specification is less than 40A,the maximum input current depends on the external circuit breaker specification.

15.2 Battery parameters

Item	Mode	MKH5000-22	MKH6500-42	Note
Battery Information	Number of Batteries	2Pcs	4Pcs	12V/Pcs
	Automatic Start Function	Yes		
	Battery Test Function	No		
	Battery Type	AGM/FLD/LIB/FEL/CUS		
	Rated Battery Voltage	N*12V		@25°C
	Battery Management	Yes		
Battery Protection	Battery Overvoltage	30.5V	61V	
	Battery Undervoltage	10.5V*N		Adjustable: 10*N~11*N
	Battery Low Voltage Alarm	10.8V*N		Adjustable: 10.3*N~11.3*N
	Overcurrent Protection	Fuse		Fast Acting

Note:N = Number of batteries.

15.3 Charging parameters

Item	Mode	MKH5000-22	MKH6500-42	Note
Charging (Utility Mode)	Charging Voltage	FV mode:27V CV mode:28.2V	FV mode:54V Adjustable:53.2~55.6V CV mode:56.4V Adjustable:56~58V	
	Temperature Compensation	No		
	Charging Current	2~160A	2~120A	Adjustable
	Default Charging Current	80A	60A	
	Charging Method	Two/Three/Auto Adjustable		Three states: CC/CV/Float Two states: CC/Float
	Charging Voltage Accuracy	±5%		Calibrated via RS232
Charging (PV Mode)	PV Charging Method	MPPT		
	Max.PV Input Power	27A/9000W		
	Efficiency	99.5%(Max.)		
	MPPT	60~450Vdc		
	Min. PV Voltage	80V		
	Max. PV Voltage	500Vdc		
	Max. PV Charging Current	160A	120A	
Max. Charging Current	/	160A(Max. allowable value) Default:120A	120A(Max.allowable value) Default:100A	Adjustable

15.4 Output parameters

Item	Mode	MKH5000-22	MKH6500-42	Note
Output Power Rating	Output	L1+N1+L2+N2+PE		
	Max. Output Power	5000W	6500W	Power reduction when powered by battery only.
Output Voltage	Rated Voltage	230Vac		Adjustable:208/220/230/240Vac, Manually set via RS232 or LCD.
	Waveform	Sine Wave		
	Voltage Regulation	±5%		
	DC Offset	±100mV(Battery mode)		No-load and Linear load mode
Output Frequency	Rated Frequency	50/60Hz		50/60Hz Auto-Select(Default On)
	Battery Mode	50/60Hz		
	Frequency Regulation	0.1%		

	Utility Mode	50Hz: (40~60)Hz (UPS mode) (40~70)Hz (APP/GEN mode) 60Hz: (50~70)Hz (UPS mode) (40~70)Hz (APP/GEN mode)	50Hz: (43.5~56.5)Hz (UPS mode) (40~70)Hz (APP/GEN mode) 60Hz: (53.5~66.5)Hz (UPS mode) (40~70)Hz (APP/GEN mode)	
Overload Capacity	1 minute@102%~120% load,10 seconds > 120% load.(Battery mode)			
Output Short Circuit Protection	Battery Mode	Current Limiting		
	Utility Mode	Circuit Breaker (40A)		

15.5 Transfer time parameters

Item	Mode	Parameters	Note
Transfer Time	Utility Mode to Battery Mode	10ms(Typical Value)	UPS mode
		10ms(Typical Value)	Appliance (APP) Mode
		20ms(Typical Value)	Generator (GEN) Mode

15.6 Efficiency parameters

Item	Mode	MKH5000-22	MKH6500-42	Note
Efficiency	Utility Mode	> 99.5%@6KVA		Full R Load: Efficiency vs. Load Curve at Different Input Voltages; No Battery Connection Required.
	Battery Mode	93.5%(Max)	94%(Max)	Full R Load: Efficiency vs. Load Curve at Different Input Voltages.
	Standby Power	< 35W	< 30W	No Load / Battery Mode