

User Manual

OPTI-Solar

**Solar Hybrid 3Phase PV Inverter
SP Giant Series**

Table of Contents


1 Safety Information	1
2 Product Overview	2
2.1 Product Description.....	2
2.2 Front Panel.....	2
2.3 Technical Data.....	3
2.4 System Principle.....	5
2.5 Overview of User Interface	5
2.5.1 Display Interface.....	6
2.5.2 Status LED Indicators.....	8
2.5.3 Buttons.....	9
3 Installation	11
3.1 Selecting the Mounting Location.....	11
3.2 Storage and Transportation.....	14
3.3 Unpacking.....	14
3.4 Handling.....	15
3.5 External Protective Devices.....	15
3.6 Preparing for Cables.....	16
3.7 Wiring.....	16
3.7.1 AC Mains Wiring.....	16
3.7.2 Power Cable Wiring in Parallel System	19
3.7.3 Wiring Procedure.....	20
3.8 Communication Ports.....	21
4 Operation	23
4.1 Operation Modes	23
4.1.1 Off-Grid Mode.....	23
4.1.2 ECO Mode.....	26
4.1.3 Other Operation Modes.....	27
4.1.4 Parallel Redundancy Mode (System Expansion).....	29
4.1.5 Microgrid Mode (Example of Application).....	29
4.2 Switching On and Off.....	31
4.2.1 Switching On.....	32
4.2.2 Switching Off.....	32
4.2.3 Parallel System Startup.....	32
4.2.4 Parallel System Shutdown.....	32
4.3 Emergency Power Off (EPO).....	33
4.4 Clearing System Fault	33
4.5 Maintenance Bypass Operation	33
4.5.1 Entering Maintenance Mode	33
4.5.2 Exiting Maintenance Mode	34
4.6 Configuration.....	34
4.6.1 User Settings	34

4.6.2 System Information	38
4.6.3 Advanced Settings	38
5 Maintenance.....	43
5.1 Preventive Maintenance	43
5.2 Battery Maintenance	43
6 Troubleshooting	44
6.1 Fault and Alarm Messages	44
6.2 MPPT Module Fault and Alarm Messages	46

1 Safety Information

In order to keep safe in using, please comply with the followings:

- This system is a dedicated power supply device, and the installation and maintenance must be performed by technical staff.
- When installing the inverter, the clearance between the inverter and the wall must be at least 1000 mm to ensure the good ventilation and cooling performance.
- It's normal that the temperature of the inverter surface reaches up to 50°C when it is in operation.
- The battery banks of all series inverters are external, ensure to configure the battery bank meeting the requirements of the inverter rated voltage.
- Do not open the inverter's case; otherwise it may cause a dangerous electric shock. If you want to have an internal inspection, please bring it to appointed service center.
- The internal part of the inverter will lead to a high voltage, do not open the inverter's case to avoid electric shock.
- Manual bypass switch is only used for maintenance personnel. Unauthorized personnel are strictly prohibited from opening the switch to avoid damages to the device;
- The system is featured with multiple PV inputs, which must be connected with an independent loop; do not connect the electrode to the ground.
- The "EPO" button on the panel is the emergency stop (shutdown) device, please operate cautiously.
- The internal part of the inverter will lead to an electric shock or fire by short circuit, please do not place any vessel containing liquid on inverter to avoid electric shock.
- If the inverter is in abnormal working status, please cut down the electricity immediately and contact the agents or appointed service center.
- Please do not use liquid fire extinguishers instead of the powder one. Liquid fire extinguisher may trigger the danger of shock.
- Please put the socket near the inverter so that you can unplug it to cut off the electricity supply in case of emergency.
- It is strictly forbidden to place and operate the inverter in following environments:
 - Out of door
 - The place of poor air ventilation
 - Places with flammable gas, corrosive substances, or large amounts of dust
 - Places with abnormal high temperature or abnormal low temperature (above 40°C or below 0°C), high humidity (above 90%)
 - Places with direct sunlight or closing to heater

Symbol	Description
 CAUTION	<ul style="list-style-type: none"> • The equipment must be grounded before operating. • Improper operation may cause enormous loss. Please be sure to operate the device according to instructions.

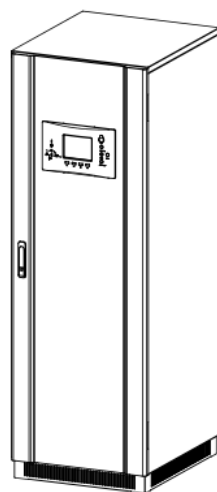
2 Product Overview

2.1 Product Description

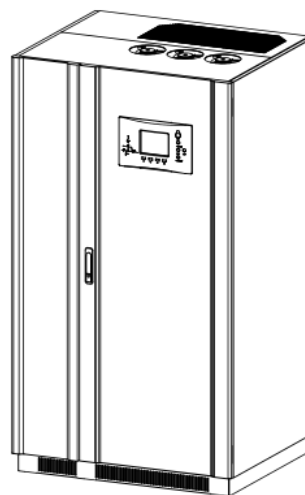
The PV off-grid system mainly consists of PV modules, combiner box, off-grid inverter, battery bank and user loads. Off-Grid inverter range is available in models from 30 kVA ~ 120 kVA with DSP digital control technology, it is combined with pulse-width modulation (SVPWM), disturbance MPPT control and multi-level control technology to enable the system to track the maximum power of PV modules fast. Its secure power supply feature provides good quality power with regulated voltage and frequency to the loads, and it is featured with energy storage and staggering power consumption as well. It is an ideal inverter for medium-sized or large-scale residential, commercial and industrial PV applications which are off the grid, such as village, farm, factory, office building and islands etc.



2.2 Front Panel



30/40/60 kVA



80/100/120 kVA

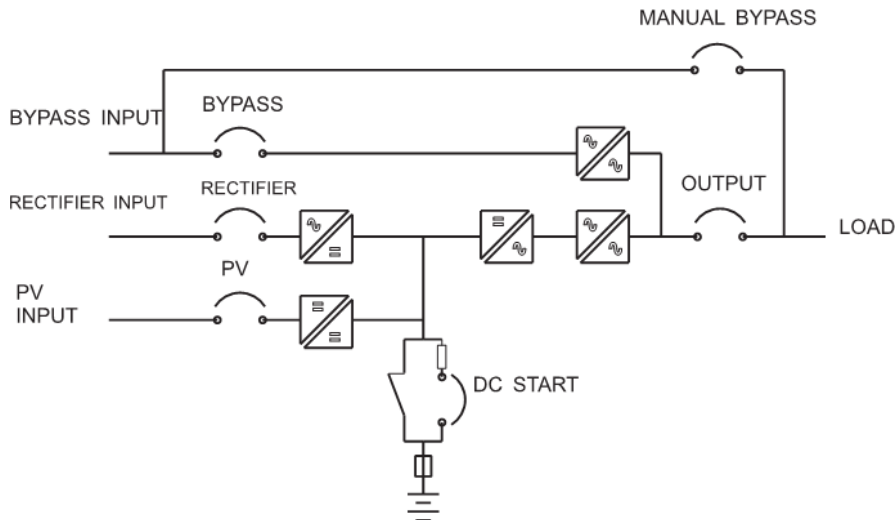
2.3 Technical Data

MODEL	SP30K Giant	SP40K Giant	SP60K Giant	SP80K Giant	SP100K Giant	SP120K Giant
Rated power	27 kW	36 kW	54 kW	72 kW	90 kW	108 kW
Rated current	45 A	60 A	91 A	120 A	152 A	182 A
Output power factor	0.9					
Rated input voltage	380 Vac \pm 20%					
Rated output voltage	380 Vac \pm 1%					
Battery voltage	360 Vdc					
Number of battery	12 Vdc * 30 pcs / 2 Vdc * 180 pcs					
Operating mode	AC and PV complementation					
PV INPUT						
Max. voltage (Voc)	750 Vdc					
Optimum operating voltage (Vmp)	450 ~ 550 Vdc					
Max. conversion efficiency	\geq 98%					
Floating charge voltage (25°C)	414 Vdc \pm 1%					
Equalizing charge voltage (25°C)	428 Vdc \pm 1%					
MPPT Max. current	120 A		180 A	240 A	300 A	360 A
Max. PV power	2 * 25 kW		3 * 25 kW	4 * 25 kW	5 * 25 kW	6 * 25 kW
Number of PV input	2 + 1 (reserve)		3 + 1 (reserve)	4 + 2 (reserve)	5 + 3 (reserve)	6 + 2 (reserve)
MPPT modules	2 + 1 (reserve)		3 + 1 (reserve)	4 + 2 (reserve)	5 + 3 (reserve)	6 + 2 (reserve)
AC RECTIFIER						
Input voltage range	380 V \pm 20% three-phase					
Rated frequency	50 Hz / 60 Hz \pm 5 Hz (settable)					
Power factor	0.8					
Floating charge voltage (25°C)	410 V \pm 1%					
Equalizing charge voltage (25°C)	415 V \pm 1%					
Max. charging current	38 A	50 A	75 A	167 A	208 A	250 A
INVERTER						
Inverter voltage	380 Vac three-phase + N+PE					
Phase voltage	220 / 230 / 240 Vac (settable)					
Output voltage precision	\pm 1%					
Transient voltage range	\pm 5%					
Transient recovery time	20 ms					
Rated frequency	50 / 60 Hz \pm 1 Hz (settable)					

Frequency tracking range	50 / 60 Hz \pm 3 Hz					
Peak factor	3 : 1					
Waveform	Sinusoidal					
Waveform distortion	\leq 3% (linear load)					
Voltage unbalance	\pm 3% (100% unbalanced load)					
Overload	\geq 105% ~ 110% for 1 h, \geq 110% ~ 125% for 10 min, \geq 125% ~ 150% for 1 min, \geq 150% shut down in 10 s, \geq 200% shut down immediately					
Short circuit	Current-limiting, shut down immediately until the user start up					
Max. efficiency	\geq 92%			\geq 93%		
BYPASS						
Rated voltage	380 Vac three-phase + N+PE					
Voltage range	\pm 20%					
Rated frequency	50 Hz / 60 Hz \pm 5 Hz					
Max. current	57 A	76 A	114 A	152 A	190 A	228 A
BATTERIES MANAGEMENT						
EOD voltage settings	1.58 ~ 1.83 Vdc (settable), 1.75 Vdc (default)					
Staggering DOD (Depth of Discharge) settings	1.85 ~ 2.1 Vdc (settable), 1.89 Vdc (default)					
Charging current settings	Factory default 0.15 C ₁₀ ; 0.07 ~ 0.3 C ₁₀ (settable)					
Battery management	Auto-transfer between equalizing charge and floating charge; Auto- temperature compensation of batteries					
TRANSFER TIME						
Inverter – Bypass	0 ms					
Bypass – Inverter	0 ms					
COMMUNICATIONS						
Remote control	Inverter startup, shutdown, abnormal clearance, EPO, battery self-test					
Communication interface	RS232, RS485, SNMP (optional)					
Dry contacts output	Bypass input abnormal, rectifier input abnormal, system fault, system alarm, low battery, output overload, fan fault, generator ON / OFF					
OTHERS						
Operating temperature	0°C ~ 40°C					
Max. relative humidity	90% (non-condensing)					
Max. altitude	1000 m at rated power (derating 1% for each additional 100 m); Max. 4000 m					
Noise level at 1 m	\leq 65 dB (varies with loads and temperature)					
IP rating	IP 20					
Dimensions (W x D x H) (mm)	600 x 700 x 1750			960 x 800 x 1700		
Packaged dimensions (W x D x H) (mm)	690 x 790 x 1850			1040 x 890 x 1750		
Weight (kg)	380	430	515	760	800	860

2.4 System Principle

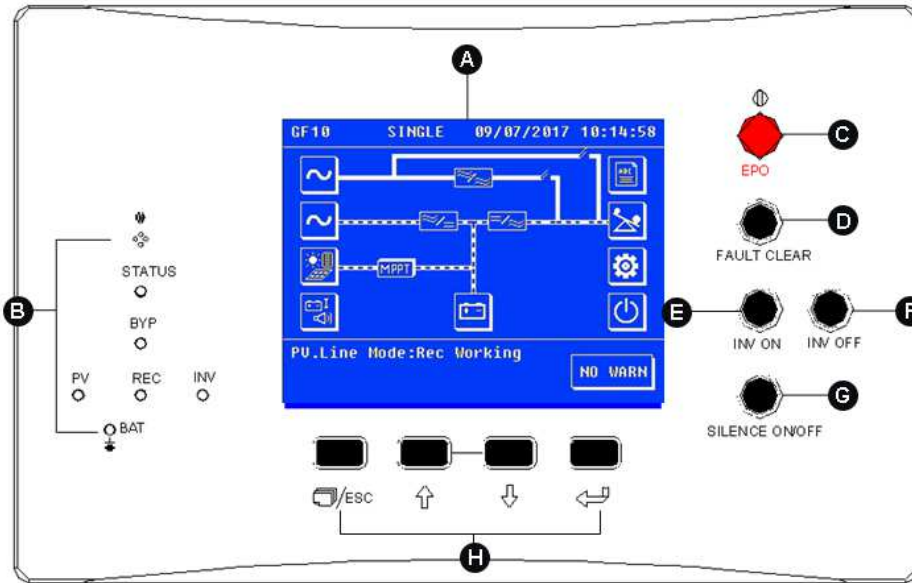
AC mains power is input via the rectifier switch and is converted to DC power to charge the battery and power up DC bus. Solar power input is converted by a PV switch through MPPT power module to supply to the battery and DC bus. The inverter module converts the DC power of DC bus to pure AC power free from the mains interference. In the event of mains supply interruption, backup power is provided to the load by the battery and MPPT module through inverter module. For inverter failure or overload timeout, loads can be driven by AC bypass through bypass breaker and bypass static switch. In addition, to maintain or service the system, maintenance switch can be manually controlled to power the loads. When the system is in normal operation, all switches except the maintenance switch are closed.



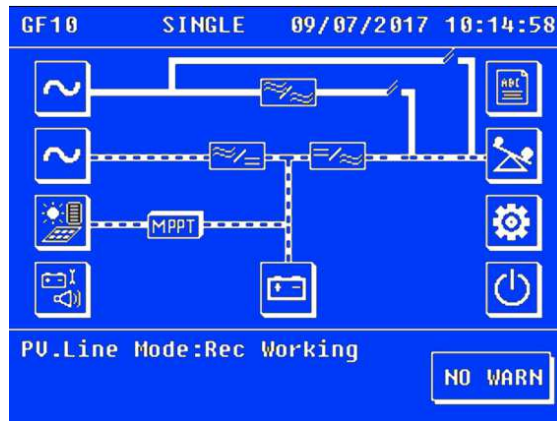
2.5 Overview of User Interface

Users can control the off-grid inverter and query all the input and output parameters, battery status, power generation, and event and alarm information through the user interface. The user interface is placed on the front panel of the inverter and consists of:

- A. Display interface
- B. Status LEDs
- C. EPO button
- D. Clear button
- E. Inverter ON button
- F. Inverter OFF button
- G. Mute ON/OFF button
- H. Operation button








2.5.1 Display Interface





















User-friendly LCD display interface provides a 320 x 240 dot matrix graphical display. LCD can display alarm information in real time, provide 10,000 alarm records for user query and provide a reliable basis for fault diagnosis. Users can perform various operation commands through the LCD display interface to conveniently view the input, output, load, and battery parameters, and obtain the current system status and alarm information in time. The LCD also shows the version information of the control software and internal monitor board software.

A total of five menu buttons are available, with functions described below:

Menu Icons	Menu Items	Explanation	
	Input parameters	Line voltage (V)	Rectifier input line voltage
		Current (A)	Rectifier input current
		Frequency (Hz)	Rectifier input frequency
		Power factor	Rectifier input power factor
	Bypass parameters	Phase voltage (V)	Phase voltage
		Frequency (Hz)	Frequency
		Phase current (A)	Phase current
		Phase power (W)	Phase power

	Output parameters	Phase voltage (V)	Inverter output phase voltage
		Phase current (A)	Inverter output phase current
		Frequency (Hz)	Inverter output frequency
		Power factor	Load power factor
	Load parameters	Apparent power (kVA)	Sout: Apparent power
		Active power (kW)	Pout: Active power
		Load percentage (%)	Load (inverter rated load percentage)
	Parallel parameters	Apparent power (KVA)	Sout: Apparent power
		Active power (kW)	Pout: Active power
		Stand-alone system with no parallel data	When the inverter is set to stand-alone, it has only local load and no system load
	Battery parameters	Bus voltage (V)	System bus running voltage
		Battery voltage (V)	System battery voltage
		Battery current (A)	Battery charge and discharge current
		Battery temperature (°C)	Current battery bank ambient temperature
		Ambient temperature (°C)	Current temperature inside the machine
		Battery status	Battery box (pack) switch is on;
	System power generation	Generation power	Current total power generation of the system
		Daily power generation	System total power generation of the day
		Total power generation	Accumulated total power generation of the system
	MPPT1#—n# modules parameters	Module version number	Module software version number
		PV voltage	MPPT n # single module input PV voltage
		PV current	MPPT n # single module input PV current
		Battery voltage	Current battery voltage detected by MPPT module
		Charge current	Current battery charge current
	Module status	Current module status	

Button Icons		Description
	Settings	Press to enter system settings
	ON/OFF	Press to execute power on / off command selection, and tap YES to take effect
	Battery bank parameters	Press to view the battery voltage, charge / discharge current and battery connection status.
	Rectifier input parameters	Press this button to see the rectifier operating parameters
	Bypass input parameters	Press this button to see the rectifier input operating parameters

	Output parameters	Press this button to view the system output operating parameters
	Battery self-test and maintenance	Press this button to set battery test or end test
	History record button	Press this button to view inverter system history records
	Jump button	Press this button to see another data message in the same directory
	Back to home page	Press this button to return to the main system control interface
	Back to the previous menu	Press this button to return to the previous menu of this directory
	Page down button	Press this button to page down
	Page up button	Press this button to page up
	Left shift button	Press this button to move the cursor to the left
	Right shift button	Press this button to move the cursor to the right
	Up and down switch button	Press this button to jump up / down line between lines
	Confirm button	Press this button to confirm the previous operation
	Delete button	Press this button to delete

2.5.2 Status LED Indicators

STATUS (alarm indicator) and alarm sound:

LED Signal	Functions Description	Buzzer Status
The red LED is glowing	EPO emergency power off	Long beep
	Communication fault	
	System fault	
The Red LED is flashing once/second	Battery low voltage	Beep once/second
	Bypass overload delay time up	
	Lock overload timeout	
	Fan fault	
	Output overload	
The Red LED is flashing once/4 s	Other normal alarm information	Beep once/4s
The Red LED is flashing once/2 s	Battery test	Beep once/2s
The green LED is glowing	No fault	No beep

Panel indicators and alarm:

Status LEDs	Glowing (Red)	Glowing (Green)	Off	Flashing (Green)
BYP (Bypass power)	Input voltage abnormal	System bypass power supply	Bypass standby	No such condition
PV (MPPT indicator)	PV abnormal /MPPT abnormal	Running normally	MPPT not started	MPPT module power-off / under-voltage / charge off
REC (rectifier indicator)	Input abnormal/fault	Running normally	Rectifier off	Rectifier being activated
INV (inverter indicator)	Inverter abnormal	Inverter power supply is normal	Rectifier off	Inverter soft start / standby
BAT (Battery indicator)	Battery under-voltage/ abnormal	Battery power supply	Normal status	Battery test / under-voltage

MPPT module panel indicators (as shown below) and alarm definitions:



MPPT Module LEDs	Off	Glowing	Flashing
COMM	Running normally or MPPT not started	PV reverse connection	Communication abnormal
RUN	Under-voltage or MPPT not started	Running normally	PV over-voltage
FAULT	Running normally or MPPT not started	Power supply failure or over temperature	Overcurrent or BUS overvoltage or capacitor overvoltage

2.5.3 Buttons

Symbols	/ESC			
Function 1	Switch	Page up	Page down	Enter
Function 2	Exit	Move left	Move right	Enter


- The display supports two kinds of control modes, i.e. buttons control and touch control. Default setting of the system is touch screen input mode. Perform corresponding operations by pressing icons on the LCD screen directly.

- Press “” button in any interface to switch to button control mode, and press “” button again to return to touch screen control mode.

- After pressing “” button, select the desired control button by pressing “,” buttons to move the cursor. After that, press the “” button to execute.

Button Symbols	Explanation	
INV ON	Power ON button	As this button is pressed, the system executes startup command, tap "YES" to confirm on the display interface, then the system starts running.
INV OFF	Power OFF button	As this button is pressed, the system executes shutdown command, tap "YES" to confirm on the display interface, then the system and output are shut down.
SILENCE ON/OFF	Mute ON/OFF button	As this button is pressed, system alarm is eliminated. Press again to start up the system alarm.
FAULT CLEAR	Clear faults button	Press this button to clear the executed abnormal protection commands and restart the system.
EPO	Emergency power off	As this button is pressed, the system immediately terminates power supply.

3 Installation

CAUTION	
	<ul style="list-style-type: none"> • The inverter must be properly earthed/grounded and due to a high leakage current, the earthing/grounding conductor must be connected first. Ensure that all external input power switches are turned off before the installation of the inverter system is completed. • All installations must conform with the laws, regulations, codes and standards applicable in the jurisdiction of installation. • All work on the inverter must only be carried out by electrically qualified personnel. • Be carefull of battery installation. When the battery is connected, the battery terminal voltage will exceed 360 Vdc, with a deadly danger. Wear eye shields to avoid accidental arc damage to eyes. Remove all metal wear such as rings, watches and more. Use a tool with an insulated handle. Wear rubber gloves. If the battery electrolyte leaks or the battery is damaged, the battery must be replaced and placed in a corrosion resistant container and disposed of in accordance with local regulations. In case of skin contact with electrolyte, rinse immediately with water.

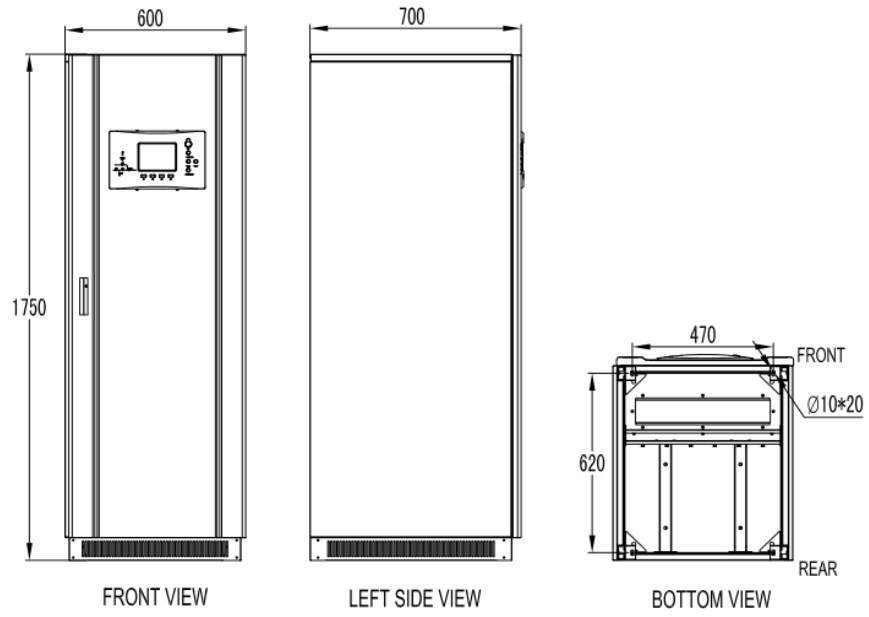
3.1 Selecting the Mounting Location

Follow the following requirements for the mounting Location:

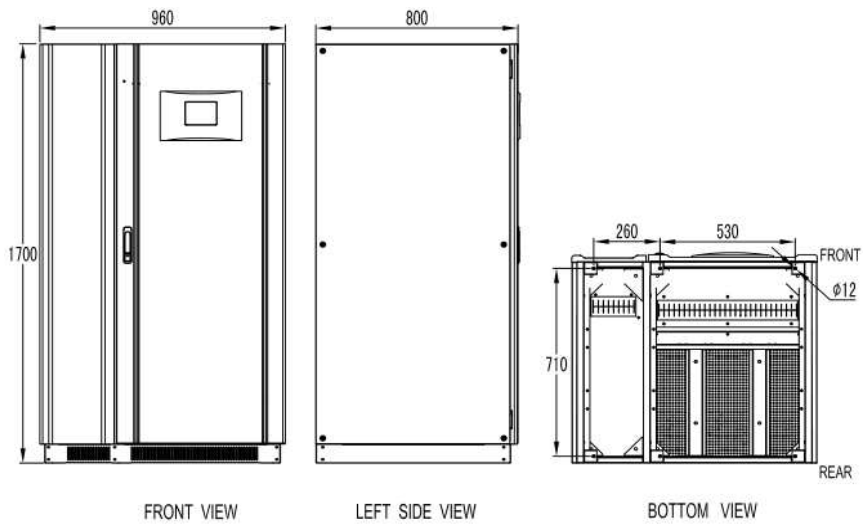
- The inverter system must be installed on a level floor.
- Do not install the inverter near highly flammable materials.
- Do not install the inverter in potentially explosive areas.
- Install the inverter away from water and heat sources. Keep the inverter away from direct sunlight, dust, volatile gases, corrosive materials, and air dense with salt particles.
- Install the inverter system in a temperature controlled environment free of conductive contaminants and humidity. (The normal operating temperature is °C ~ 40°C. but the startup temperature should be higher than 0°C. The most ideal operating temperature is 25°C. Users should ensure that the location environment is well ventilated so that the equipment can be adequately cooled. If necessary, a fan or air conditioning should be considered to install in the location. This equipment is not suitable for outdoor use.
- Altitude: Below 1000 meters. Derating is required if the altitude exceeds 1000 m.
- The mounting location must be suitable for the weight and dimensions of the product.

Table 3-1 Inverter Weights and Dimensions

Models	Weight (kg)	WxDxH (mm)
SP30/40/60K Giant	380/430/515	600 × 700 × 1750
SP80/100/120K Giant	860	960 × 800 × 1700



30-60 kVA Inverter Dimensions



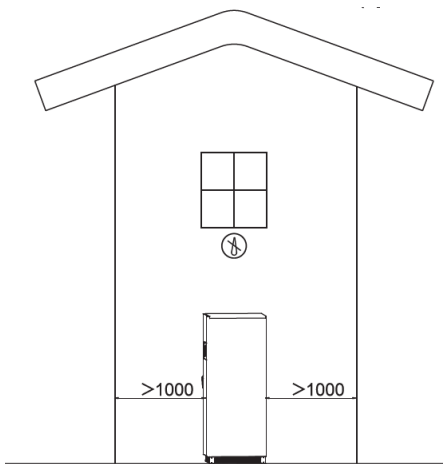
80-120 kVA Inverter Dimensions

- The equipment uses forced air cooling to cool the internal components. The air inlet of the 30-60 kVA inverter is at the front and the bottom of the cabinet with the air outlet on its rear; the air inlet of the 80-120 kVA inverter is on the front and the bottom of the cabinet with the outlet on its top. Maintain the following clearances around the cabinet to facilitate operations and ventilation:

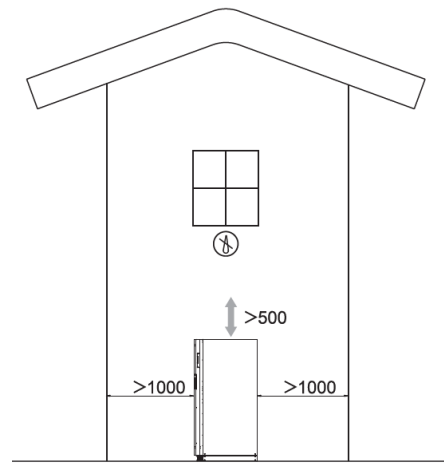
Table 3-2 Clearance Dimensions

Model \ Position Clearance	Top	Front	Rear	Right Side	Left Side
30-60 kVA	Not required	≥ 1000 mm	≥ 1000 mm	Not required	Not required
80-120 kVA	≥500mm	≥ 1000 mm	≥ 1000 mm	Not required	Not required

- There is no air grille on the side of each cabinet, and there is no special space requirement for the side of the cabinet. In order to facilitate routine maintenance, in addition to meeting local regulations, sufficient space should be reserved in front of the cabinet. After the front door of the cabinet is fully opened, that is, people are free to pass, the distance between the top of the cabinet and the ceiling should be at least 500 mm to ensure that the top of the inverter system is well ventilated. A certain space can also be reserved at the side and back of the cabinet for easy installation and future maintenance. The recommended installation space for the inverter system is as shown in the figure below. At least 1 meter of installation space is reserved for the front and rear, and the distance between two units should be at least 0.5 meters.



Clearance for 30-60 kVA Inverter Installation



Clearance for 80-120 kVA Inverter Installation

- Battery installation location:

The ambient temperature where the battery is located should be constant. Ambient temperature is a major factor affecting battery capacity and lifetime. The battery's standard operating temperature is 20 ° C to 25 ° C. Operating in an ambient temperature above this range will shorten battery life, and operating at an ambient temperature below this range will reduce the battery's capacity. Under normal circumstances, the battery allowable ambient temperature is between 15°C ~ 25°C. To avoid the formation of an explosive mixture of hydrogen and oxygen, the battery must be far away from heat and proper ventilation is required. The battery switch should be installed near the battery as far as possible, and to ensure that the routing distance from the battery to the machine is the shortest.

3.2 Storage and Transportation

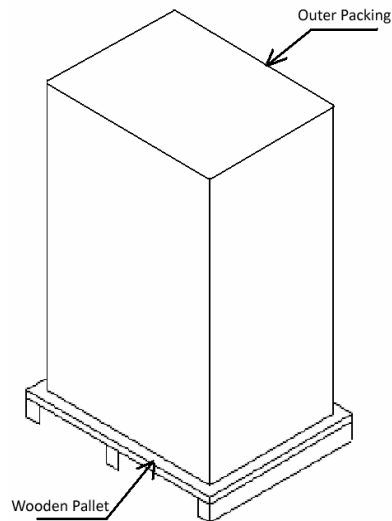
The product can be transported by railways, highways, waterways and airlines; Keep it dry, clean the environment, avoid rain, snow, dust, exposure, humidity, pollution and other harsh environments; do not take the means of transport, tools, loading and unloading modes and packaging methods that are harmful to the product.

If it is not installed immediately, install the machine vertically according to the instructions on the package and store it in a dry, sheltered room with its container to avoid dust and high temperatures.

When the machine room or storage place needs to be renovated or the cabinets of the inverter system are not used for a long time, the machine must be covered with a packing box to prevent dust or other impurities from entering the machine chassis and affecting the reliability of the machine.

3.3 Unpacking

Check the weight of each cabinet (see Table 3-1) before transportation. The cabinet is screwed to the wooden pallet with the protection of packing material (see figure below).



Outer Packing and Wooden Pallet

Do the following before installing the inverter system:

- Carefully inspect the outer packing of the product to confirm that there is no obvious damage during the transportation. After removing the box, visually inspect each product for any damage during transportation. If any damage is found, please inform the carrier immediately and contact the customer service staff as soon as possible.
- Open the box and remove the protective foam;
- Check the product technical data sheet to confirm the correctness of the equipment. Product technical data sheet is located on the name plate above the product back plate, and the nameplate indicates the product model, capacity and the main parameters;
- Before removing the cabinet from the wooden pallet, remove the screws which can only be seen after the front plate and rear plate at the bottom of the cabinet are removed. Please refer to Figure 2-2 to Figure 2-5 for the fixed position.
- Use a forklift to move the cabinet to the installation position. For details on how to handle it, refer to "Section 2.2.1 Handling of Cabinets".
- Disassemble the packing material and discard or recycle it in a proper manner. If you want to

permanently install the cabinet, save the shipping bracket and mounting hardware for later use.



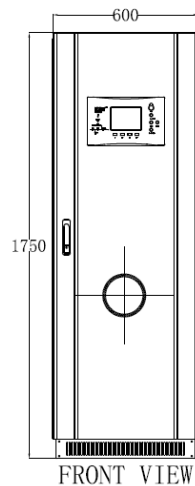
Note: Due to the weight, please keep the cabinet vertical to the ground during disassembly or transportation. The tilt of the cabinet must not exceed 10 degrees (difference from the vertical line), otherwise the cabinet may turn over.

3.4 Handling

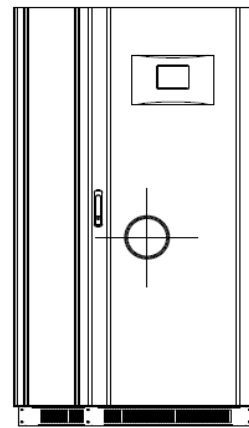
Lifting equipment used for handling the inverter must have sufficient lifting capacity (refer to Table 3-1 Inverter Weights and Dimensions). Before placing in the final position, lift or move the inverter using a forklift or crane.

Do the following operations while handling:

- After lifting the plate on the bottom of the inverter and removing the fixing screws, if a forklift is used to lift, insert the forks of forklift into the gap between the pallet and the bottom of the cabinet (refer to the reference point of the cabinet's center of gravity).



30-60 kVA Cabinet



80-120 kVA Cabinet

- Lift the inverter until the bottom of the inverter leaves the pallet about 20 mm.
- Once the inverter leaves the pallet, pull the pallet away from the bottom of the cabinet. Keep pallets in a proper way.
- Use a forklift to move the inverter to the final installation site.
- Slowly lower the inverter until it touches the ground.
- Use the hardware provided by the user to fix the inverter on the floor.
- If you want to install the inverters back to the wall side by side, you must fix one inverter before installing the next one.

3.5 External Protective Devices

Circuit breakers or other protective devices must be installed at the external power input of the machine. This chapter only provides general guidance to qualified installation engineers. The installation engineer should know about the local wiring regulations for the equipment to be installed.

- To ensure reliable operation of equipment, make sure that the power of the external power supply must be more than 1.5 times of the rated power of the equipment; and ensure that the circuit breaker near to the power supply equipment is more than 1.2 times bigger than the "RECTIFIER, BYPASS" air switch of equipment itself (it cannot be bigger than the switch on the upper level of the specifications).

- To improve the reliability of equipment, use a separate “circuit breaker” or “over-current protection switch” for the “BYPASS INPUT” and “AC INPUT” power supplies.
- Set the external power switch near to the equipment to cut off the power supply in case of emergency.

Notice: For RFI filter grounding, a filter capacitor is connected. So, it may produce a certain current leakage to the ground. For this reason, it is not recommended that the system uses leakage protection switch for power supply to the inverter. According to EN50091-1 standard, taking into account the machine's leakage current, external battery is required to be configured with a DC circuit breaker to provide over-current protection for the inverter and its battery.

3.6 Preparing for Cables

When preparing external wiring cables, consider the power cable current capacity and system overload requirements, taking into account the ambient temperature and physical support media. Installation engineers should refer to the relevant local regulations and actual situations of the user to conduct a comprehensive selection. The length of the connecting cable is generally 2 to 10 meters. Too long cable will cause voltage drop. The corresponding cable cross-sectional area should be increased.

System grounding cables cut off capacity must be greater than or equal to twice of the rated input current of each cabinet.

Table 3-3 Recommended Cable Sizes

Rated Capacity (kVA)		30	40	60	80	100	120
AC Input Cable	Max. current (A)	73	97	144	167	208	250
	American Standard (AWG)	≥ 5	≥ 4	≥ 2	≥ 1	≥ 1/0	≥ 2/0
Bypass Input Cable	Max. current (A)	68	90	135	180	225	270
	American Standard (AWG)	≥ 5	≥ 4	≥ 2	≥ 0	≥ 0	≥ 2/0
AC Output Cable	Max. current (A)	68	90	135	180	225	270
	American Standard (AWG)	≥ 5	≥ 4	≥ 2	≥ 0	≥ 0	≥ 2/0
Battery Input Cable	Max. current (A)	96	127	191	254	318	380
	American Standard (AWG)	≥ 4	≥ 3	≥ 0	≥ 2/0	≥ 3/0	≥ 3/0
PV Input Cable	Max. current (A)	60					
	American Standard (AWG)	6#					

 **Note**

- For the connection of external wiring cables, refer to the national or local electrical codes.
- The connection cable between the battery and the inverter should not produce a voltage drop greater than 1% of the nominal DC voltage at the rated battery current.

3.7 Wiring

3.7.1 AC Mains Wiring

Off-grid solar inverter applies the bottom cable entry system. Before wiring, open the front door with the provided key. After removing the front cover, the terminals of all connection cables can be seen. See the following figure for the connection cables of the inverter system. Terminals for all power cables (except ground) are wired with screws and nuts of size M8 / M10 delivered with the inverter.

 **Note**

Before the inverter system wiring is completed and the external power switch of the inverter system is closed, the protective baffle in front of the terminal blocks (taken before wiring) must be installed.

Description of terminal blocks:

80-120 kVA:

R	S	T	R	S	T	N	N	R	S	T	BAT+	BAT-
AC INPUT			BYPASS INPUT				AC OUTPUT				BATTERY	

PV- 1#	PV- 2#	PV- 3#	PV- 4#	PV- 5#	PV- 6#	PV- 7#	PV- 8#
PV- INPUT							

PV+ 1#	PV+ 2#	PV+ 3#	PV+ 4#	PV+ 5#	PV+ 6#	PV+ 7#	PV+ 8#
PV+ INPUT							

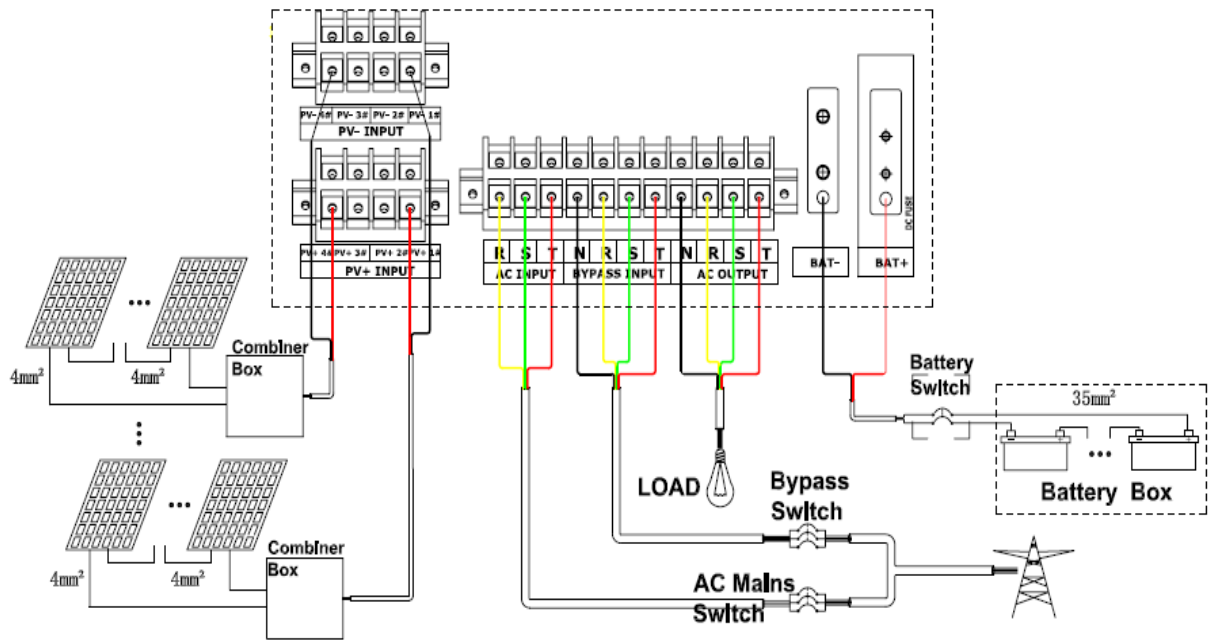
30-60 kVA:

R	S	T	N	R	S	T	N	R	S	T	BAT-	BAT+
AC INPUT			BYPASS INPUT				AC OUTPUT				BAT-	BAT+

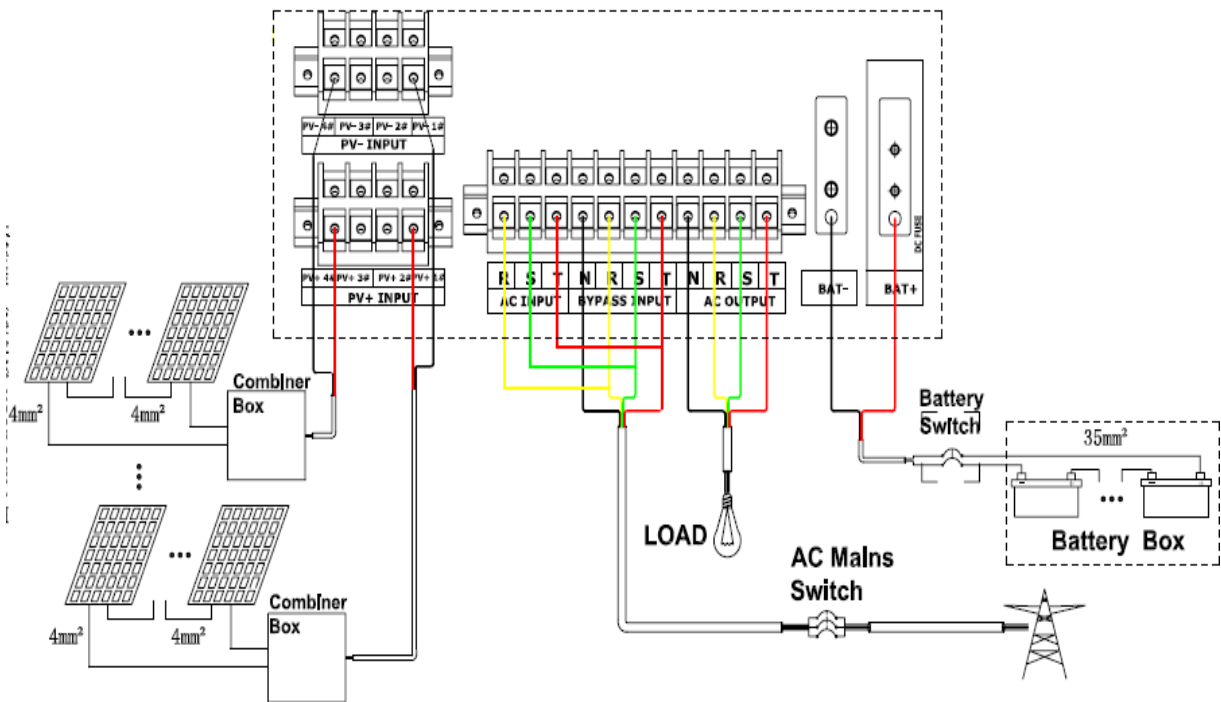
PV+ 4#	PV+ 3#	PV+ 2#	PV+ 1#	PV- 4#	PV- 3#	PV- 2#	PV- 1#
PV+ INPUT				PV- INPUT			

Description of connecting internal circuit breakers to terminal blocks

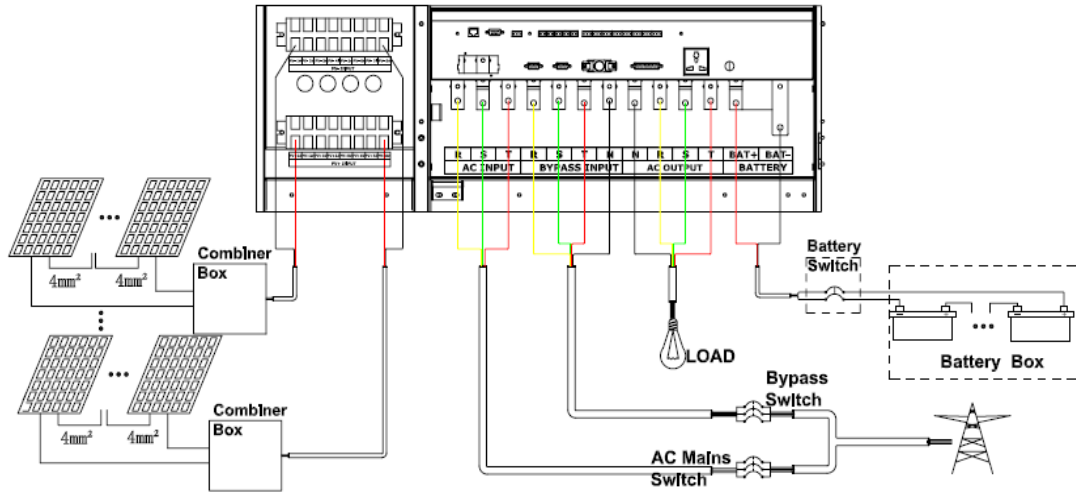
Label	Functions
PV- INPUT	PV 1#- n# input terminals pole
PV+ INPUT	PV 1#- n# input terminals " + " pole
AC INPUT	" R " line, " S " line and " T " line of rectifier input terminal
BYPASS INPUT	" R " line, " S " line and " T " line of bypass input terminal
AC OUTPUT	" R " line, " S " line, " T " line and " N " line of system output terminal
BAT +	Battery input terminals "+" pole
BAT-	Battery input terminals "-" pole



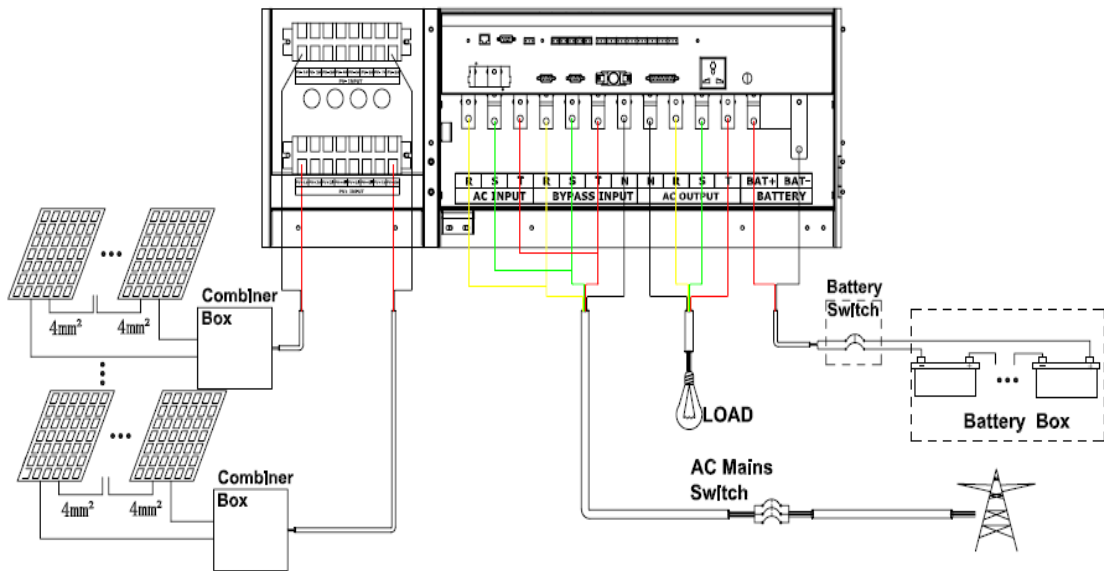
SP30-60K Giant Wiring in a Dual Mains System



SP30-60K Giant Wiring in a Single Mains System



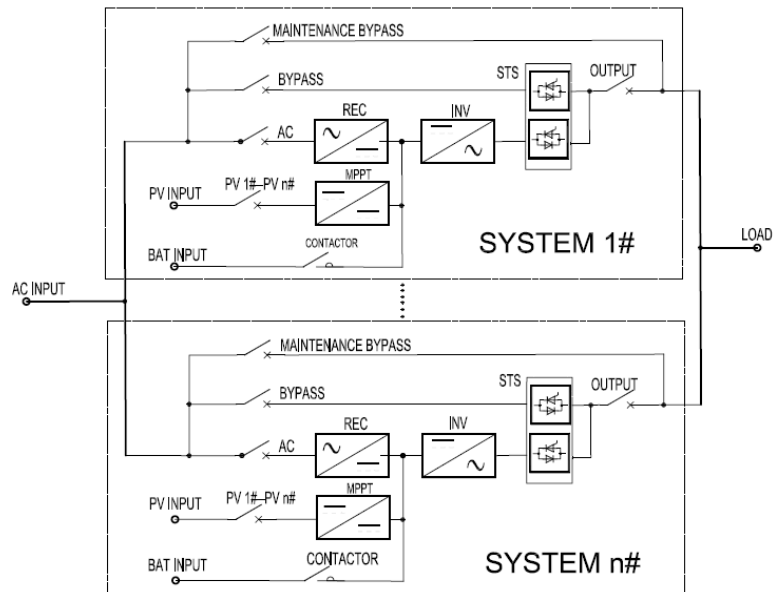
SP80-120K Giant Wiring in a Dual Mains System



SP80-120K Giant Wiring in a Single Mains System

3.7.2 Power Cable Wiring in Parallel System

After equipment is completely positioned, the input terminals of each inverter are connected together; the output terminals are connected together. The wiring diagram is shown below.



Connecting Power Cables in Parallel System

If separated bypass connection is used, connect the AC mains rectifier input terminals of each stand-alone system together; the bypass input terminals should be connected together, and the phase sequence connection must be correct (please refer to section 4.2.1 for details).

Battery cable connection is same as the standalone machine (for details, please refer to the contents of this section 4.2.1).

Each single system must have a separated battery bank, and the battery bank cannot be shared.



Note: In a parallel system, in order to achieve the current sharing effect of the system output, the length of the power cable from the input terminal to the AC power distribution connection point of each stand-alone system should be in line with and the length of the power cable from the output terminal to the load connection point, to ensure that the input and output impedances of each single system are the same.

3.7.3 Wiring Procedure

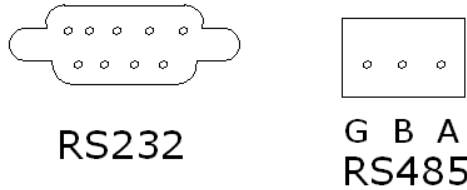
After the equipment is completely positioned, follow the steps below to connect the stand-alone system or the parallel system.

- Make sure that all input power distribution switches of the system are completely disconnected, and the internal power switches of the machine are all disconnected. At the same time, prepare the warning sign of “Forbidden to Close” to prevent others from error operation of the switch.
- Remove the protective cover of the lower connection terminal of the inverter;
- Connect the protective ground and other necessary grounding cables to the grounding copper bars of the cabinets. All cabinets must be connected to the user ground;
- Connect the internal connection terminals of the inverter system with a qualified cable and tighten it;
- Connect the external AC input power supply and tighten it. Connect a qualified input cable between the “AC INPUT” terminal block and the power supply input breaker (user-supplied). Connect another set of input cables between the “BYPASS INPUT” terminal and the power supply input breaker (user-supplied);
- Connect the key loads and tighten. Connect a qualified output cable between the “AC OUTPUT” terminal block and the load. When the commissioning engineer arrives at the site, if the load is not ready to receive power, properly handle the safety insulation at the end of the output cable of the system.

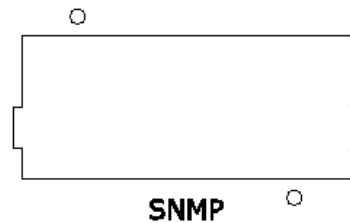
- External battery connection. Connect a qualified battery cable between the machine's battery terminals (BAT+\BAT-) and the battery breaker (user-supplied). Pay attention to the polarity of the battery cable. Please refer to chapter 4.5 of EN50091-1 standard for the battery connection. The battery cabinet must be connected to the protection ground separately.
- Reinstall all protective covers.

3.8 Communication Ports

- The system is equipped with RS485 and RS232 ports, which can provide serial data, directly used as background monitor software ports. If needed, the customer can just connect the supplied data cable directly to the communication port module. (RS485 communication cable optional)

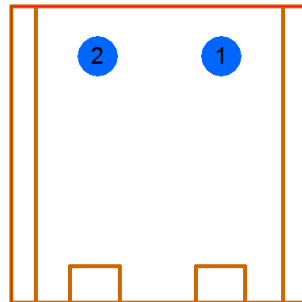


- The system is designed with a “SNMP” card slot by default (SNMP card is an optional function), which is convenient for users to realize remote monitoring (optional).



Signal Ports

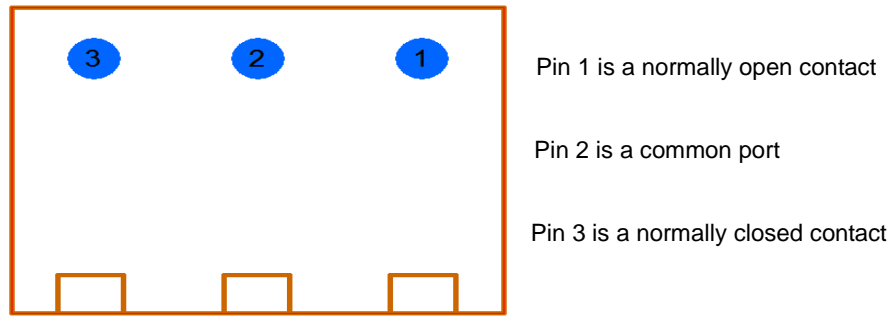
- Control signal input port is a 2 Pins port. It can execute corresponding commands in short circuit (as shown below).



Remote Control Signal Port

Label	Description	Control Mode	Action Description
BAT.TEMP	Battery temperature	Sense	Charge compensation by battery temperature coefficient
BAT.TEST	Battery self-test	Short connected \geq 0.2s	System performs battery test
INV ON	System startup		System starts up in standby mode
INV OFF	System shutdown		System shuts down in startup mode
FAULT CLEAR	Fault clearance		Clear the executed exception protection command and restart the operation.
EPO	Emergency power off		System responds to the EPO command and interrupts the output.

- Output signal port (dry contact) is a 3 Pin port. Users can select “Normally open” or “Normally closed” mode according to on-site needs (as shown in the figure below).

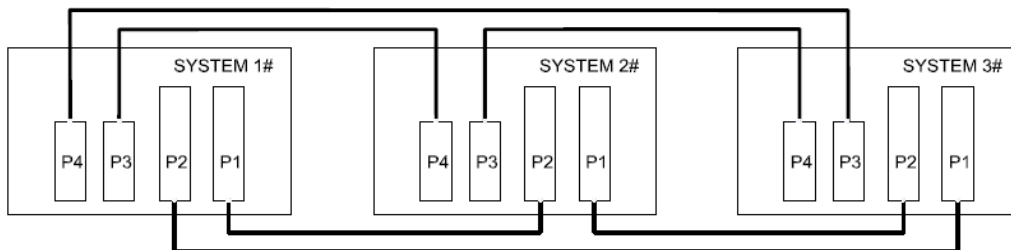
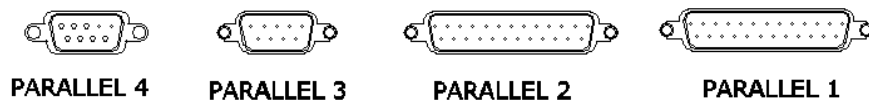


Output Dry Contact Signal Port

	Normally Closed Contacts	Normally Open Contacts
FAN FAULT	Fan is normal	Fan is abnormal
SYS ALRAM	No alarm in the system	System alarm
GENERATOR ON/OFF	Generator shutdown	Generator startup
BAT LOW	No battery low alarm	battery low alarm
OVERLOAD	Ooutput is normal	Output is overloaded
BYP FAULT	Bypass input is normal	Bypass is abnormal
AC FAULT	Rectifier input is normal	Rectifier is abnormal
SYS FAULT	System is normal	System failure

Parallel Signal Port

Each inverter has four parallel cable ports (two are DB25, and other two are DB9). In the parallel system, when connecting parallel cables of DB25 as well as DB9, it is necessary to form a closed loop circuit. Two parallel cables of the same circuit should be as close as possible to each other when they are routed. This can reduce external interference with the parallel cables. The wiring diagram is shown as follows.



Parallel Signal Ports and Parallel System Wiring

4 Operation

4.1 Operation Modes

The inverter has following different levels of operation mode:

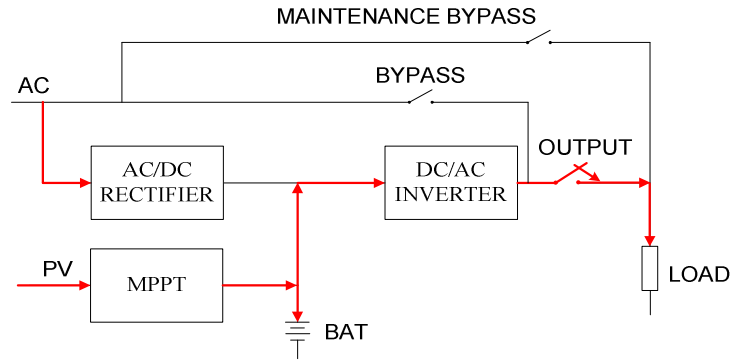
- Off-Grid Mode
- ECO Mode
- Other Operation Modes
- Parallel Redundancy Mode (System Expansion)
- Microgrid Mode (Example of Application)

4.1.1 Off-Grid Mode

In off-grid mode (GF or PV UPS), the system has one or two lines of mains power supply, PV power supply and 360 V battery bank.

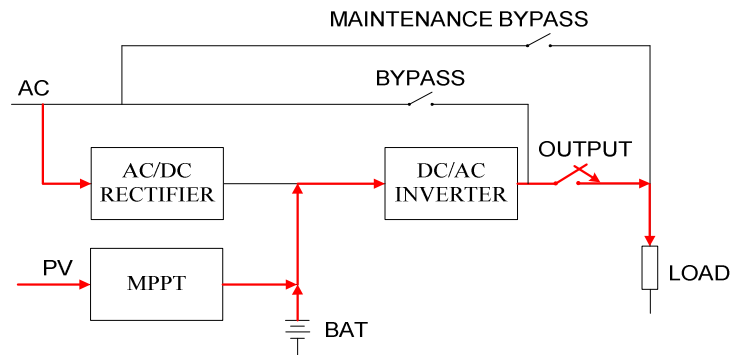
• Support load first (L)

Normal utility/mains supply: When the PV power is sufficient, PV powers the load and battery.



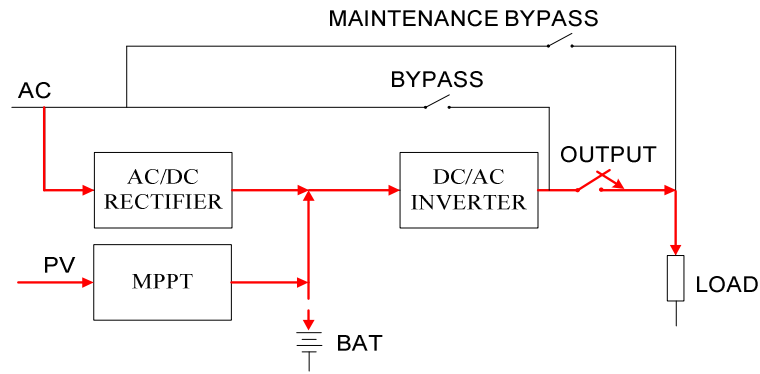
Power Supply Priority Mode 1

Normal utility/mains supply: When the PV power is insufficient, PV offers maximum power output, and the loads are powered by PV module and the battery.



Power Supply Priority Mode 2

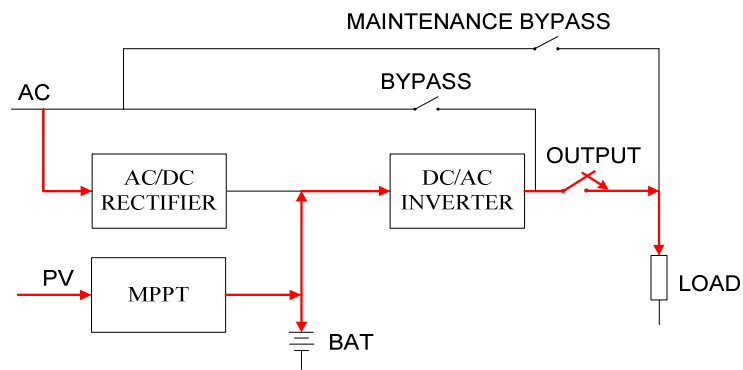
Normal utility/mains supply: When the PV power is insufficient and battery voltage is lower than the module DOD setting value, both the utility/mains supply and PV module supply power to the load, and the system automatically enters the current limit charging mode.



Power Supply Priority Mode 3

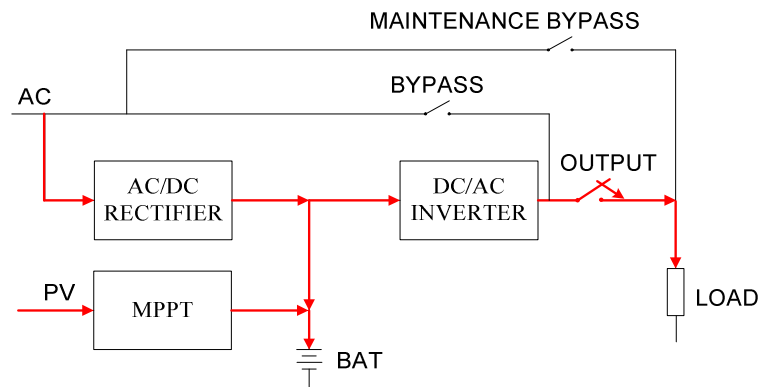
• **Store energy first (S)**

Normal utility/mains supply: When the PV power is sufficient, PV module powers the load and battery.



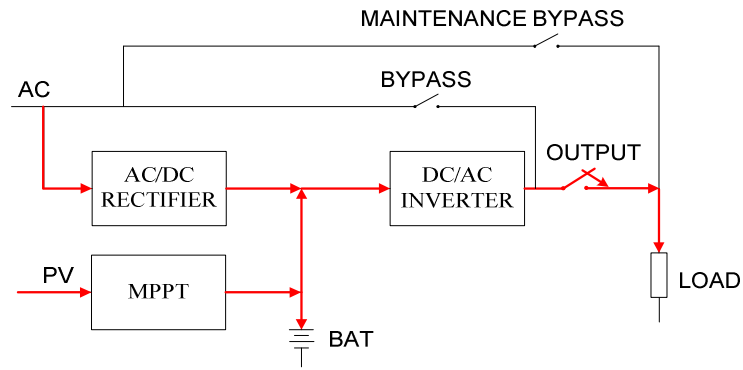
Energy Storage Priority Mode 1

Normal utility/mains supply: When the PV power is insufficient and lower than battery charging power, both PV module and utility/mains supply charge the battery and the utility/mains supply powers the loads.



Energy Storage Priority Mode 2

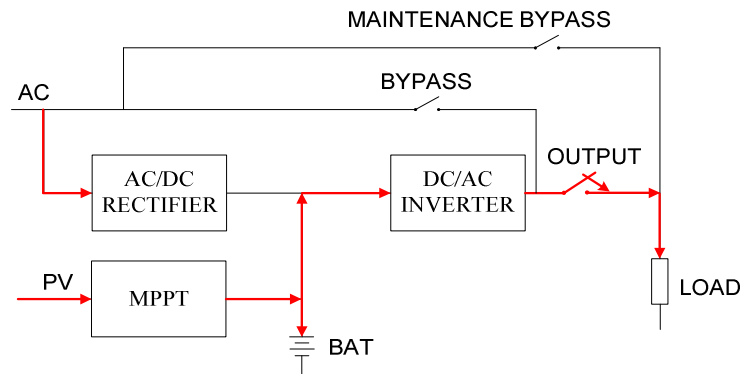
Normal utility/mains supply: When the PV power is insufficient and larger than battery charging power, PV module charges the battery, both the utility/mains supply and PV module supply power to the loads.



Energy Storage Priority Mode 3

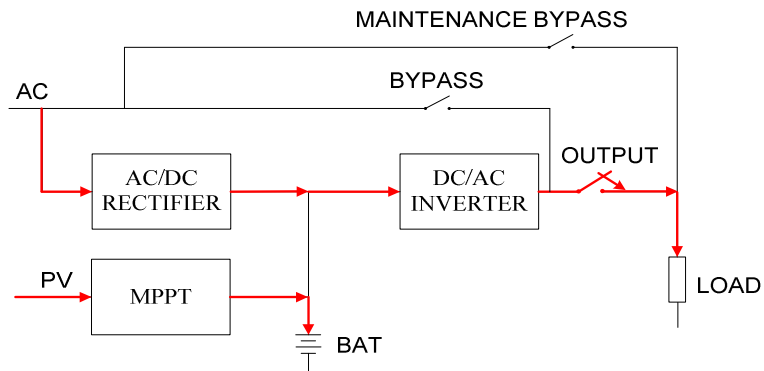
• **AC charge off (O)**

Normal utility/mains supply: When the PV power is sufficient, PV module powers the load and battery.



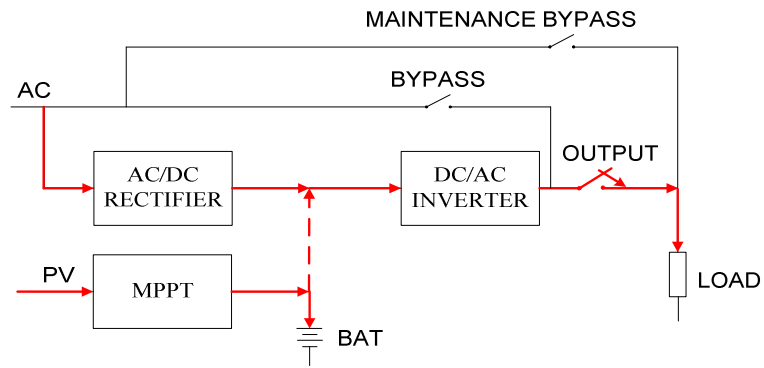
AC Charge Off Mode 1

Normal utility/mains supply: When the PV power is insufficient and lower than battery charging power, PV module only charges the battery while the load is powered by the utility/mains supply.



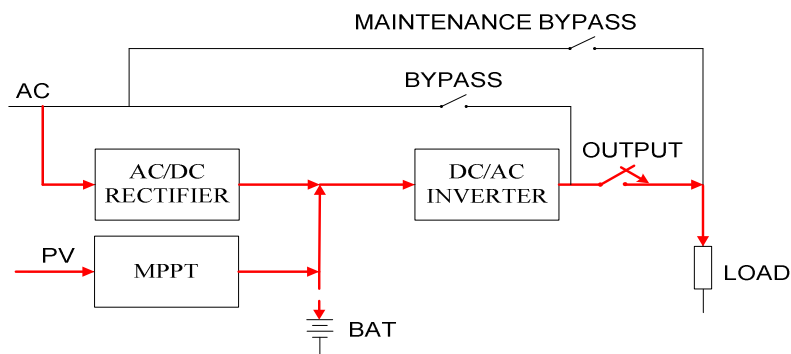
AC Charge Off Mode 2

Normal utility/mains supply: When the PV power is insufficient and larger than battery charging power, PV module charges the battery, while delivering excess energy with the utility/mains supply to the load.



AC Charge Off Mode 3

Normal utility/mains supply: When the PV power is insufficient and battery voltage is lower than the module DOD setting value, both the utility/mains supply and PV module supply power to the load, and the system automatically enters the current limit charging mode.

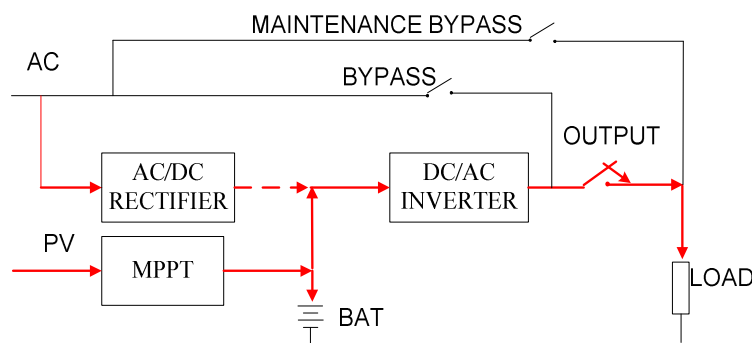


AC Charge Off Mode 4

4.1.2 ECO Mode

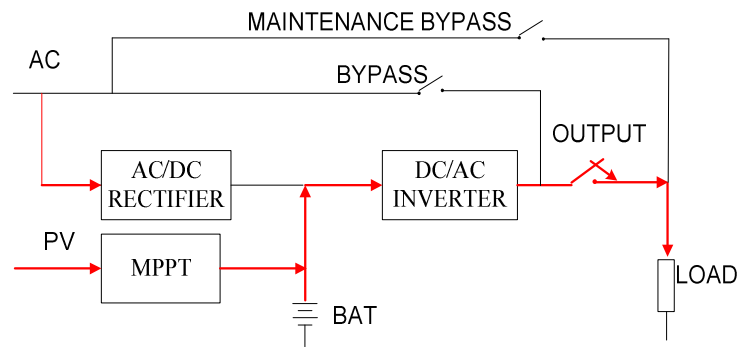
Note: When ECO mode is selected, output power down will be caused under certain conditions. Please select the ECO mode carefully!

- **BYP, PV and AC input normal:** When the PV power is sufficient, the rectifier and inverter will start up. The rectifier enters standby mode. The PV system supplies power to the loads in priority and the remaining energy charges the battery.



ECO Mode 1

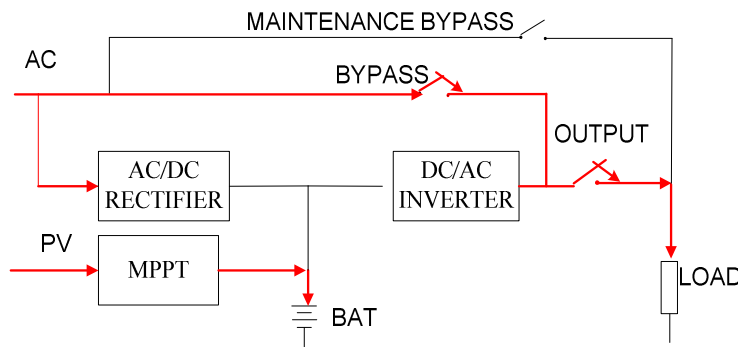
- **BYP, PV and AC input normal:** When the PV power is lower than the load power and the rectifier power is larger than the load power, the rectifier will shut down. The loads will be powered by both PV module and battery.



ECO Mode 2

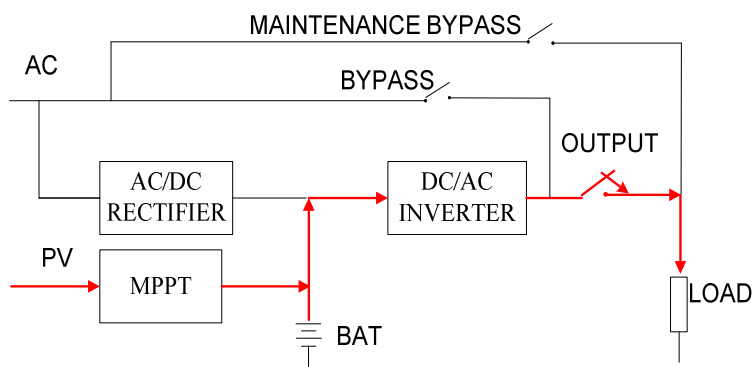
At this time, when the battery is discharged to the DOD setting point, the system will shut down the inverter and the load will be powered by the bypass circuit. The PV only charges the battery. Until the battery voltage is equal to or greater than the rectifier equalizing charge voltage + 3 V and bypass output lasts for 10 minutes, the inverter will start up.

Note: In this state, if the bypass input is abnormal, the output will be completely powered down. Wait for the inverter to be started.



ECO Mode 3

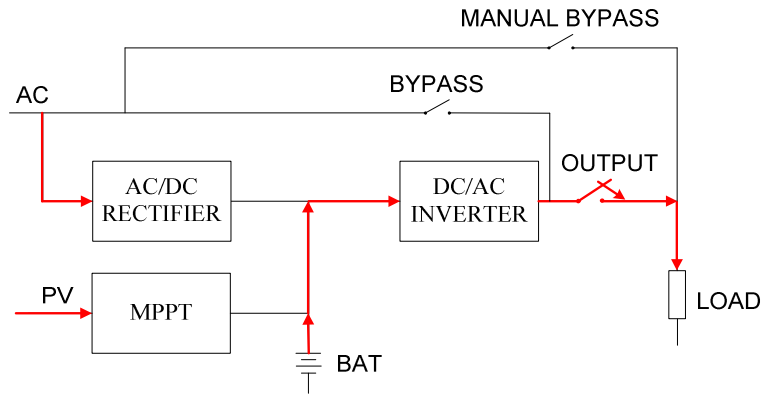
- When BYP and AC input are abnormal, both PV + battery supply power to the load until the battery discharges to the EOD shutdown point.



ECO Mode 4

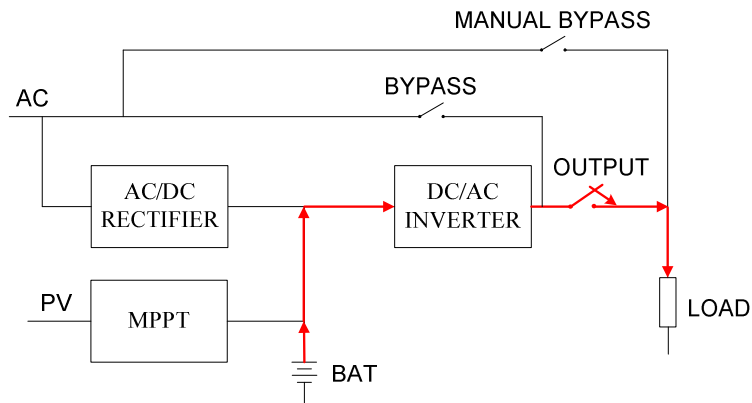
4.1.3 Other Operation Modes

Battery test operation mode: In battery test mode, the battery powers the load. Until the battery voltage reaches the set DOD point, it will exit the battery test mode and be switched to the operation mode configured by the user.



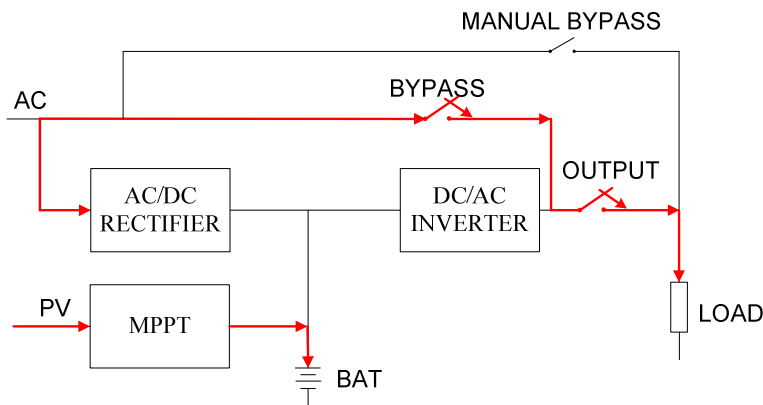
Battery Test Mode

Battery discharge operation mode: When the utility/mains supply and PV input are abnormal, battery powers the load. Until the battery voltage reaches the set EOD point, the inverter is turned off and the system output powers down.



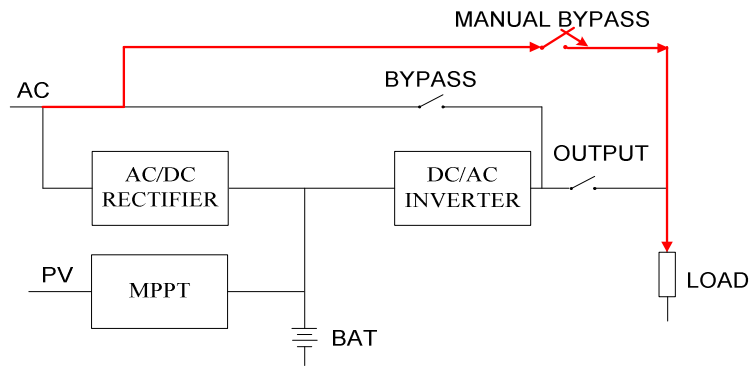
Battery Discharge Mode

Bypass operation mode: When the system fails, it will be automatically switched to the bypass mode and the PV charges the battery through MPPT module.



Bypass Operation Mode

Maintenance bypass operation mode: When maintain the system, it will enter this mode to prevent the system from output power off.



Maintenance Bypass Operation Mode

4.1.4 Parallel Redundancy Mode (System Expansion)

To improve system capacity and reliability, several off-grid stand alone inverter systems can be set to be directly connected in parallel. The parallel control logic in each standalone inverter system ensures that all inverters can automatically and evenly drive the loads.

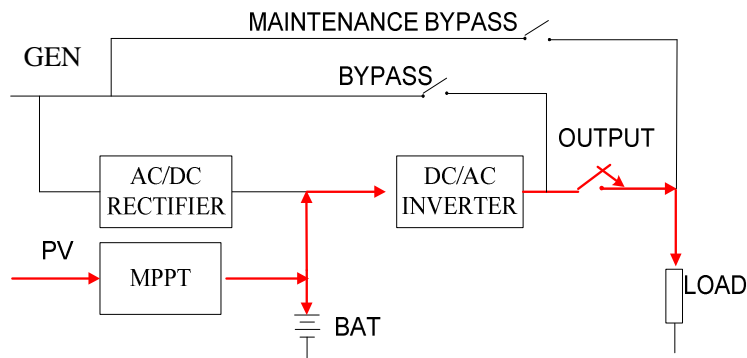
If one of the machines in the parallel system fails, the abnormal machine has not output, and the other normal machines in the parallel system will supply power to the load. If all machines in the parallel system are abnormal, the parallel system will switch to bypass mode.

Parallel system can be composed of up to 6 single units connected in parallel.

4.1.5 Microgrid Mode (Example of Application)

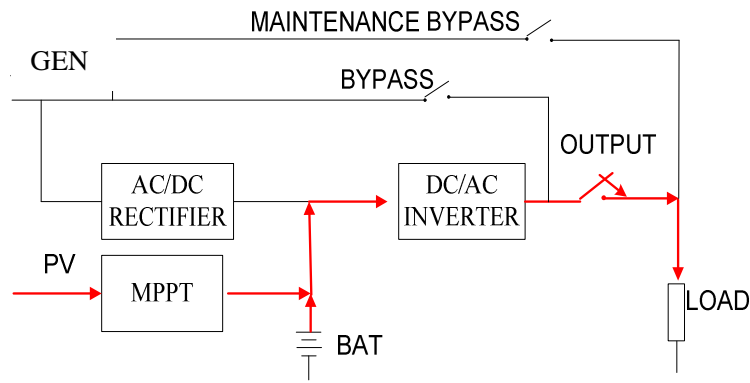
When there is no utility grid and the inverter system is connected to a generator, it is suggested that select “Support load first” mode in the off-peak power settings interface (“PEAK REC”). The operation details are as follows:

- Generator is normal: When the PV power is sufficient, PV module powers the load and the battery.



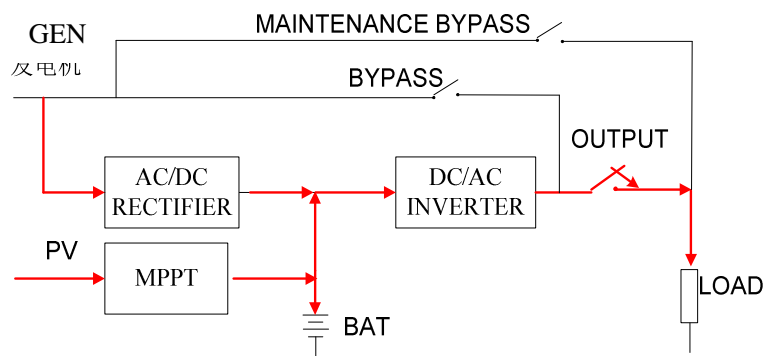
Microgrid Mode 1

- Generator is normal: When the PV power is insufficient, PV offers maximum power output, and the load is powered by both the PV module and the battery.



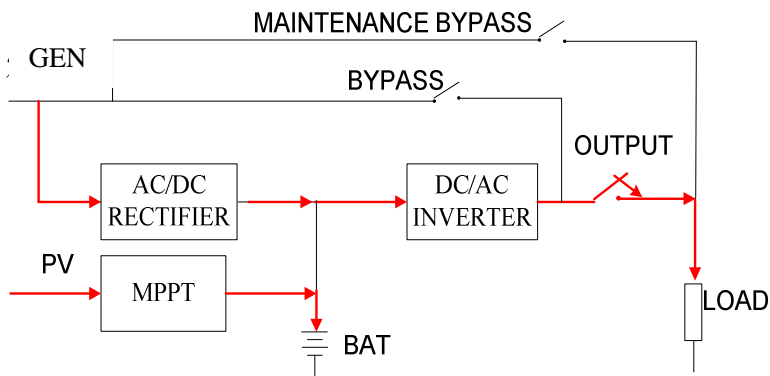
Microgrid Mode 2

- Generator is normal: When the PV power is insufficient and battery voltage is lower than the module DOD setting value, the system will start up the generator via the dry contact signal. At this time, the generator and PV charge the battery, and the remaining energy is supplied to the load.



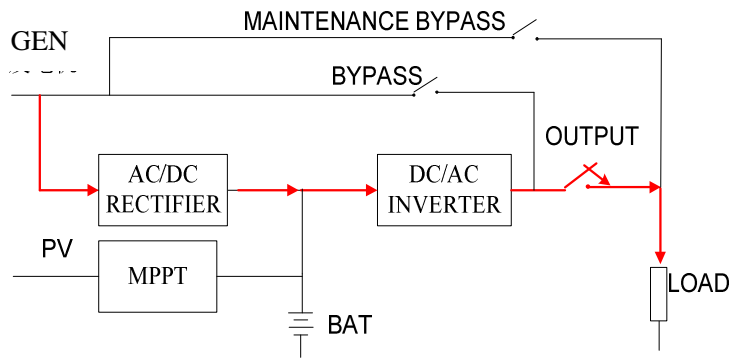
Microgrid Mode 3

- Generator is normal: When PV power is insufficient and battery voltage is lower than the module DOD setting value, the generator will be turned on. At this point, the generator powers the load and the PV module charges the battery. The generator does not charge the battery.



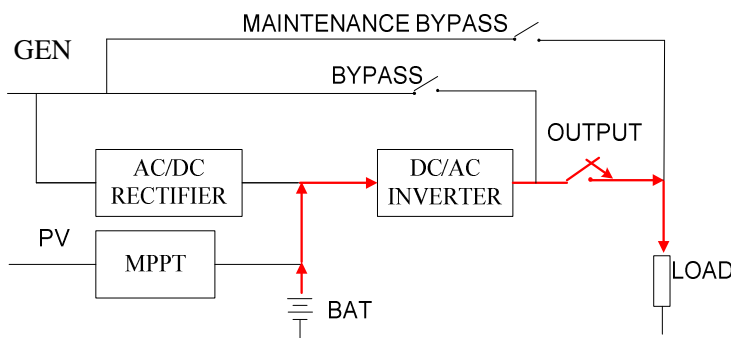
Microgrid Mode 4

- Generator is normal: When there is no PV input, the load is driven by the generator which will not charge the battery.



Microgrid Mode 5


- Generator is abnormal: When there is no PV input, the load is driven by the battery until the battery voltage reduces to EOD shutdown point.



Microgrid Mode 6

4.2 Switching On and Off

This procedure is used to start up when the inverter is fully powered down, that is, the inverter has not supplied power to the load or power the load through maintenance bypass breaker. It is assumed here that the inverter has been installed and has been debugged by the engineer and the external power switch is closed.

CAUTION	
	<ul style="list-style-type: none"> • This operation will make the inverter output terminal alive with voltage. • If necessary, disconnect the lower-level load connection and attach a warning sign at the load connection. • The parts behind the protective cover that need to be opened by tools are inoperable parts for the user. Only technical maintenance personnel authorized by the company are allowed to open such protective covers.

Circuit breakers

Label	Description	Function
DC START	DC startup breaker	Close this breaker and the system performs battery soft start
MAUNUAL BYPASS	Manual bypass switch	For professional maintenance personnel only, close this switch and the load is directly connected to the bypass output
OUTPUT	Output breaker	Close this breaker to connect the load and the system static switch
BYPASS	Bypass breaker	Close this breaker to connect the bypass mains input
RECTIFIER	Rectifier switch	Close this switch to connect the rectifier mains input


PV n#	PV n# input breaker	Close this breaker, the system MPPT n# supply power
-------	---------------------	---

4.2.1 Switching On

Note: If the panel requires a power-on password, please contact the after-sales staff.


Proceed as follows.

- **Close** the battery bank output breaker.
- **Close** the inverter external power input (RECTIFIER, BYPASS) breaker.
- **Close** the inverter “DC START” breaker.
- **Close** the inverter “RECTIFIER”, “BYPASS” breakers.
- **Close** the “PV n#” breakers in turn.
- Press “INV ON” button on the panel, press “YES” to confirm the display information (touch operation:

press “” → “ON” → “YES” on the main interface) to turn the power on; turn on the output breaker.

4.2.2 Switching Off

- Press the “INV OFF” button on the panel, press “YES” to confirm the display information (touch

operation: press “” → “OFF” → “YES” to turn the power off.


- **Open** the output breaker.
- **Open** the “PV n #” switches in turn.
- **Open** the inverter “RECTIFIER”, “BYPASS” breakers.
- **Open** the inverter “DC START” breaker.
- **Open** the inverter external power input (RECTIFIER, BYPASS) breaker.
- **Open** the battery bank breaker.

4.2.3 Parallel System Startup

Note: If the panel requires a power-on password, please contact the after-sales staff.

- Make sure that all parallel cables are connected properly, and the total output of the parallel system is disconnected from the load.
- Close the output breaker, “BYPASS” breaker and “DC START” breaker of all units in the parallel system.
- Close the INVERTER 1 “RECTIFIER” switch and press the INVERTER 1 “ON” button to power on. The REC indicator starts blinking, and after about 15 s, the BYP green indicator is off, the INV green indicator is glowing and the unit starts inverter output, then close the INVERTER 1 battery breaker, “PV 1#-PV N#” breakers and “DC START” breaker in turn; the REC, INV, OUT, STATUS and PV indicators on the panel light up in green, while BYP and BAT indicators are off.
- Start up the INVERTER 2, INVERTER 3...INVERTER N parallel system according to the procedures of step 3.
- After all units have been switched on, their indicators are the same as INVERTER 1. At this point, the parallel system is switched on.
- Before the total output of the parallel system drives load, please make sure that all the output breakers of the parallel system are all closed and the output terminals are all connected together.

4.2.4 Parallel System Shutdown

- Shut down all loads of the total output of parallel system.
- Tap the ON/OFF icon “” on the main interface of INVERTER 1, and then press “YES” to turn off the

unit; this operation will turn off the rectifier and inverter, disconnect the static switch and stop supplying power to the load. Please be cautious.

- After shutdown, disconnect the INVERTER 1 output breaker, battery breaker, rectifier switch, bypass breaker, “PV 1 # -PV N #” breakers and DC START breaker; the REC, INV, OUT, BYP, BAT and PV indicators on the panel are all off.
- Shut down INVERTER 2, INVERTER 3 ... INVERTER N parallel system according to steps 2 and 3.
- For single unit exit from the parallel system, please follow the steps 2 and 3 of this section.

4.3 Emergency Power Off (EPO)

In emergency situations (such as electric shock, fire, flood, etc.), press the Red (EPO) button on the panel to execute the emergency power off command. When the button is pressed, the system will immediately shut down all outputs (including inverter and bypass outputs, battery charging or discharging). After power off, please execute the switching Off procedures, and when the system display, indicators are completely off, perform the switching On procedures. Please operate carefully.

4.4 Clearing System Fault

When rectifier and inverter over-temperature disappearing, overload $\geq 150\%$, bus instantaneous over-voltage, abnormal protection and other reasons cause the inverter to be shut down, please follow the alarm message on the display and confirm that the exceptions have gone, press the “FAULT CLEAR” button on the panel. At this point, the system will automatically clear the past exceptions, and restart the system to normal working condition.

Note: The system has self-diagnosis and self-recovery function. Within one hour, the restriction is valid for three times. If exception persists, the system will wait for one hour and then run automatically.



4.5 Maintenance Bypass Operation

Note:

- Please read the safety precautions carefully and operate the maintenance bypass carefully. Otherwise, it may damage the inverter or cause the load to power down, which may even threaten personal safety.
- In order to ensure normal use for the user, during maintenance and troubleshooting, please go to the control panel “Inverter Settings” and set manual bypass as “ON” and then close the manual maintenance switch and open the system output breaker.

4.5.1 Entering Maintenance Mode



The following procedures can switch the load from being powered by inverter to be directly connected to the AC input bypass power supply via the maintenance bypass breaker.

- After detecting the bypass parameters, press “” → “USER” → enter a password (default password: 87654321) → “” on the main interface to enter “INV SET” → “MANU BYP” → “ON” → “YES”. At this point, the inverter supplies power to the load through a static bypass.
- Remove lock catch from the “MAUNUAL BYPASS” breaker to turn it on; at this time, the maintenance bypass power supply and inverter static bypass power supply are in parallel to power the load.
- Press “OFF” button on the panel, and then Tap “YES” on the display screen. The system will shut down immediately;
- Disconnect the “RECTIFIER, BYPASS, DC STAR, OUTPUT, PV n #” and external battery bank breakers manually;


- Now, the operation of switching the inverter output to the maintenance bypass is completed. The load is driven by the maintenance bypass, the entire fan stops, and the inverter is turned off completely. But, at this point, there is still high voltage on the bus inside the machine. After discharge, the maintenance staff can perform routine maintenance or repair for inverter. In maintenance mode, loaded devices have no AC power abnormal protection.

4.5.2 Exiting Maintenance Mode

After the maintenance work is completed, the following procedures can be executed to switch the load from the non-AC power supply abnormal protection status to the inverter power supply protection status.

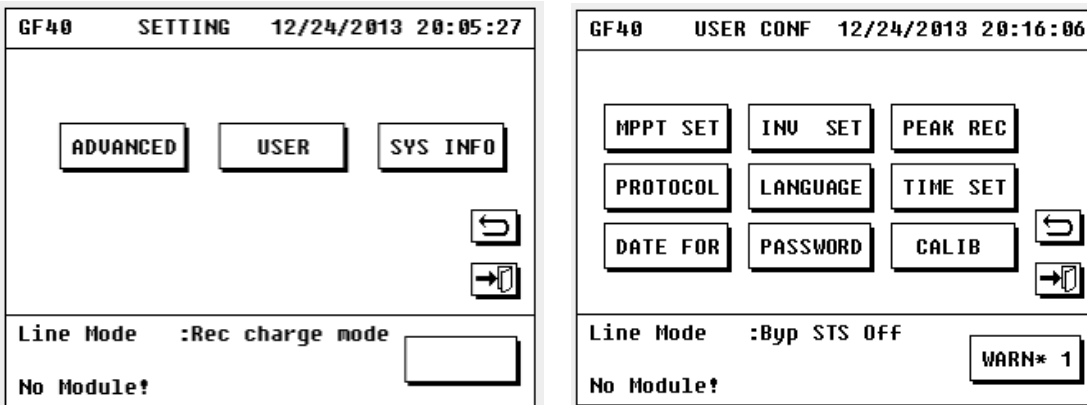
- Carefully confirm that no objects are left in the inverter cabinet, and the internal connecting cables of the inverter are restored to the status before maintenance.
- Start up the system according to the switching on procedures; after completion, the inverter is in the standby state and the “INV LED” indicator is flashing;
- Open the maintenance bypass breaker, and add the lock catch back to it.
- Press “” → “USER” → enter a password (default password: 87654321) → “” on the main interface to enter “INV SET” → “MANU BYP” → “OFF” → “YES”. All procedures to exit maintenance mode is completed and the load is switched from the bypass power supply to the inverter power supply.

4.6 Configuration

Press “” to access the system settings interface. Settings must be configured by a qualified technician.

4.6.1 User Settings

Tap “USER” and enter the password to access the USER setting interface.



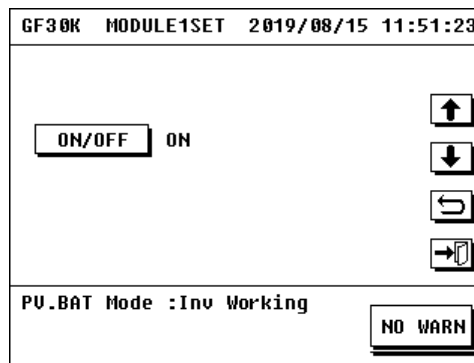
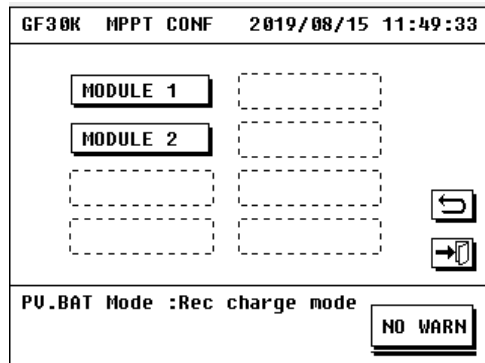
Configure these settings at any time, using the USER interface.

	Parameters	Options	Description	
USER	MPPT SET	ON	MPPT module can be started to run	
		OFF	MPPT module is prohibited from running	
	INV SET	MANU BYP	OFF	Exit manual bypass mode
			ON	Enter manual bypass mode
	PEAK REC		Support load first (L)	Select power supply priority mode of the regular version, referred to as “L”
			Store energy first (S)	Select energy storage mode of the regular version, referred to as “S”

		AC charger off (O)	Select AC charging off mode of the regular version, referred to as "O"
		AC IN OFF (P)	Select power supply priority mode of the ECO version, referred to as "P"
		AC NOMAL (C)	Select energy storage mode of the ECO version, referred to as "C"
		AC CHG OFF (L)	Select AC charging off mode of the ECO version, referred to as "L"
	PROTOCOL	ADDRESS	External communication address bit:1-8
		BAUDRATE	External communication baud rate: 1200/2400/4800/9600
		MODE	External communication protocol: RTU
		PARITY	External communication validation bit: NONE/ODD/EVEN
	LANGUAGE	ENGLISH	Language required for the inverter display interface: ENGLISH
	TIME SET	/	Set the system time
	DATE FOR	Y/M/D	System date format is set to Y/M/D
		M/D/Y	System date format is set to M/D/Y
	PASSWORD	/	Reset the user password
	CALTB	YES/NO	Touch screen display calibration

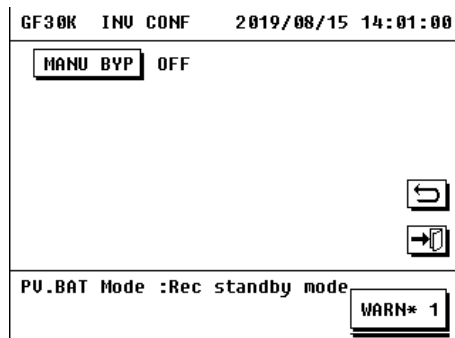
4.6.1.1 MPPT Settings

MPPT settings are used to turn the MPPT module on and off.



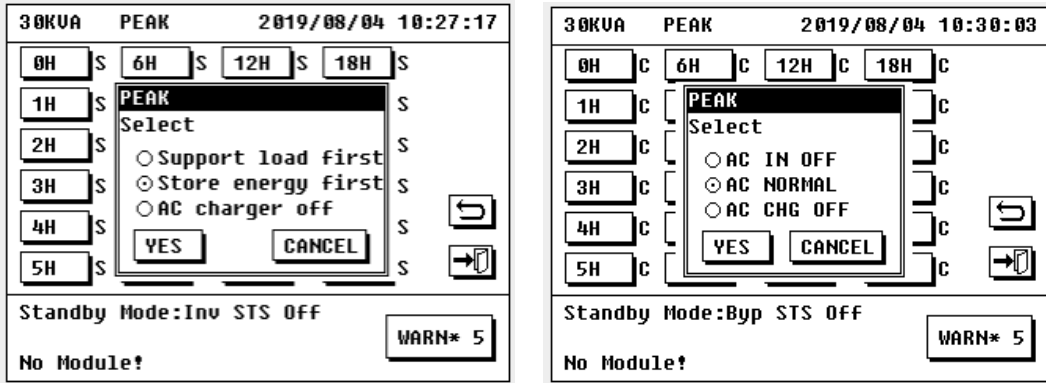
4.6.1.2 INV Settings

MANU BYP: When the system needs maintenance, manual bypass operation is required, and the system is forced to switch from inverter to bypass power supply. After system maintenance is completed, it only allows inverter output after setting MANU BYP to OFF.



4.6.1.3 Off-Peak Power Settings

Tap “PEAK REC”. There are three options in the submenu of off-peak power user settings:

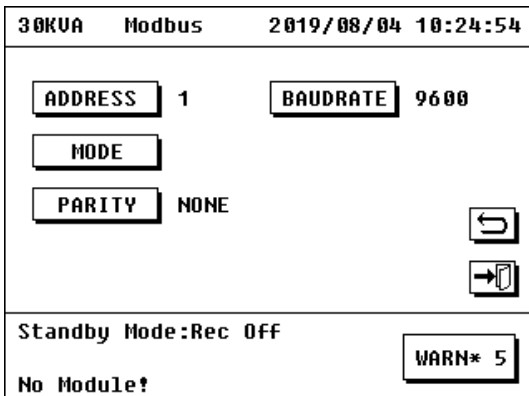


- Support load first (AC IN OFF): Within the set time, the system will shut down the rectifier, and PV and battery supply power to the load. The system won't start up the rectifier to perform current limit (1A) charging (according to the display value) until the battery is discharged to the low voltage alarm point (DOD). This mode on the screen is referred to as “L” in the DEFAULT version, referred to as “P” in the ECO version.
- Storage energy first (AC NORMAL): When the time reaches the set value, the system starts up the rectifier. PV and rectifier supply power the load and the battery. This mode on the screen is referred to as “S” in the DEFAULT version, referred to as “C” in the ECO version.
- AC charger off (AC CHG OFF): Within the set time, the rectifier will perform current limit (1A) charging (according to the display value). This mode on the screen is referred to as “O” in the DEFAULT version, referred to as “L” in the ECO version.


4.6.1.4 Protocol Settings

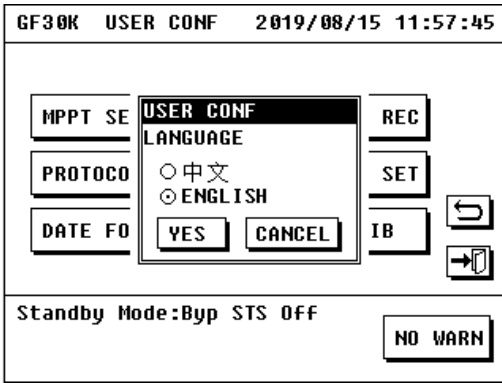
Protocol settings are used to configure the 485 communication protocol. The following three items can be set:

- ADDRESS: 1 (default);
- BAUDRATE: 2400 (default);
- PARITY: NONE




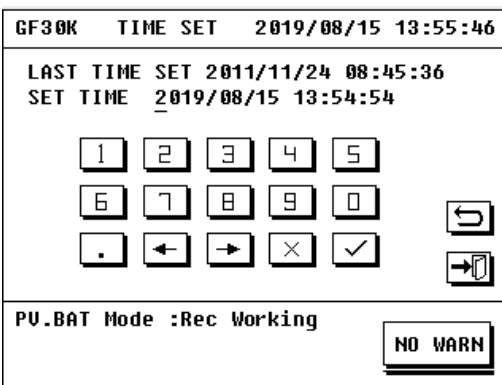
4.6.1.5 Language Selection

Touch screen menus and data are available in both English and Chinese. Press  on the main interface, then tap “USER” → “LANGUAGE” to select the language.



4.6.1.6 Time Settings

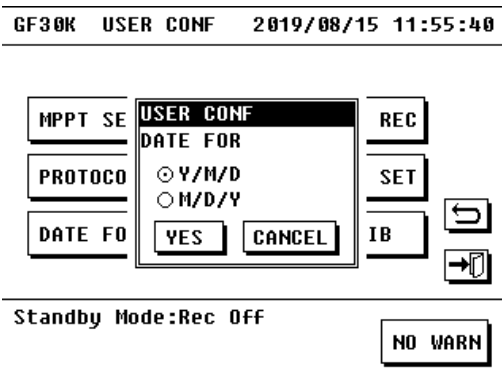
Tap  → “USER” → “TIME SET” options to set the current time of the inverter.



4.5.1.7 Date Format Settings


Date display supports the following two formats:

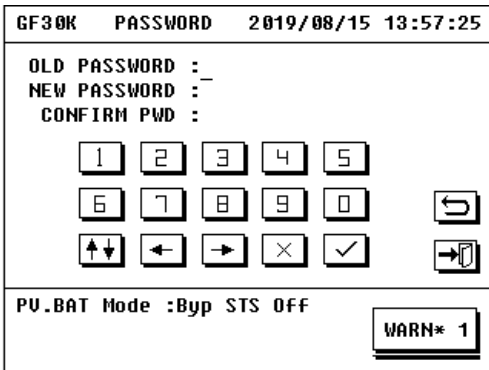
- Y/M/D
- M/D/Y



4.6.1.8 User Password Settings

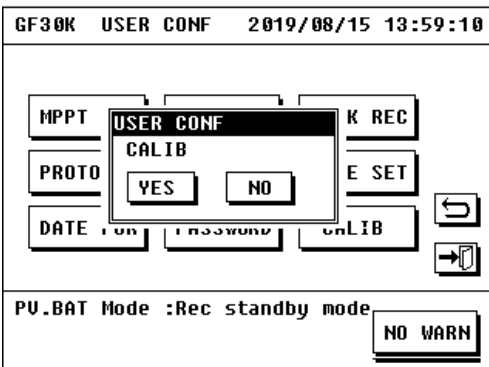
The system provides password protection and restricts certain control operations for operators. The initial password is “87654321.” When the password is enabled, enter the user setting interface “USER” and

“BAT TEST”  only after the password is confirmed.



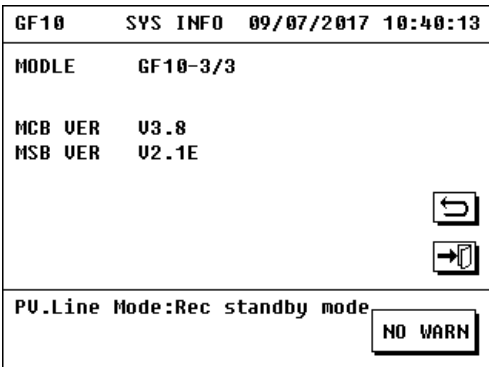
4.6.1.9 Touch Screen Calibration

Touch screen calibration is used to calibrate the center point of the screen. When the system is restored to factory settings, the touch screen needs to be corrected. When the touch screen is calibrated, press the center of the screen cross point according to the prompts.



4.6.2 System Information

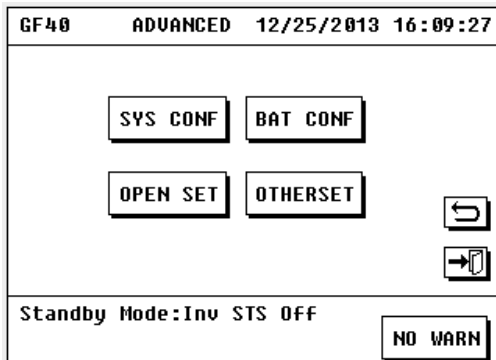
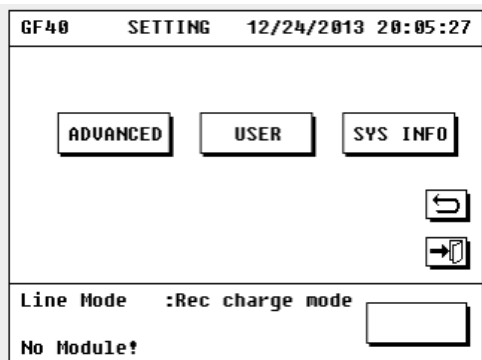
Tap “SYS INFO” to view the system information which contains information about the inverter model, versions of the main control software and the monitoring software.



	Parameters	Description
SYS INFO	MODLE	The inverter model name
	MCB VER	The version of the main control software
	MSB VER	The version of the monitoring software

4.6.3 Advanced Settings

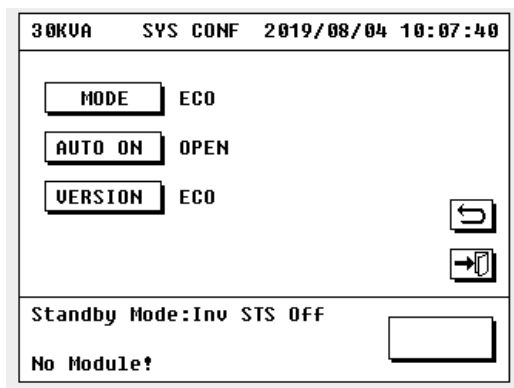
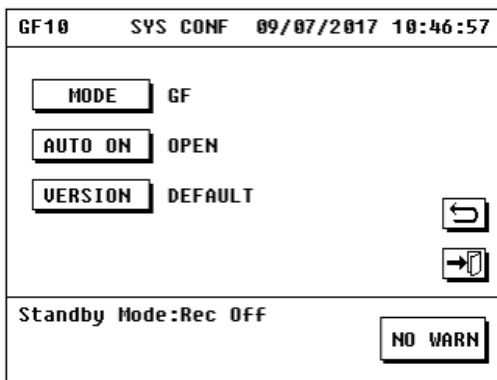
Advanced settings must be configured by an authorized technician. Tap “ADUANCED” and enter using an advanced password.



	Parameters	Options	Description	
ADVANCED	SYS CONF	MODE	GF	General off-grid inverter mode of the regular version, same as PV UPS
			G/GF	Undefined
			PV UPS	General off-grid inverter mode of the ECO version, same as GF
			ECO	In ECO version: ECO customized mode
		AUTO ON	OPEN	Enable PV auto start
			CLOSE	Disable PV auto start
		VERSION	DEFAULT	Select the regular version
	ECO		Select the ECO version (customized)	
	BAT CONF	BAT TYPE	LEAD	Select the battery type: Lead-acid battery
			LITH	Select the battery type: lithium battery
		CHG RATE	0.05C-0.25C	Set the charging rate for lead-acid batteries, 0.15 C by default
			0.05C-2C	Set the charging rate for lithium batteries, 0.5 C by default
		TEMP CMP	0mV-5mV	Set the battery temperature compensation coefficient, 2mV/°C by default
		BAT CELL	166-180PCS	Set numbers of lead-acid batteries, 180 by default
			103-116PCS	Set numbers of lithium batteries, 114 by default
		BAT GROUP	1-8	Set numbers of battery banks: 1 by default
		CAPACITY	38-9999AH	Set the battery capacity, 100AH by default
		EOD VOLT	1.58-1.83V	Set the EOD voltage of lead-acid batteries, 1.75V by default
			2.30-2.64V	Set the EOD voltage of lithium batteries, 2.50V by default
		DOD VOLT	1.85-2.10V	Set the DOD voltage of lead-acid batteries, 1.89V/2.00V by default
2.80-3.47V			Set the DOD voltage of lithium batteries, 2.80V by default	

	OPEN SET	LOCK PWD	OPEN	Enter advanced settings, enable a user setting password (a password required)
			CLOSE	Enter advanced settings, unlock the user setting password (no password required)
		OPEN PWD	OPEN	Execute startup command, enable a password (a password required)
			CLOSE	Execute startup command, unlock the password (no password required)
	OTHER SET	DEFAULT	YES/NO	Factory reset
		CLR LOG	YES/NO	Clear the event log
DEBUG.D		/	Internal debugging parameter query	

4.6.3.1 System Mode Settings



Tap “VERSION” → “DEFAULT” version or “ECO” version, tap “YES” to enable it.

- “DEFAULT” version: Tap “SYS CONF”→ “MODE” → “GF” mode, tap “YES” to enable it.
 - “GF” mode: General off-grid inverter mode
- “ECO” version: Tap “SYS CONF” → “MODE” → “ECO” mode or “PV UPS”, tap “YES” to enable it.
 - ① “PV UPS” mode: General off-grid inverter mode
 - ② “ECO” mode: Input power of the rectifier \geq output power, enter PV+ battery discharging mode, till fall to DOD of the batteries, switch to bypass to supply power, wait for PV startup to power the batteries and not restart the rectifier until PV is sufficient.

Note: See 4.1 for detailed operating logic description of the above models.

4.6.3.2 PV Auto start Settings

PV auto start: When PV auto start is set to ON, auto start will be performed in the following two cases,

- After the battery operation is shut down with low-voltage protection, when the MPPT is sufficient, the system will execute an automatic startup command.
- After the system is shut down with a fault, when PV input is sufficient, the system automatically clears the fault once.

Operation procedure: tap “AUTO ON” to enable and disable this function. The system default setting is ON.

4.6.3.3 Battery Parameters Settings

Tap “BAT CONF” to enter.


GF10				CHG CONF		09/07/2017 11:20:33	
BAT TYPE	LEAD	CHG RATE	0.15C				
CHG CURR	15A	TEMP CMP	2mV/°C				
BAT CELL	180	BATGROUP	1				
CAPACITY	100	EOD VOLT	1.75V		↩		
DOD VOLT	1.89V	→					
Standby Mode:Inv STS Off							WARN* 1


Note: The battery parameter settings will affect reliability and safety of the system and may cause damage to the battery. Please be sure to input according to the actual data of the system to ensure safe use of the battery and reliability of the system. The minimum capacity can be selected as 38AH for the battery capacity.

- Battery capacity input: Tap “CAPACITY” and select the appropriate battery capacity (If the preset capacity does not match the actual one, please set it to the same value as the actual capacity); the battery capacity range is 38-9999 AH; tap “YES” to bring the setting into effect.
- Numbers of battery banks setting: tap “BATGROUP” to select the actual battery bank number (note to multiply the coefficient relationship in selection of battery capacity); the range of numbers that can be set is 1-8 banks; tap “YES” to confirm.
- Charging rate settings: Tap “CHG RATE”, and input the charging coefficient according to the battery characteristics (C represents the battery capacity, the system will calculate the standard charging current according to the total battery capacity, the system default is 0.15 C*100 Ah= 15 A); Click “↩” to confirm execution.

Capacity	Max. Value	Default Value	Min. Value
30 kVA	75 A	15 A	5 A
40 kVA	100 A		
60 kVA	150 A		
80 kVA	200 A		
100 kVA	250 A		
120 kVA	300 A		

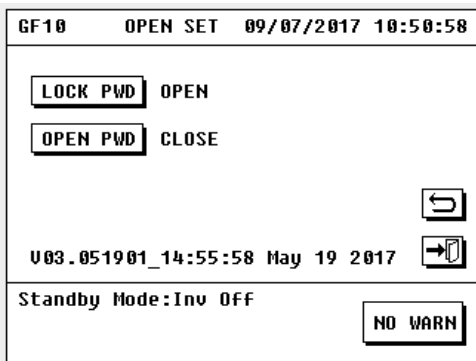
- Battery type settings (reserved option): Tap “BAT TYPE” and select “Lead Acid” or “Lithium” to confirm execution.
- Number of cells settings (fine tuning setting): Tap “BAT CELL” and input the number of battery cells in the system (this system calculates the number of cells according to 2 V/3.3 V cell standard, and the number of cells is 180/114); the settable range for lead acid battery is 166-182 cells, and range for lithium battery is 103-116 cells; tap “YES” to confirm execution.
- Temperature compensation settings: Tap “TEMP CMP” to enter (the default setting of the system is 2mV/°C, the engineer can select an appropriate parameter according to the battery's characteristic requirements); the settable range is 0mV/°C-5mV/°C; tap “YES” to execute (When a temperature sensor is not connected, the system will perform compensation according to the ambient temperature).
- DOD voltage settings (discharge depth): Tap “DOD VOLT” to enter. The depth of discharge represents power supply priority, battery test end point and battery low voltage alarm point; the system default

lead-acid battery DOD voltage point is 1.89V from March to October and 2.0 V from November; settable range is 1.85 V-2.10 V; lithium battery DOD voltage point is 2.80V, and the settable range is 2.80 V-3.30 V. Click “” to confirm execution.

- EOD voltage setting (battery end-of-discharge point): Tap “EOD VOLT” to enter. The default EOD voltage point of lead-acid battery is 1.75 V, and the settable range is 1.58 V-1.83 V; the EOD voltage point of lithium battery is 2.50 V, and the settable range is 2.30 V-2.64 V. Click “” to confirm execution.

4.6.3.4 Password Lock Settings

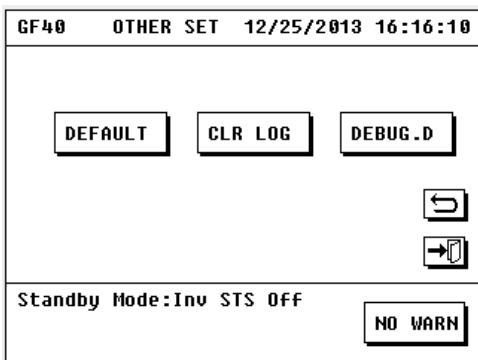
Tap “OPEN SET” to enter.



- Tap “LOCK PWD” to display “LOCK PWD OPEN” (Tap “LOCK PWD” again to display “LOCK PWD CLOSE”) and tap “YES” to confirm, then entering a password is required when performing important settings.
- Tap “OPEN PWD” to display “OPEN PWD OPEN” (Tap “OPEN PWD” again to display “OPEN PWD CLOSE”) and tap “YES” to confirm, then entering a password is required when the system executes startup command.

4.6.3.5 Other Settings

Tap “OTHER SET” to enter.



- Factory reset settings: Tap “DEFAULT” and tap “YES” to confirm. The system will be restored to factory settings. The user's original settings will be completely cleared. Please exercise caution. If it is operated, please be sure to set the relevant parameters according to the requirements of the on-site system configuration to ensure system safety and reliable operation.
- Clear the log: Tap “CLE LOG” and tap “YES” to confirm. The system will clear the event log.

5 Maintenance

5.1 Preventive Maintenance

Preventive maintenance of inverter system can ensure the reliability and long-term service of inverter. The following inspection should be done every month:



- Turn off the inverter (See 4 Operation).
- Check the air vents on this unit, make sure they are not blocked.
- Check whether the unit cover is covered with excessive dust.
- Check and make sure that the power cables are securely connected and the cable insulation is good.
- Ensure that the product is protected from moisture.
- Turn on the inverter (switch on/off).

5.2 Battery Maintenance

Note: The battery must be replaced by a qualified electrician. Wasted batteries should be recycled. Do not litter.

Sealed lead acid battery and lithium battery can be connected to this inverter. Environmental factors impact battery life. Elevated ambient temperatures, poor quality utility power, and frequent short duration discharges will shorten battery life. Even if the battery is not used, its performance will gradually decline. It is suggested that make a discharge test every three months when there is no power failure for a long time (Ensure that perform the battery discharge test under normal conditions of the bypass power supply).

The battery inspection procedures are described as follows (when the battery service life is approached, the battery performance will decline rapidly, so the following inspection and maintenance must be kept in mind):

- ① Tap “” → enter a password (default password: 87654321) → select “BAT TEST” → tap “YES” on the display interface. At this time, the inverter shuts down the MPPT and rectifier, and the battery is discharged, the "REC" indicator light on the front panel is extinguished, the "MPPT" red indicator light is illuminated, and the "BAT" indicator flashes green.
- ② When the inverter is tested to the battery low voltage alarm (the discharge depth can be adjusted by itself), and “Bat selftest success” is displayed on the display interface, indicating that the manual battery maintenance has been completed. After this, the inverter rectifier starts up normally, and the output is switched to the mains inverter output without interruption and charge the batteries. If necessary, the maintenance personnel only need to select the “CLR TEST” option in the  menu to stop the manual maintenance of the battery, and the inverter is restored to normal operation mode.
- ③ As the time of use goes by, battery performance gradually declines (identified by discharge time). When the discharge time drops to 80% of the initial value, its performance degradation is accelerated. Accordingly, the battery test time should be changed from once every six months to once a month.
- ④ Dust-proof treatment: Remove dust and dirt from the battery.
- ⑤ Verify that all the battery cables are not loose or corroded, and replace and repair them if necessary.
- ⑥ Ensure that batteries and battery terminals are securely connected.

6 Troubleshooting

6.1 Fault and Alarm Messages

This section lists the fault and alarm messages that the inverter might display. A suggested corrective action is listed with each alarm message to help you troubleshoot problems.

Tap “” to view.



Alarm/Event	Description	Corrective Action
AC mains fault	Any one of rectifier input power phase sequence, voltage, frequency and voltage imbalance is abnormal	Check and confirm the input power voltage and frequency are consistent with the system requirements, and the switch is normal.
AC mains voltage abnormal	AC mains voltage is out of system rated value range	Adjust the system input power or wait for recovery (for short-time abnormalities)
AC mains frequency abnormal	AC mains frequency is out of system rated value range	Adjust the system input power or wait for recovery (for short-time abnormalities)
AC mains phase sequence abnormal	AC mains phase sequence access error	Adjust any two phases in system input wiring
Bypass overload protection	Bypass load $\geq 150\%$ timeout, bypass output is turned off	Deloading $< 90\%$, press “FAULT CLEAR” to recover
Inverter overload protection	Inverter load $\geq 150\%$ timeout, inverter protection power off	
Output overload	Load is greater than 105%	Deloading $< 90\%$
Rectifier fault	After rectifier is activated, the rectifier voltage is lower than the system set value.	Press “FAULT CLEAR” to recover; if not solved, ask local authorized technicians for troubleshooting
Rectifier bus overvoltage	Bus voltage high voltage protection	
Rectifier soft start failure	Rectifier soft-start does not succeed	
Charger fault	Charge current is greater than the set value	
Low bus low voltage power off	Battery discharge, bus voltage is lower than the minimum set value	Wait for AC mains recovery or PV power to be sufficient. When the battery capacity $\geq 90\%$, system automatically powers on;
Low battery voltage	Battery voltage is lower than the set value	
Battery EOD	Battery voltage is lower than the minimum value	
Switch times are	Within one hour, the number of times	After waiting for 1 hour, the system

limited in this hour	of switch to inverter reaches 6, and only count the total number of times whether it continues or not;	becomes normal and automatically starts
Bypass fault	Any one of rectifier input power phase sequence, voltage, frequency and voltage imbalance is abnormal.	Check and confirm the input power voltage and frequency are consistent with the system requirements, and the switch is normal.
Bypass phase sequence reverse	Bypass phase sequence is reversed	Adjust any two phases in system input wiring
Bypass voltage abnormal	AC mains voltage is out of system rated value range	Adjust the system input power or wait for recovery (for short-time abnormalities)
Bypass frequency beyond tracking	Inverter frequency cannot track bypass	
Bypass thyristor fault	Bypass thyristor is abnormal	Press "FAULT CLEAR" to recover; if not solved, ask local authorized technicians for troubleshooting;
Inverter thyristor fault	Inverter thyristor is abnormal	
A inverter output voltage high /low	A phase inverter voltage is above / below the set value	
B inverter output voltage high / low	B phase inverter voltage is above / below the set value	
C inverter output voltage high / low	C phase inverter voltage is above / below the set value	
Inverter IGBT over-current	Inverter current is greater than the set value	
Radiator over-temperature	System over-temperature protection	
Fan fault	The system detected an abnormal rotation of the fan	Ask local authorized technicians for troubleshooting
Output short circuit	Three-phase maximum output current effective value is 5 times of rated power, the time is 100ms, short circuit protection;	Confirm the load connecting wire or load. If they are normal, press "FAULT CLEAR" to recover.
EPO	Panel red button is pressed or remote EPO operation	Remove the remote EPO command and execute the "Power Off Procedure". Perform the "Power On Procedure" after the system is powered off.
Battery not connected	The battery air switch is not closed	Check if the battery output air switch or battery is good
Parallel line connection fault	The main control board J32 is a standalone/parallel settings port ("12-- parallel, 56--standalone"), one	Properly connect the short-circuit cap

	of the followings reports failure: 1, stand-alone but short circuit cap connects to 12 pin of J32; 2, parallel but short circuit cap connects to 56 pin of J32	
--	--	--

Note: "Occur" means exception occurs and "Disappear" means exception has disappeared.

6.2 MPPT Module Fault and Alarm Messages

Tap  →  to switch to the MPPT event log for viewing.

Alarm/Event	Description	Corrective Action
PV n# reversed polarity	MPPT n # module PV input line polarity reversed	Check and adjust the MPPT n # PV input line polarity
MPPT fault	MPPT system fault	Ask local authorized technicians for troubleshooting
MPPT Communication abnormal	MPPT communication is interrupted	<ul style="list-style-type: none"> • Check if the MPPT module screws are loose; • If not loose, ask local authorized technicians for troubleshooting
MPPT over-current protection	PV plate power is too large, resulting in instantaneous over-current	Determine the plate power is in line with system ratings
MPPT over-temperature protection	Module over-temperature due to excessive plate power or excessive local temperature rise or fan failure	<ul style="list-style-type: none"> • Confirm if the plate power and ambient temperature comply with system requirements • Ask local authorized technicians for troubleshooting
BUS overvoltage	Load instantaneous connection and removal causes bus fluctuations	<ul style="list-style-type: none"> • The system should automatically adjust and recover after 1 minute; • Ask local authorized technicians for troubleshooting
PV capacitor overvoltage	Load instantaneous connection and removal causes bus fluctuations	<ul style="list-style-type: none"> • Ask local authorized technicians for troubleshooting
PV overvoltage	Plate configuration voltage is too high	Reduce the Voc voltage of the plates in series
PV under-voltage	Sun illumination is insufficient	Confirm the plate direction laying slope
MPPT not detected	MPPT is off or communication is interrupted	<ul style="list-style-type: none"> • MPPT system is automatically powered off and exists at night; • Turn PV n # input switch on; • If MPPT module fastening screws are loose, fasten them; • Ask local authorized technicians for troubleshooting
PV charging is on	PV energy is sufficient and system works normally	Normal phenomenon
PV charging is off	PV energy is insufficient or MPPT has been turned off manually	It is common that PV energy is insufficient at nightfall; Go into the MPPT settings, and turn on charging.
Note: "Occur" means exception occurs and "Disappear" means exception has disappeared		