USER MANUAL

RCT

RCT-ALP/ALM 3K-24V~5K-48V
INVERTER / CHARGER

Version: 1.0

Table Of Contents

ABOUT THIS MANUAL

Purpose

This manual describes the assembly, installation, operation and troubleshooting of this unit. Please read this manual carefully before installations and operations. Keep this manual for future reference.

Scope

This manual provides safety and installation guidelines as well as information on tools and wiring.

SAFETY INSTRUCTIONS

WARNING: This chapter contains important safety and operating instructions. Read and keep this manual for future reference.

1. Before using the unit, read all instructions and cautionary markings on the unit, the batteries and all appropriate sections of this manual.
2. **CAUTION** --To reduce risk of injury, charge only deep-cycle lead acid type rechargeable batteries. Other types of batteries may burst, causing personal injury and damage.
3. Do not disassemble the unit. Take it to a qualified service center when service or repair is required. Incorrect re-assembly may result in a risk of electric shock or fire.
4. To reduce risk of electric shock, disconnect all wirings before attempting any maintenance or cleaning. Turning off the unit will not reduce this risk.
5. **CAUTION** – Only qualified personnel can install this device with battery.
6. **NEVER** charge a frozen battery.
7. For optimum operation of this inverter/charger, please follow required spec to select appropriate cable size. It's very important to correctly operate this inverter/charger.
8. Be very cautious when working with metal tools on or around batteries. A potential risk exists to drop a tool to spark or short circuit batteries or other electrical parts and could cause an explosion.
9. Please strictly follow installation procedure when you want to disconnect AC or DC terminals. Please refer to INSTALLATION section of this manual for the details.
10. Fuses (6 pieces of 40A, 32VDC for 3KVA and 1 piece of 200A, 58VDC for 5KVA) are provided as over-current protection for the battery supply.
11. GROUNDING INSTRUCTIONS -This inverter/charger should be connected to a permanent grounded wiring system. Be sure to comply with local requirements and regulation to install this inverter.
12. NEVER cause AC output and DC input short circuited. Do NOT connect to the mains when DC input short circuits.
13. **Warning!!** Only qualified service persons are able to service this device. If errors still persist after following troubleshooting table, please send this inverter/charger back to local dealer or service center for maintenance.

INTRODUCTION

This is a multi-function inverter/charger, combining functions of inverter, AVR, solar charger and battery charger to offer uninterruptible power for office and home appliances. Its comprehensive LCD display offers user-configurable and easy-accessible button operation such as battery charging current, AC/solar charger priority, and acceptable input voltage based on different applications.

Features

- Pure sine wave inverter
- Built-in solar charge controller
- Built in boost and buck AVR for voltage regulation
- Configurable home appliances and personal computers via LCD setting
- Configurable battery charging current based on applications via LCD setting
- Configurable AC/Solar Charger priority via LCD setting
- Compatible to mains voltage or generator power
- Auto restart while AC is recovering
- Overload/ Over temperature/ short circuit protection
- Smart battery charger design for optimized battery performance
- Cold start function

Basic System Architecture

The following illustration shows basic application for this inverter/charger. It also includes following devices to have a complete running system:

- Generator or Utility.
- PV modules (option)

Consult with your system integrator for other possible system architectures depending on your requirements.

This inverter can power all kinds of appliances in home or office environment, including motor-type appliances such as tube light, fan, refrigerator and air conditioner.

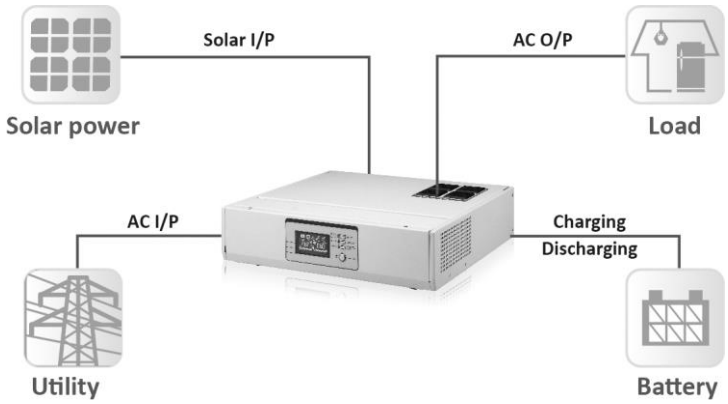
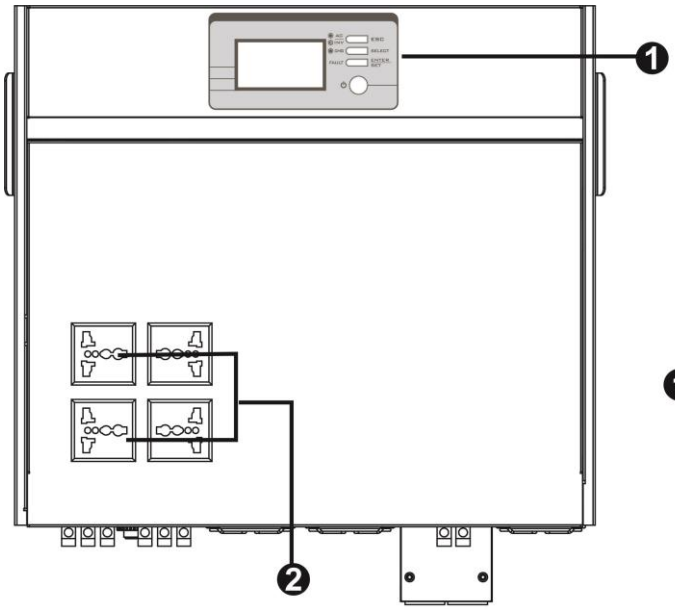


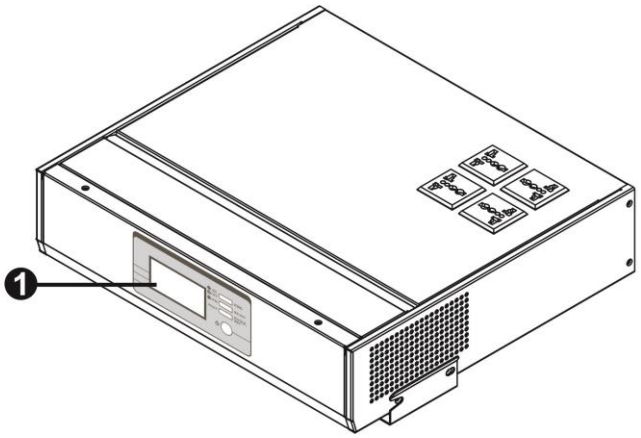
Figure 1 Hybrid Power System

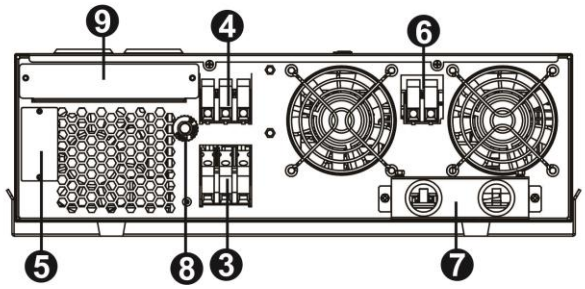
Product Overview

Wall-mounted

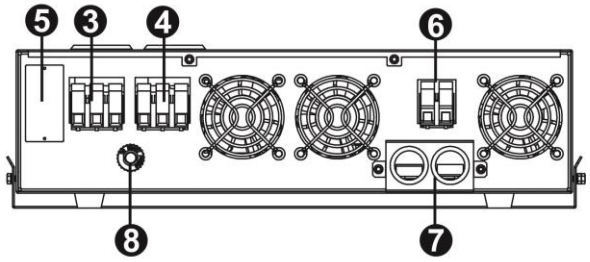


Desktop





5K



3K

1. Operation panel
2. Output sockets
3. AC output terminal
4. AC input
5. Communication port
6. PV input
7. Battery input
8. Circuit breaker
9. Parallel connectors
   (only available for parallel models)

INSTALLATION

Unpacking and Inspection

Before installation, please inspect the unit. Be sure that nothing inside the package is damaged. You should have received the following items inside of package:

- The unit x 1
- User manual x 1
- Communication cable x 2
- Software CD x 1
- Mounting plate x 1
- Screws x 4

Installation

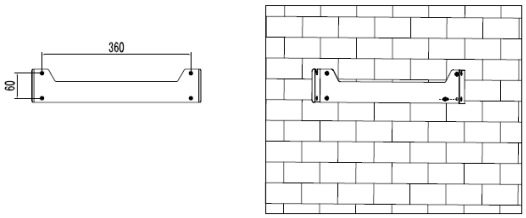
Wall mounted

Consider the following points before selecting where to install:

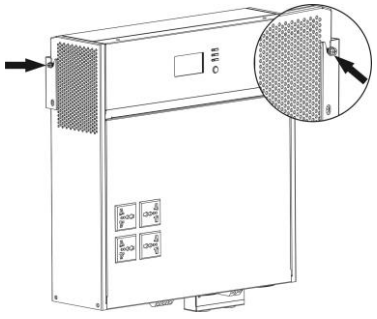
- Do not mount the inverter on flammable construction materials.
- Mount on a solid surface
- Install this inverter at eye level in order to allow the LCD display to be read at all times.
- The ambient temperature should be between 0°C and 55°C to ensure optimal operation.
- The recommended installation position is to be adhered to the wall vertically.
- For proper air circulation to dissipate heat, allow a clearance of approx. 20 cm to the side and approx. 50 cm above and below the unit.

SUITABLE FOR MOUNTING ON CONCRETE OR OTHER NON-COMBUSTIBLE SURFACE ONLY.

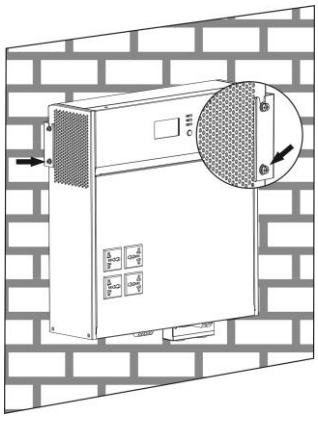
Please follow the steps as below to finish the installation.



Employ the mounting plate as a template for marking the positions of the boreholes. Mount the mounting plate with supplied screws to fix the plate in place.



Insert two screws to the two sides of inverter as showed in the figure. Please don't screw them tightly at this time. Then, place the inverter onto the mounting plate and fix two screws tightly.

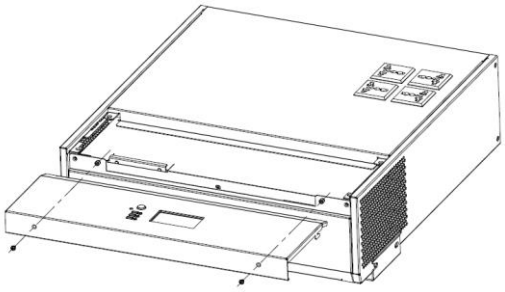


Then, insert the other two screws on the two sides of inverter as showed in the figure and fix them tightly.

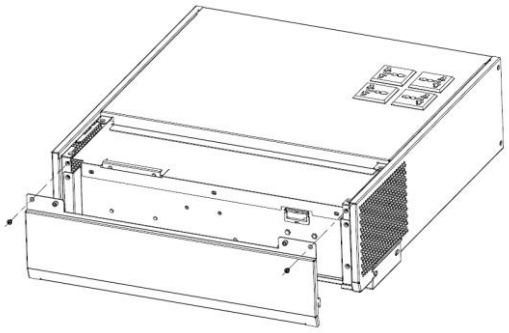
For proper air circulation to dissipate heat, please keep the space around the inverter more than 20 cm.

Desktop

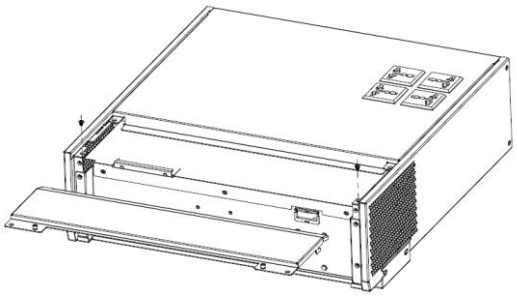
The inverter can be switched to desktop form factor by following the below steps:



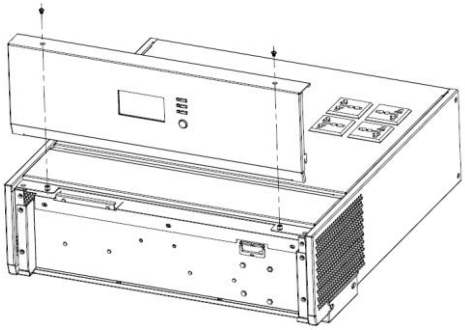
Take off the LCD panel by removing screws.



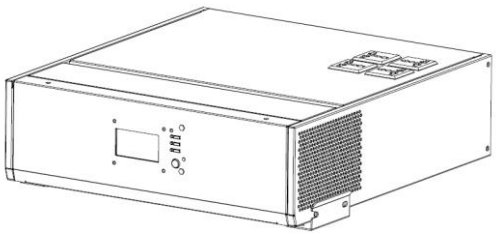
Remove the metal case showed in the figure.



Place the metal case to the position where the LCD panel was previously removed and fix it with screws.



Place the LCD panel to the position where the metal case was previously removed and fix it with two screws.

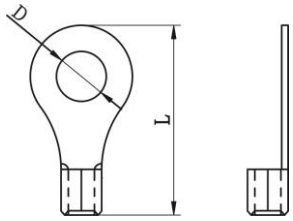


Place the inverter in a protected area that is free of excessive dust and has adequate air flow. Please place the inverter away from other units at least 20 cm to avoid interference.

Battery Connection

CAUTION: For safety operation and regulation compliance, it's requested to install a separate DC over-current protector or disconnect device between battery and inverter. It may not be requested to have a disconnect device in some applications, however, it's still requested to have over-current protection installed. Please refer to typical amperage in below table as required fuse or breaker size.

Ring terminal:



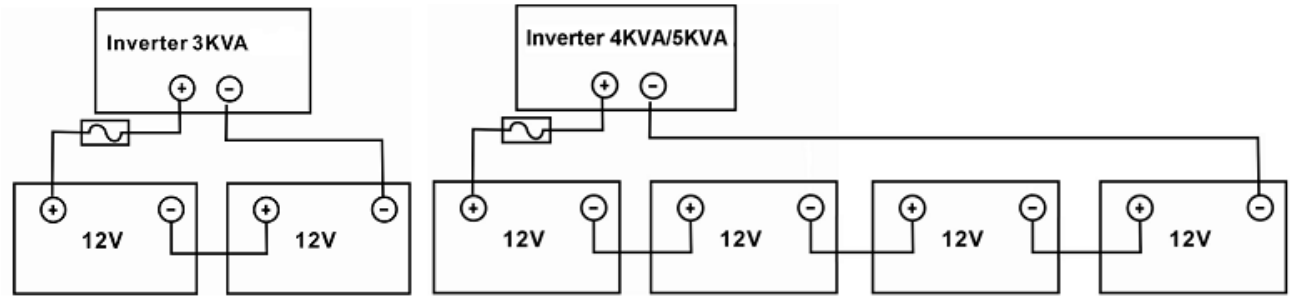
WARNING! All wiring must be performed by a qualified personnel.
WARNING! It's very important for system safety and efficient operation to use appropriate cable for battery connection. To reduce risk of injury, please use the proper recommended cable and terminal size as below.

Recommended battery cable and terminal size:

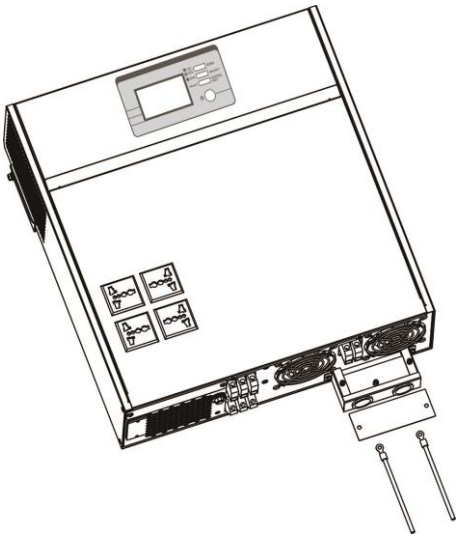
Model	Typical Amperage	Battery capacity	Wire Size	Ring Terminal			Torque value
				Cable mm^2	Dimensions		
					D (mm)	L (mm)	
RCT-ALP 3K-24/ RCT-ALM 3K-24	100A	100AH 200AH	1*4AWG	22	6.4	33.2	2~ 3 Nm
			2*8AWG	14	6.4	29.2	
RCT-ALP 3K-24/ RCT-ALM 3K-24	84A	200AH	1*4AWG	22	6.4	33.2	2~ 3 Nm
			2*8AWG	14	6.4	29.2	

Please follow below steps to implement battery connection:

1. Assemble battery ring terminal based on recommended battery cable and terminal size.
2. 3KVA model supports 24VDC system and 5KVA model supports 48VDC system. Connect all battery packs as below chart. It's suggested to connect at least 100Ah capacity battery for 3KVA model and at least 200Ah capacity battery for 5KVA model.



3. Insert the ring terminal of battery cable flatly into battery connector of inverter and make sure the bolts are tightened with torque of 2-3 Nm. Make sure polarity at both the battery and the inverter/charge is correctly connected and ring terminals are tightly screwed to the battery terminals.



⚠	**WARNING: Shock Hazard** Installation must be performed with care due to high battery voltage in series.

⚠	**CAUTION!!** Do not place anything between the flat part of the inverter terminal and the ring terminal. Otherwise, overheating may occur. **CAUTION!!** Do not apply anti-oxidant substance on the terminals before terminals are connected tightly. **CAUTION!!** Before making the final DC connection or closing DC breaker/disconnector, be sure positive (+) must be connected to positive (+) and negative (-) must be connected to negative (-).

AC Input/Output Connection

CAUTION!! Before connecting to AC input power source, please install a **separate** AC breaker between inverter and AC input power source. This will ensure the inverter can be securely disconnected during maintenance and fully protected from over current of AC input. The recommended spec of AC breaker is 30A for 3KVA and 50A for 5KVA.

CAUTION!! There are two terminal blocks with "IN" and "OUT" markings. Please do NOT mis-connect input and output connectors.

WARNING!! When using sockets as the output, please make sure that the current of each socket is less than 10A, in case of electric hazard.

WARNING! All wiring must be performed by qualified person.

WARNING! It's very important for system safety and efficient operation to use appropriate cable for AC input connection. To reduce risk of injury, please use the proper recommended cable size as below.

Suggested cable requirement for AC wires

Model	Gauge	Torque Value
RCT-ALP 3K-24/ RCT-ALM 3K-24	12 AWG	1.2~ 1.6 Nm
RCT-ALP 5K-48/ RCT-ALM 5K-48	8 AWG	1.4~ 1.6Nm

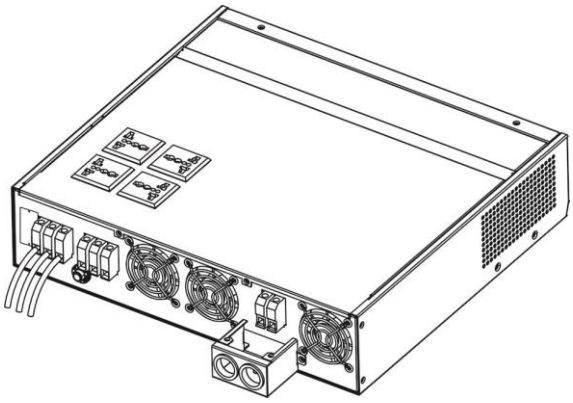
Please follow below steps to implement AC input/output connection:

1. Before making AC input/output connection, be sure to open DC protector or disconnect first.
2. Remove insulation sleeve 10mm for six conductors.
3. Insert AC input wires according to polarities indicated on terminal block and tighten the terminal screws. Be sure to connect PE protective conductor (⏚) first.

   ⏚**→Ground (yellow-green)**

   L→LINE (brown or black)

   N→Neutral (blue)



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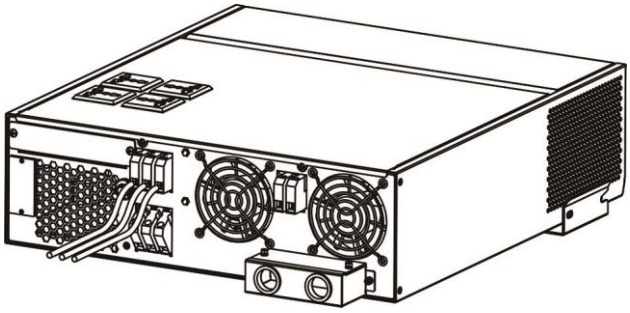
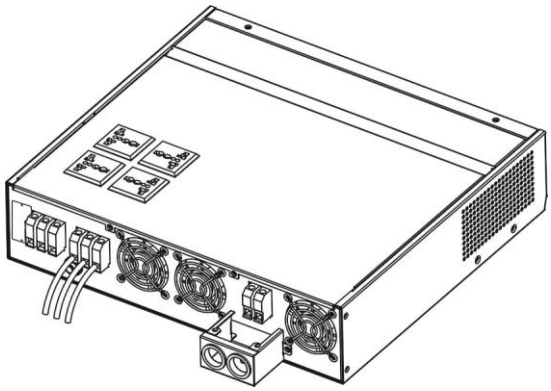


5K

⚠	**WARNING:** Be sure that AC power source is disconnected before attempting to fix the wire to the unit.

4. Then, insert AC output wires according to polarities indicated on terminal block and tighten terminal screws. Be sure to connect PE protective conductor (⏚) first.
   ⏚**→Ground (yellow-green)**
   L→LINE (brown or black)

   N→Neutral (blue)



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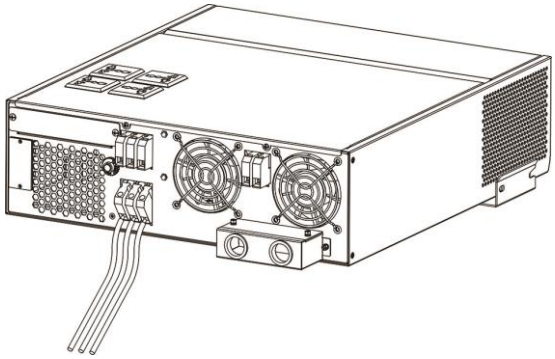


5K

5. Make sure the wires are securely connected.

CAUTION: Appliances such as air conditioner are required at least 2~3 minutes to restart because it's required to have enough time to balance refrigerant gas inside of circuits. If a power shortage occurs and recovers in a short time, it will cause damage to your connected appliances. To prevent this kind of damage, please check manufacturer of air conditioner if it's equipped with time-delay function before installation. Otherwise, this inverter/charger will trig overload fault and cut off output to protect your appliance but sometimes it still causes internal damage to the air conditioner.

PV Connection

CAUTION: Before connecting to PV modules, please install **separately** a DC circuit breaker between inverter and PV modules.

WARNING! All wiring must be performed by a qualified personnel.
WARNING! It's very important for system safety and efficient operation to use appropriate cable for PV module connection. To reduce risk of injury, please use the proper recommended cable size as below.

Model	Typical Amperage	Cable Size	Torque
RCT-ALP 3K-24	50A	8 AWG	1.4~1.6 Nm
RCT-ALM 3K-24	40A	8 AWG	1.4~1.6 Nm
RCT-ALP 5K-48	50A	8 AWG	1.4~1.6 Nm
RCT-ALM 5K-48	80A	6 AWG	1.4~1.6 Nm

PV Module Selection:
When selecting proper PV modules, please be sure to consider below parameters:
1. Open circuit Voltage (Voc) of PV modules not exceeds max. PV array open circuit voltage of inverter.
2. Open circuit Voltage (Voc) of PV modules should be higher than min. battery voltage.

Solar Charger				
INVERTER MODEL	RCT-ALP 3K-24	RCT-ALM 3K-24	RCT-ALP 5K-48	RCT-ALM 5K-48
Max. PV Array Open Circuit Voltage	75VDC	100VDC	105VDC	145VDC
Recommended PV Array MPPT Voltage Range: Vmp*	30~32VDC	30~80VDC	60~72VDC	60~115VDC
Max. charging current	50A	40A	50A	80A

Note: * Vmp: panel max power point voltage.

The PV charging efficiency is maximized while PV system voltage is close to Best Vmp.

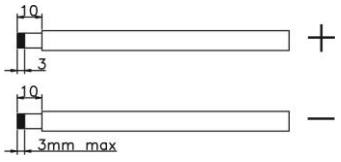
Maximum PV module numbers in Series: Vmpp of PV module * X pcs ≒ Best Vmp of Inverter or Vmp range
PV module numbers in Parallel: Max. charging current of inverter / Impp
Total PV module numbers = maximum PV module numbers in series * PV module numbers in parallel

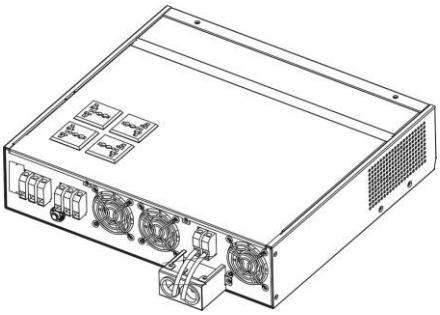
Take RCT-ALM 5K-48 model inverter as an example to select proper PV module. After considering Voc of PV module not exceed 105Vdc and max. Vmpp of PV module close to 60Vdc or within 56Vdc ~ 72Vdc, we can choose PV module with below specification.

Maximum Power (Pmax)	260W	Max. PV module numbers in series
Max. Power Voltage Vmpp(V)	30.9V	2 ➔ 30.9 x 2 ≒ 56 ~ 72
Max. Power Current Impp(A)	8.42A	PV module numbers in parallel
Open Circuit Voltage Voc(V)	37.7V	6 ➔ 50 A / 8.42
Short Circuit Current Isc(A)	8.89A	Total PV module numbers
		2 x 6 = 12

Maximum PV module numbers in Series: 2
PV module numbers in Parallel: 6
Total PV module numbers: 2 x 6 = 12

Please follow below steps to implement PV module connection:
1. Remove insulation sleeve 10 mm for positive and negative conductors.
2. Check correct polarity of connection cable from PV modules and PV input connectors. Then, connect positive pole (+) of connection cable to positive pole (+) of PV input connector. Connect negative pole (-) of connection cable to negative pole (-) of PV input connector.





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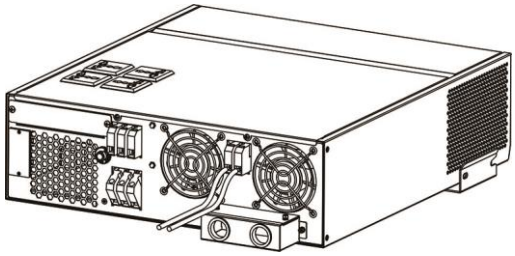


5K

3. Make sure the wires are securely connected.

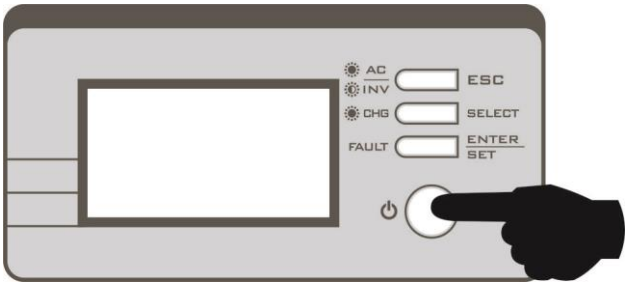
Communication Connection

The inverter is equipped with communication port either RS-232 or USB. Please use supplied communication cable to connect to inverter and PC. This communication port is also can be replaced with SNMP card. When installing with SNMP card in the inverter, it will provide advanced communication and monitoring options.

After communication cable is connected well, insert bundled CD into a computer and follow on-screen instruction to install the monitoring software. For the detailed software operation, please check user manual of software inside of CD.

OPERATION

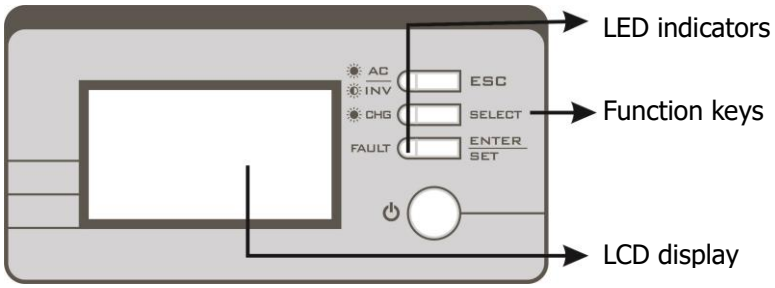
Power ON/OFF



Once the unit has been properly installed and the batteries are connected well, simply press On/Off switch to turn on the unit.

Operation and Display Panel

The operation and display panel, shown in below chart, is on the front panel of the inverter. It includes three LED indicators, three function keys and a LCD display, indicating the operating status and input/output power information.



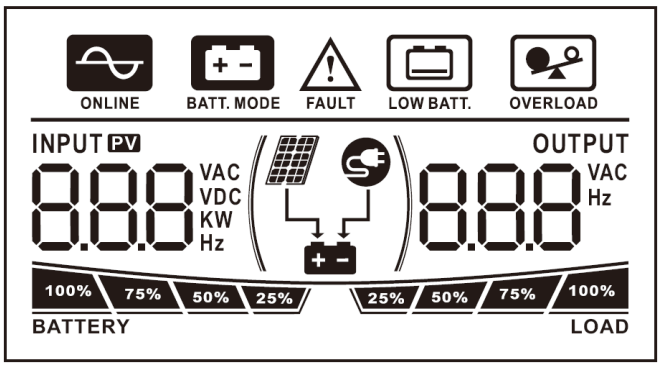
LED Indicators

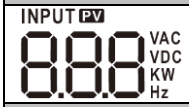
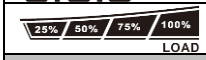
LED Indicator			Messages
☀ AC / ☀ INV	Green	Solid On	Output is powered by utility in Line mode.
		Flashing	Output is powered by battery or PV in battery mode.
☀ CHG	Green	Solid On	Battery is fully charged.
		Flashing	Battery is charging.
⚠ FAULT	Red	Solid On	Fault occurs in the inverter.
		Flashing	Warning condition occurs in the inverter.

Function Keys

Function Key	Description
ESC	To exit setting mode
SELECT	To go to next page or next selection
ENTER	To confirm the selection in setting mode or enter setting mode

LCD Display Icons



Icon	Function description
Input Source Information	
	Indicate input voltage, input frequency, PV voltage, battery voltage and PV input power, charging power or setting value.
Output Information	
	Indicate output voltage, output frequency, setting program NO or fault code.
	Indicate load percentage
Battery Information	
	Indicates battery level by 0-24%, 25-49%, 50-74% and 75-100% in battery mode and charging status.
	Indicates battery voltage is low.

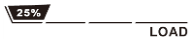
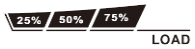
In line mode, it will present battery capacity as below table when unit is charging.

Status	Battery voltage	LCD Display
Constant Current mode / Constant Voltage mode	<2V/cell	BATTERY 4 bars will flash in turns.
	2 ~ 2.083V/cell	25% BATTERY 25% bar will be on and the other three bars will flash in turns.
	2.083 ~ 2.167V/cell	50% 25% BATTERY Two bars will be on and the other two bars will flash in turns.
	> 2.167 V/cell	75% 50% 25% BATTERY Three bars will be on and the leftmost bar will flash.
Floating mode. Batteries are fully charged.		100% 75% 50% 25% BATTERY 4 bars will be on.

In battery mode, it will present battery capacity.

Load Percentage	Battery Voltage	LCD Display
Load >50%	< 1.717V/cell	25% BATTERY
	1.717V/cell ~ 1.8V/cell	50% 25% BATTERY
	1.8 ~ 1.883V/cell	75% 50% 25% BATTERY
	> 1.883 V/cell	100% 75% 50% 25% BATTERY

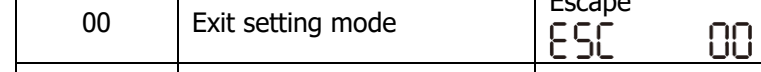
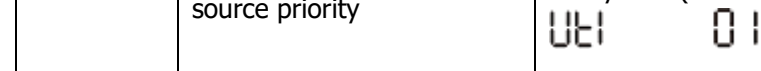
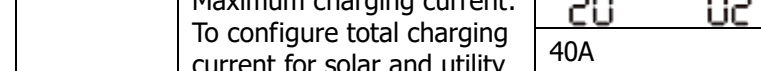
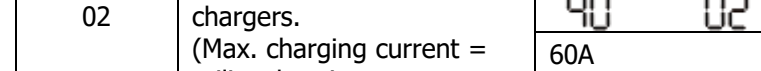
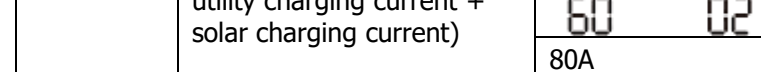
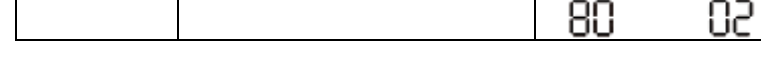
50%> Load > 20%	< 1.817V/cell	
	1.817V/cell ~ 1.9V/cell	
	1.9 ~ 1.983V/cell	
	> 1.983	
Load < 20%	< 1.867V/cell	
	1.867V/cell ~ 1.95V/cell	
	1.95 ~ 2.033V/cell	
	> 2.033	

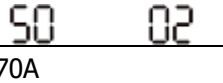
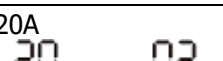
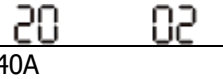
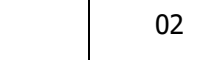
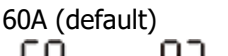
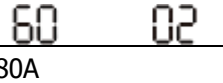
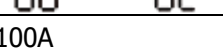
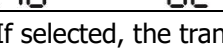
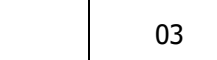
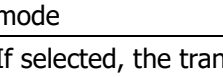
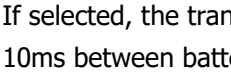
Load Information				
	Indicates unit is overload.			
	Indicates the load level by 0-24%, 25-50%, 50-74% and 75-100%.			
	0%~25%	25%~50%	50%~75%	75%~100%
				
Mode Operation Information				
	Indicates the load is supplied by utility power.			
	Indicates the load is supplied by battery or solar.			
	Indicates alarm or fault is happened.			
	Indicates the solar charger circuit is working.			
	Indicates the utility charger circuit is working.			

LCD Setting

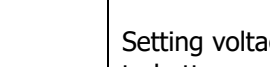
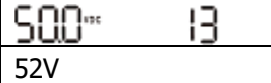
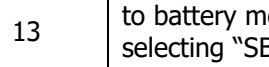
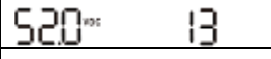
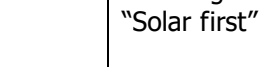
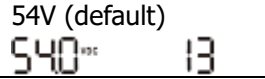
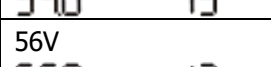
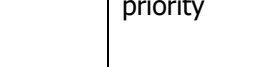
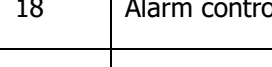
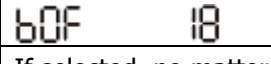
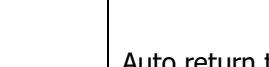
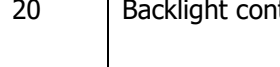
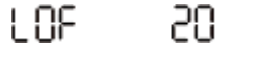
After pressing and holding ENTER button for 3 seconds, the unit will enter setting mode. Press "SCROLL" button to select setting programs. And then, press "ENTER" button to confirm the selection or ESC button to exit.

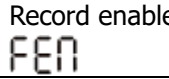
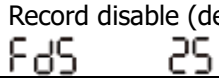
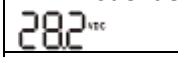
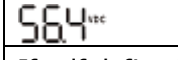
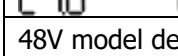
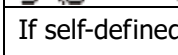
Setting Programs:

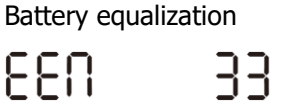
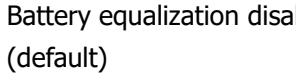
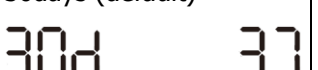
Program	Description	Selectable option	
00	Exit setting mode	Escape 	
01	Output source priority: To configure load power source priority	Solar first 	Solar energy provides power to the loads as first priority. If solar energy is not sufficient to power all connected loads, battery energy will supply power the loads at the same time. Utility provides power to the loads only when any one condition happens: - Solar energy is not available - Battery voltage drops to either low-level warning voltage or the setting point in program 12.
		Utility first (default) 	Utility will provide power to the loads as first priority. Solar and battery energy will provide power to the loads only when utility power is not available.
		SBU priority 	Solar energy provides power to the loads as first priority. If solar energy is not sufficient to power all connected loads, battery energy will supply power to the loads at the same time. Utility provides power to the loads only when battery voltage drops to either low-level warning voltage or the setting point in program 12.
02	Maximum charging current: To configure total charging current for solar and utility chargers. (Max. charging current = utility charging current + solar charging current)	Available options for RCT-ALP 3K-24 model:	
		20A 	30A
		40A 	50A (default)
		60A 	70A
		80A 	

<table>
<tr><td rowspan="12">02</td><td rowspan="12">Maximum charging current:
To configure total charging current for solar and utility chargers.
(Max. charging current = utility charging current + solar charging current)</td><td colspan="2">Available options for RCT-ALM 3K-24:</td></tr>
<tr><td>20A
</td><td>30A
  </td></tr>
<tr><td>40A (default)
</td><td>50A
  </td></tr>
<tr><td>60A
</td><td>70A
  </td></tr>
<tr><td colspan="2">Available options for RCT-ALP 5K-48/RCT-ALM 5K-48 models</td></tr>
<tr><td>10A
</td><td>20A
  </td></tr>
<tr><td>30A
</td><td>40A
  </td></tr>
<tr><td>50A
  </td><td>60A (default)
  </td></tr>
<tr><td>70A
</td><td>80A
  </td></tr>
<tr><td>90A
</td><td>100A
  </td></tr>
<tr><td>110A
</td><td>120A
  </td></tr>
<tr><td>130A
</td><td>140A
  </td></tr>
<tr><td rowspan="2">03</td><td rowspan="2">AC input voltage range</td><td>Appliances (default)
</td><td>If selected, the transfer time is within 20ms between battery mode and line mode</td></tr>
<tr><td>UPS
</td><td>If selected, the transfer time is within 10ms between battery mode and line mode</td></tr>
<tr><td rowspan="2">04</td><td rowspan="2">Power saving mode enable/disable</td><td>Saving mode disable (default)
</td><td>If disabled, no matter connected load is low or high, the on/off status of inverter output will not be effected.</td></tr>
<tr><td>Saving mode enable
</td><td>If enabled, the output of inverter will be off when connected load is pretty low or not detected.</td></tr>
<tr><td rowspan="2">05</td><td rowspan="2">Battery type</td><td>AGM (default)
  </td><td>Flooded
  </td></tr>
<tr><td>User-Defined
</td><td>If “User-Defined” is selected, battery charge voltage and low DC cut-off voltage can be set up in program 26, 27 and 29.</td></tr>
<tr><td>06</td><td>Auto restart when overload occurs</td><td>Restart disable (default)
  </td><td>Restart enable
  </td></tr>
<tr><td>07</td><td>Auto restart when over temperature occurs</td><td>Restart disable (default)
</td><td>Restart enable
  </td></tr>
</table>

09	Output frequency	50Hz (default) 	60Hz
11	Maximum utility charging current	Available options for RCT-ALP 3K-24/RCT-ALM 3K-24 models:	
		20A 	30A (default)
		Available options for RCT-ALP 5K-48/RCT-ALM 5K-48 models	
		2A 	10A
		20A 	30A (default)
		40A 	50A
		60A 	
12	Setting voltage point back to utility source when selecting “SBU priority” or “Solar first” in program 01.	Available options for RCT-ALP 3K-24/RCT-ALM 3K-24 models:	
		22.0V 	22.5V
		23.0V (default) 	23.5V
		24.0V 	24.5V
		25.0V 	25.5V
		Available options for RCT-ALP 5K-48/RCT-ALM 5K-48 models	
		44V 	45V
		46V (default) 	47V
		48V 	49V
		50V 	51V
13	Setting voltage point back to battery mode when selecting “SBU priority” or “Solar first” in program 01.	Available options for RCT-ALP 3K-24/RCT-ALM 3K-24 models:	
		Battery fully charged 	24V
		24.5V 	25V
		25.5V 	26V
		26.5V 	27V (default)
		27.5V 	28V
		28.5V 	29V

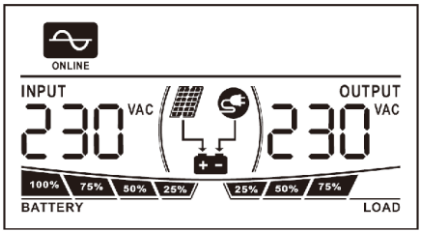
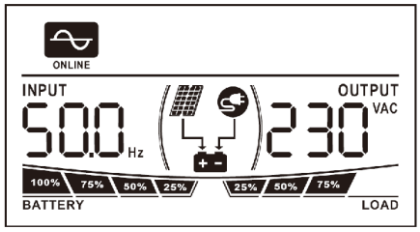
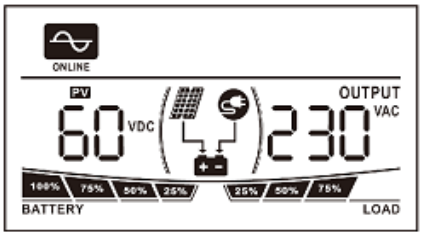
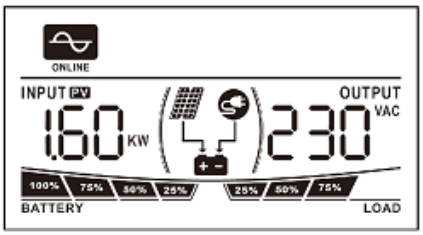
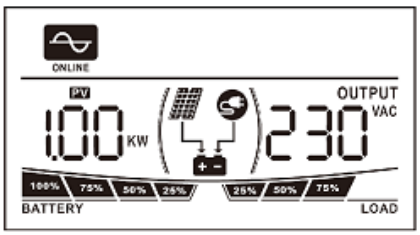
<table>
<tr><td rowspan="7">13</td><td rowspan="7">Setting voltage point back to battery mode when selecting “SBU priority” or “Solar first” in program 01.</td><td colspan="2">Available options for RCT-ALP 5K-48/RCT-ALM 5K-48 models</td></tr>
<tr><td>Battery fully charged
</td><td>48V
  </td></tr>
<tr><td>49V
</td><td>50V
  </td></tr>
<tr><td>51V
  </td><td>52V
  </td></tr>
<tr><td>53V
  </td><td>54V (default)
  </td></tr>
<tr><td>55V
  </td><td>56V
  </td></tr>
<tr><td>57V
</td><td>58V
  </td></tr>
<tr><td rowspan="6">16</td><td rowspan="6">Charger source priority:
To configure charger source priority</td><td colspan="2">If this inverter/charger is working in Line, Standby or Fault mode, charger source can be programmed as below:</td></tr>
<tr><td>Solar first
</td><td>Solar energy will charge battery as first priority.
Utility will charge battery only when solar energy is not available.</td></tr>
<tr><td>Utility first
</td><td>Utility will charge battery as first priority.
Solar energy will charge battery only when utility power is not available.</td></tr>
<tr><td>Solar and Utility
  </td><td>Solar energy and utility will charge battery at the same time.</td></tr>
<tr><td>Only Solar
</td><td>Solar energy will be the only charger source no matter utility is available or not.</td></tr>
<tr><td colspan="2">If this inverter/charger is working in Battery mode or Power saving mode, only solar energy can charge battery. Solar energy will charge battery if it's available and sufficient.</td></tr>
<tr><td>18</td><td>Alarm control</td><td>Alarm on (default)
  </td><td>Alarm off
  </td></tr>
<tr><td rowspan="2">19</td><td rowspan="2">Auto return to default display screen</td><td>Return to default display screen (default)
  </td><td>If selected, no matter how users switch display screen, it will automatically return to default display screen (Input voltage /output voltage) after no button is pressed for 1 minute.</td></tr>
<tr><td>Stay at latest screen
</td><td>If selected, the display screen will stay at latest screen user finally switches.</td></tr>
<tr><td>20</td><td>Backlight control</td><td>Backlight on (default)
  </td><td>Backlight off
  </td></tr>
<tr><td>22</td><td>Beeps while primary source is interrupted</td><td>Alarm on (default)
</td><td>Alarm off
</td></tr>
</table>

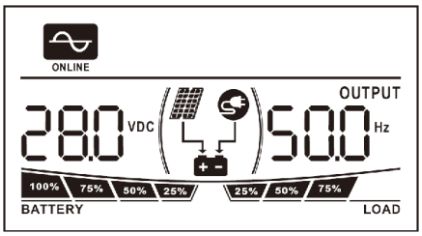
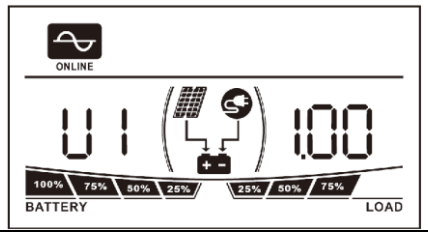
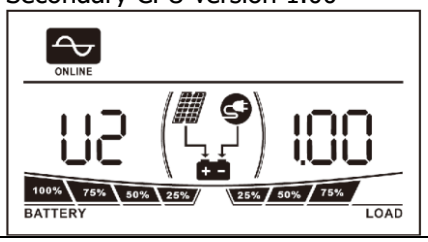
23	Overload bypass: When enabled, the unit will transfer to line mode if overload occurs in battery mode.	Bypass disable (default) 	Bypass enable 
25	Record Fault code	Record enable 	Record disable (default) 
26	Bulk charging voltage (C.V voltage)	24V model default setting: 28.2V 	
		48V model default setting: 56.4V 	
		If self-defined is selected in program 5, this program can be set up. Setting range is from 24.0V to 29.2V for 24V model and 48.0V to 58.4V for 48V model. Increment of each click is 0.1V.	
27	Floating charging voltage	24V model default to 27.0V 	
		48V model default setting: 54.0V 	
		If self-defined is selected in program 5, this program can be set up. Setting range is from 24.0V to 29.2V for 24V model, 48.0V to 58.4V for 48V model. Increment of each click is 0.1V.	
29	Low DC cut-off voltage	24V model default setting: 21.0V 	
		48V model default setting: 42.0V 	
		If self-defined is selected in program 5, this program can be set up. Setting range is from 20.0V to 24.0V for 24V model, 40.0V to 48.0V for 48V model. Increment of each click is 0.1V. Low DC cut-off voltage will be fixed to setting value no matter what percentage of load is connected.	
31	Solar power balance: When enabled, solar input power will be automatically adjusted according to connected load power. (Only available for 5KVA model)	Solar power balance enable (Default): 	If selected, solar input power will be automatically adjusted according to the following formula: Max. input solar power = Max. battery charging power + Connected load power.
		Solar power balance disable: 	If selected, the solar input power will be the same to max. battery charging power no matter how much loads are connected. The max. battery charging power will be based on the setting current in program 02. (Max. solar power = Max. battery charging power)

<table>
<tr><td rowspan="4">32</td><td rowspan="4">Bulk charging time
(C.V stage)
(Only available for 5KVA model)</td><td>Automatically (Default):
  </td><td>If selected, inverter will judge this charging time automatically.</td></tr>
<tr><td>5 min
  </td><td rowspan="2">The setting range is from 5 min to 900 min. Increment of each click is 5 min.</td></tr>
<tr><td>900 min
  </td></tr>
<tr><td colspan="2">If “USE” is selected in program 05, this program can be set up.</td></tr>
<tr><td rowspan="2">33</td><td rowspan="2">Battery equalization (Only available for 5KVA model)</td><td>Battery equalization
  </td><td>Battery equalization disable (default)
  </td></tr>
<tr><td colspan="2">If “Flooded” or “User-Defined” is selected in program 05, this program can be set up.</td></tr>
<tr><td rowspan="2">34</td><td rowspan="2">Battery equalization voltage (Only available for 5KVA model)</td><td colspan="2">3KVA default setting: 29.2V. Setting range is from 24V ~ 29.2V. Increment of each click is 0.1V.
  </td></tr>
<tr><td colspan="2">5KVA Default setting: 58.4V. Setting range is from 48V ~ 58.4V. Increment of each click is 0.1V.
  </td></tr>
<tr><td>35</td><td>Battery equalized time (Only available for 5KVA model)</td><td>60min (default)
  </td><td>Setting range is from 5min to 900min. Increment of each click is 5min.</td></tr>
<tr><td>36</td><td>Battery equalized timeout (Only available for 5KVA model)</td><td>120min (default)
  </td><td>Setting range is from 5min to 900 min. Increment of each click is 5 min.</td></tr>
<tr><td>37</td><td>Equalization interval (Only available for 5KVA model)</td><td>30days (default)
  </td><td>Setting range is from 0 to 90 days. Increment of each click is 1 day</td></tr>
<tr><td rowspan="2">39</td><td rowspan="2">Equalization activated immediately (Only available for 5KVA model)</td><td>Enable
  </td><td>Disable (default)
  </td></tr>
<tr><td colspan="2">If equalization function is enabled in program 33, this program can be set up. If “Enable” is selected in this program, it’s to activate battery equalization immediately and LCD main page will shows “  ”. If “Disable” is selected, it will cancel equalization function until next activated equalization time arrives based on program 37 setting. At this time, “  ” will not be shown in LCD main page.</td></tr>
</table>

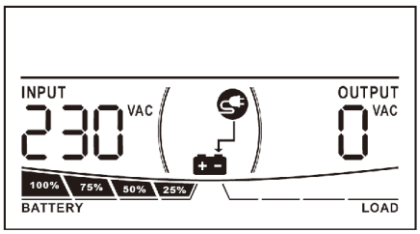
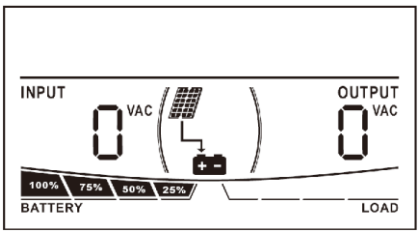
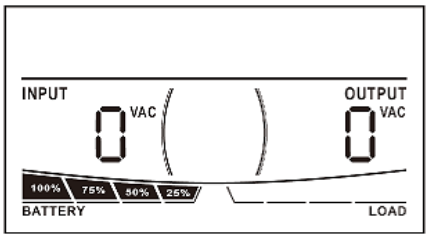
Display Setting

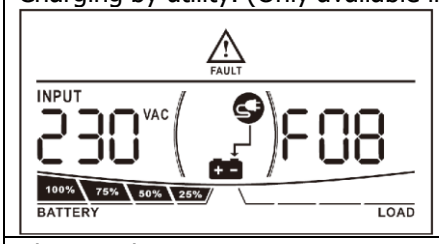
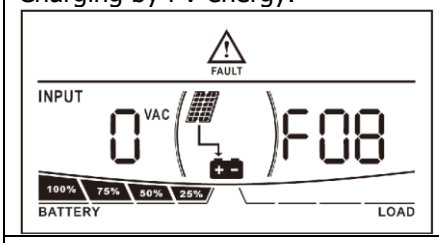
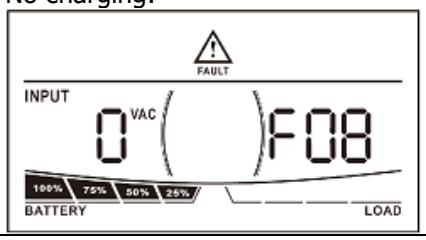
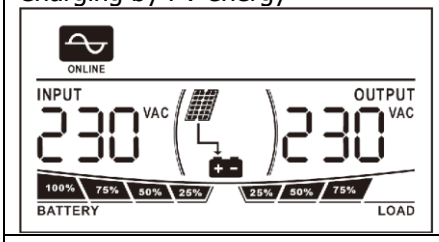
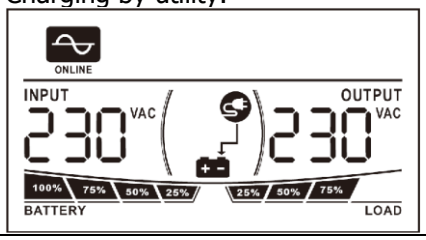
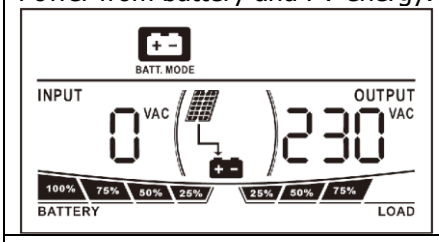
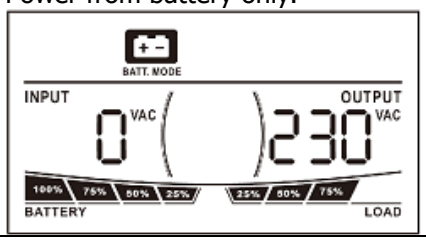
The LCD display information will be switched in turns by pressing "SELECT" key. The selectable information is switched to display in order as below: input voltage/output voltage, input frequency, PV voltage, total charging power, solar charging power, battery voltage/output frequency, main CPU Version and second CPU Version.

Selectable information	LCD display
Input voltage/Output voltage (Default Display Screen)	Input Voltage=230V, output voltage=230V 
Input frequency	Input frequency=50Hz 
PV voltage	PV voltage=60V 
Total charging power	Total charging power=1600W 
Solar charging power	Solar charging power=1000W 

Battery voltage/ Output frequency	Battery voltage=28.0V, output frequency = 50.0Hz 
Main CPU version checking	Main CPU version 1.00 
Secondary CPU version checking	Secondary CPU version 1.00 

Operating Mode Description

Operation mode	Description	LCD display
Standby mode / Power saving mode **Note:** *Standby mode: The inverter is not turned on yet but at this time, the inverter can charge battery without AC output. *Power saving mode: If enabled, the output of inverter will be off when connected load is pretty low or not detected.	No output is supplied by the unit but it still can charge batteries.	Charging by utility. 
		Charging by PV energy. 
		No charging. 

Fault mode Note: *Fault mode: Errors are caused by inside circuit error or external reasons such as over temperature, output short circuited and so on.	PV energy and utility can charge batteries.	Charging by utility. (Only available in 3K model) 
		Charging by PV energy. 
		No charging. 
Line Mode	The unit will provide output power from the mains. It will also charge the battery at line mode.	Charging by PV energy 
		Charging by utility. 
Battery Mode	The unit will provide output power from battery and PV power.	Power from battery and PV energy. 
		Power from battery only. 

Fault Reference Code

Fault Code	Fault Event	Icon on
01	Fan is locked when inverter is off.	F01
02	Over temperature	F02
03	Battery voltage is too high	F03
05	Output short circuited or over temperature is detected by internal converter components.	F05
06	Output voltage is abnormal. (For 3K model) Output voltage is too high. (For 5K model)	F06
07	Overload time out	F07
08	Bus voltage is too high	F08
09	Bus soft start failed	F09
51	Over current or surge	F51
52	Bus voltage is too low	F52
53	Inverter soft start failed	F53
55	Over DC voltage in AC output	F55
56	Battery connection is open	F56
57	Current sensor failed	F57
58	Output voltage is too low	F58

NOTE: Fault codes 51, 52, 53, 55, 56, 57 and 58 are only available in 5K model.

Warning Indicator

Warning Event	Audible Alarm	Icon flashing
Fan is locked when inverter is on.	Beep three times every second	FAULT
Battery is over-charged	Beep once every second	100% 75% 50% 25% BATTERY
Low battery	Beep once every second	LOW BATT.
Overload	Beep once every 0.5 second	OVERLOAD
Output power derating	Beep twice every 3 seconds	
Battery equalization		E9

NOTE: Battery equalization function is only available for 5K model.

Battery Equalization Description (Only available for 5KVA model)

Equalization function is added into charge controller. It reverses the buildup of negative chemical effects like stratification, a condition where acid concentration is greater at the bottom of the battery than at the top. Equalization also helps to remove sulfate crystals that might have built up on the plates. If left unchecked, this condition, called sulfation, will reduce the overall capacity of the battery. Therefore, it's recommended to equalize battery periodically.

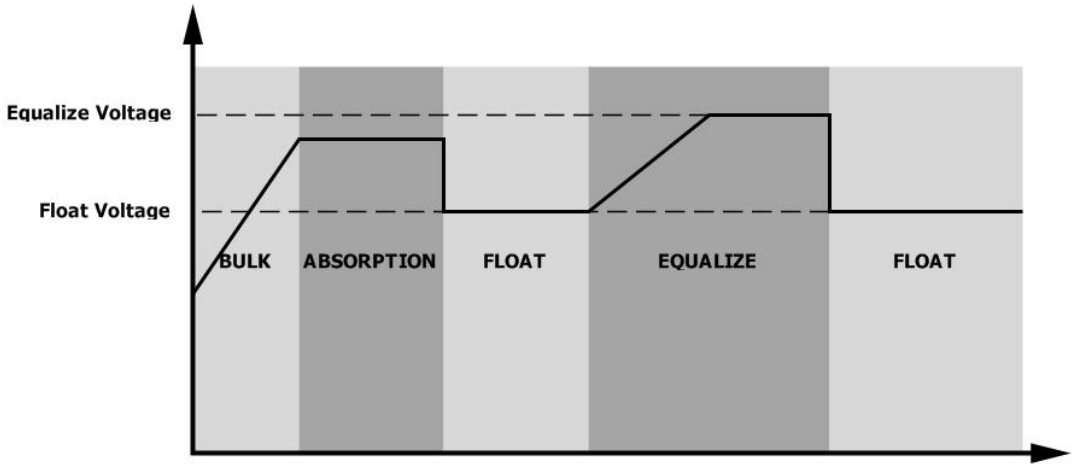
- **How to Apply Equalization Function**

You must enable battery equalization function in monitoring LCD setting program 33 first. Then, you may apply this function in device by either one of following methods:

1. Setting equalization interval in program 37.
2. Active equalization immediately in program 39.

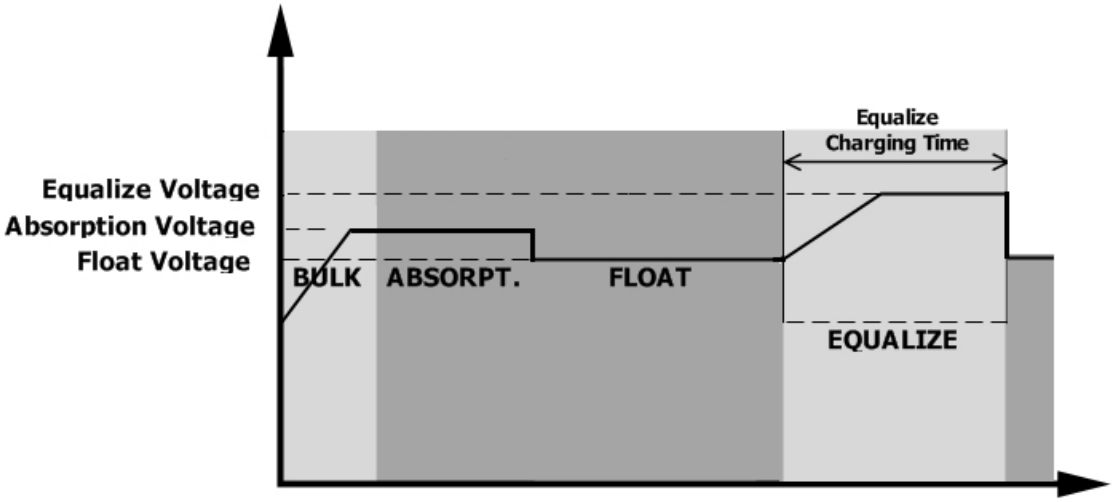
- **When to Equalize**

In float stage, when the setting equalization interval (battery equalization cycle) is arrived, or equalization is active immediately, the controller will start to enter Equalize stage.

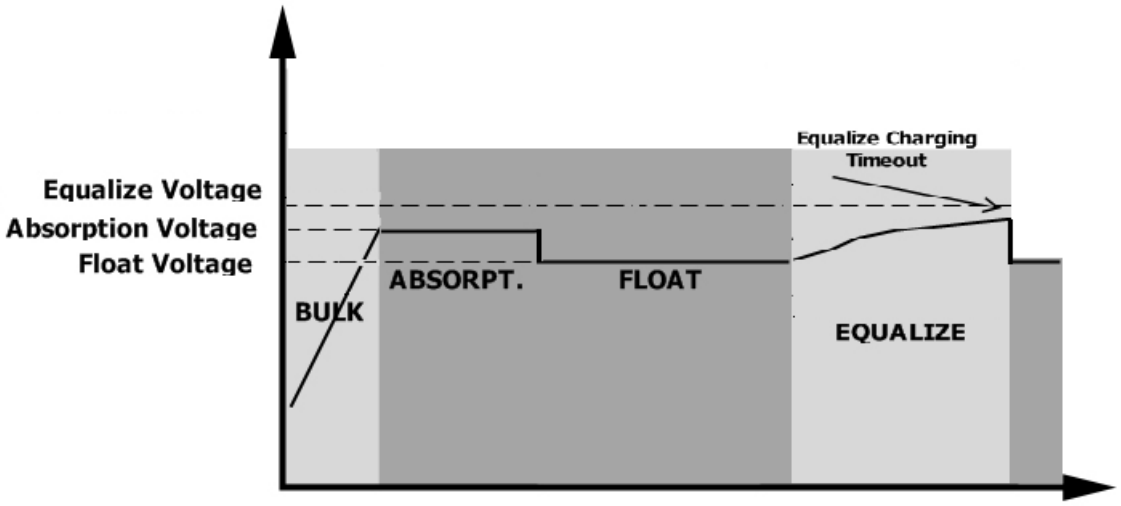


- **Equalize charging time and timeout**

In Equalize stage, the controller will supply power to charge battery as much as possible until battery voltage raises to battery equalization voltage. Then, constant-voltage regulation is applied to maintain battery voltage at the battery equalization voltage. The battery will remain in the Equalize stage until setting battery equalized time is arrived.

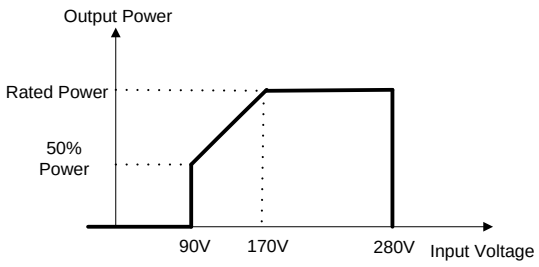


However, in Equalize stage, when battery equalized time is expired and battery voltage doesn't rise to battery equalization voltage point, the charge controller will extend the battery equalized time until battery voltage achieves battery equalization voltage. If battery voltage is still lower than battery equalization voltage when battery equalized timeout setting is over, the charge controller will stop equalization and return to float stage.



SPECIFICATIONS

Table 1 Line Mode Specifications

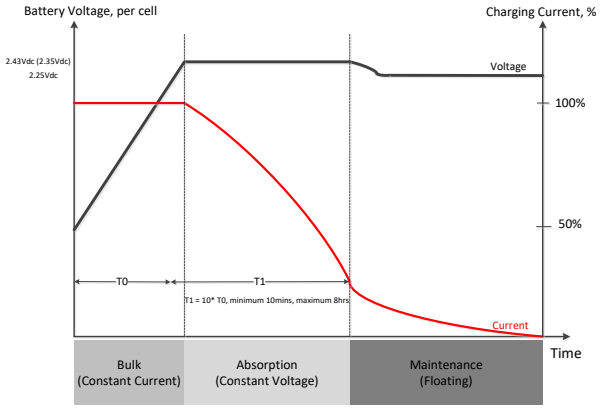
INVERTER MODEL	RCT-ALP 3K-24 RCT-ALM 3K-24	RCT-ALP 5K-48 RCT-ALM 5K-48
Input Voltage Waveform	Sinusoidal (utility or generator)	
Nominal Input Voltage	230Vac	
Low Loss Voltage	170Vac±7V (UPS) 90Vac±7V (Appliances)	
Low Loss Return Voltage	180Vac±7V (UPS); 100Vac±7V (Appliances)	
Boost activation voltage	207V±7V	
Boost deactivation voltage	213V±7V	
Buck activation voltage	253V±7V	
Buck deactivation voltage	247V±7V	
High Loss Voltage	280Vac±7V	
High Loss Return Voltage	270Vac±7V	
Max AC Input Voltage	300Vac	
Nominal Input Frequency	50Hz / 60Hz (Auto detection)	
Low Loss Frequency	40±1Hz	
Low Loss Return Frequency	42±1Hz	
High Loss Frequency	65±1Hz	
High Loss Return Frequency	63±1Hz	
Output Short Circuit Protection	Line mode: Circuit Breaker Battery mode: Electronic Circuits	
Efficiency (Line Mode)	>95% (Rated R load, battery full charged)	
Transfer Time *	10ms typical (For UPS) 20ms typical (For Appliances)	
Output power derating: When AC input voltage drops to 170V depending on models, the output power will be derated.		

*Transfer time may be longer than specified figure when the unit is operated in parallel system.

Table 2 Inverter Mode Specifications

INVERTER MODEL	RCT-ALP 3K-24 RCT-ALM 3K-24	RCT-ALP 5K-48 RCT-ALM 5K-48
Rated Output Power	3KVA/2.4KW	5KVA/5KW
Output Voltage Waveform	Pure Sine Wave	
Output Voltage Regulation	230Vac±5%	
Output Frequency	60Hz or 50Hz	
Peak Efficiency	90%	
Overload Protection	5s@≥150% load; 10s@110%~150% load	
Surge Capacity	2* rated power for 5 seconds	
Nominal DC Input Voltage	24Vdc	48Vdc
Cold Start Voltage	23.0Vdc	46.0Vdc
Low DC Warning Voltage @ load < 20% @ 20% ≤ load < 50% @ load ≥ 50%	 22.0Vdc 21.4Vdc 20.2Vdc	 44.0Vdc 42.8Vdc 40.4Vdc
Low DC Warning Return Voltage @ load < 20% @ 20% ≤ load < 50% @ load ≥ 50%	 23.0Vdc 22.4Vdc 21.2Vdc	 46.0Vdc 44.8Vdc 42.4Vdc
Low DC Cut-off Voltage @ load < 20% @ 20% ≤ load < 50% @ load ≥ 50%	 21.0Vdc 20.4Vdc 19.2Vdc	 42.0Vdc 40.8Vdc 38.4Vdc
High DC Recovery Voltage	29Vdc	58Vdc
High DC Cut-off Voltage	31Vdc	60Vdc
No Load Power Consumption	<25W	<50W
Saving Mode Power Consumption	<10W	<15W

Table 3 Charge Mode Specifications

Utility Charging Mode			
INVERTER MODEL		**RCT-ALP 3K-24** **RCT-ALM 3K-24**	**RCT-ALP 5K-48** **RCT-ALM 5K-48**
Charging Current (UPS) @ Nominal Input Voltage		30A	60A
Bulk Charging Voltage	**Flooded Battery**	29.2	58.4
	AGM / Gel Battery	28.2	56.4
Floating Charging Voltage		27Vdc	54Vdc
Charging Algorithm		3-Step	
Charging Curve			

Solar Charging Mode				
INVERTER MODEL	**RCT-ALP 3K-24**	**RCT-ALM 3K-24**	**RCT-ALP 5K-48**	**RCT-ALM 5K-48**
Efficiency	98.0% max.			
Max. PV Array Open Circuit Voltage	75VDC	100VDC	105VDC	145VDC
PV Array MPPT Voltage Range	30~32VDC	30~80VDC	60~72VDC	60~115VDC
Min battery voltage for PV charge	17VDC		34VDC	
Charging current	50A	40A	50A	80A
Standby Power Consumption	2W			
Battery Voltage Accuracy	+/-0.3%			
PV Voltage Accuracy	+/-2V			
Charging Algorithm	3-Step			
Joint Utility and Solar Charging				
Max. Charging Current	80Amp	70Amp	110Amp	140Amp
Default Charging Current	50Amp	40Amp	60Amp	

Table 4 General Specifications

INVERTER MODEL	**RCT-ALP 3K-24**	**RCT-ALM 3K-24**	**RCT-ALP 5K-48**	**RCT-ALM 5K-48**
Safety Certification	CE			
Operating Temperature Range	0°C to 55°C			
Storage temperature	-15°C~ 60°C			
Dimension (D*W*H), mm	340 x 380 x 98		420 x 397 x 120	
Net Weight, kg	12	13	16	17

TROUBLE SHOOTING

Problem	LCD/LED/Buzzer	Explanation / Possible cause	What to do
Unit shuts down automatically during startup process.	LCD/LEDs and buzzer will be active for 3 seconds and then complete off.	The battery voltage is too low (<1.91V/Cell)	1. Re-charge battery. 2. Replace battery.
No response after power on.	No indication.	1. The battery voltage is far too low. (<1.4V/Cell) 2. Battery polarity is connected reversed.	1. Check if batteries and the wiring are connected well. 2. Re-charge battery. 3. Replace battery.
Mains exist but the unit works in battery mode.	Input voltage is displayed as 0 on the LCD and green LED is flashing.	Input protector is tripped	Check if AC breaker is tripped and AC wiring is connected well.
	Green LED is flashing.	Insufficient quality of AC power. (Shore or Generator)	1. Check if AC wires are too thin and/or too long. 2. Check if generator (if applied) is working well or if input voltage range setting is correct. (UPS→Appliance)
	Green LED is flashing.	Set "Solar First" as the priority of output source.	Change output source priority to Utility first.
When the unit is turned on, internal relay is switched on and off repeatedly.	LCD display and LEDs are flashing	Battery is disconnected.	Check if battery wires are connected well.
Buzzer beeps continuously and red LED is on.	Fault code 07	Overload error. The inverter is overload 110% and time is up.	Reduce the connected load by switching off some equipment.
	Fault code 05	Output short circuited.	Check if wiring is connected well and remove abnormal load.
		Temperature of internal converter component is over 120°C. (Only available for 1-3KVA models.)	Check whether the air flow of the unit is blocked or whether the ambient temperature is too high.
	Fault code 02	Internal temperature of inverter component is over 100°C.	
	Fault code 03	Battery is over-charged.	Return to repair center.
		The battery voltage is too high.	Check if spec and quantity of batteries are meet requirements.
	Fault code 01	Fan fault	Replace the fan.
	Fault code 06/58	Output abnormal (Inverter voltage below than 190Vac or is higher than 260Vac)	1. Reduce the connected load. 2. Return to repair center
	Fault code 08/09/53/57	Internal components failed.	Return to repair center.
	Fault code 51	Over current or surge.	Restart the unit, if the error happens again, please return to repair center.
	Fault code 52	Bus voltage is too low.	
	Fault code 55	Output voltage is unbalanced.	
	Fault code 56	Battery is not connected well or fuse is burnt.	If the battery is connected well, please return to repair center.

Appendix I: Parallel function (Only for 5K parallel model)

1. Introduction

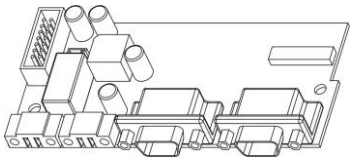
This inverter can be used in parallel with two different operation modes.

1. Parallel operation in single phase with up to 6 units. The supported maximum output power is 30KW/30KVA.
2. Maximum six units work together to support three-phase equipment. Four units support one phase maximum. The supported maximum output power is 30KW/30KVA and one phase can be up to 20KW/20KVA.

NOTE: If this unit is bundled with share current cable and parallel cable, this inverter is default supported parallel operation. You may skip section 2. If not, please purchase parallel kit and install this unit by following instruction from professional technical personnel in local dealer.

2. Package Contents

In parallel kit, you will find the following items in the package:



Parallel board

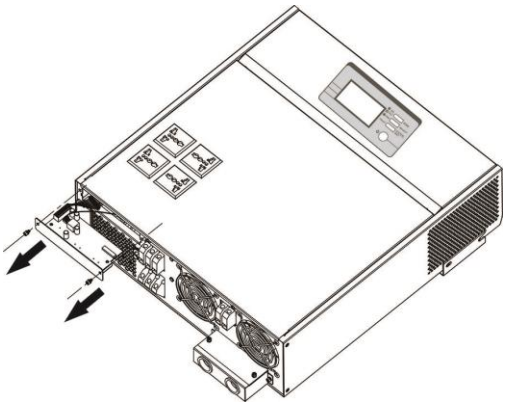
Parallel communication cable

Current sharing cable

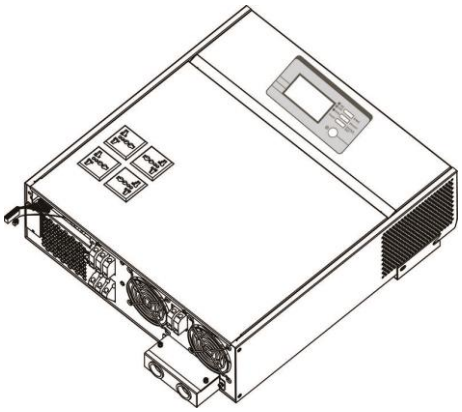
3. Parallel board installation

This installation steps are only applied to 5K model.

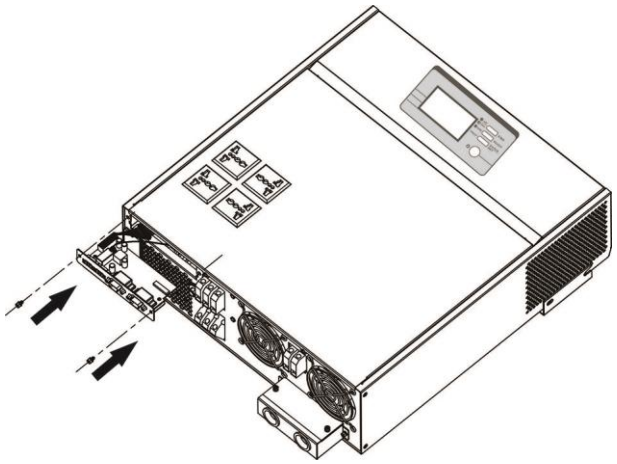
Step 1: Take the dummy board out by unscrewing two screws.



Step 2: Disconnect the cable and remove the dummy board.

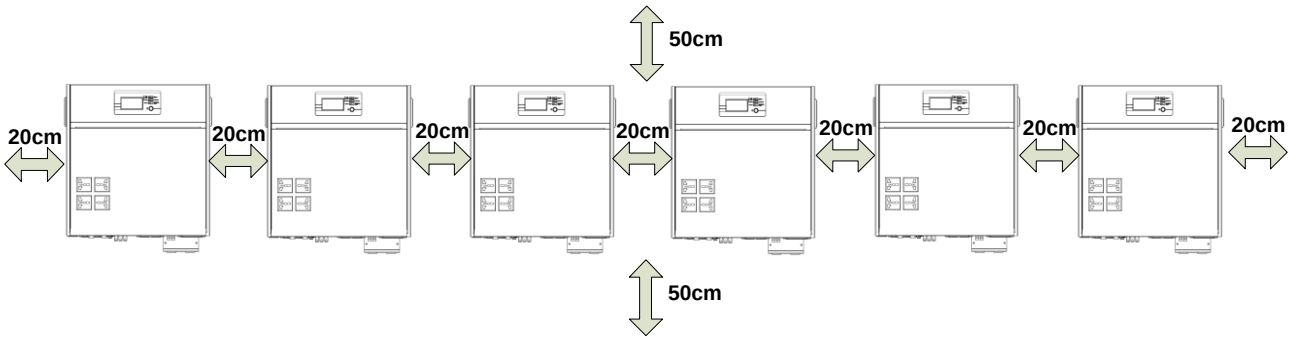


Step 3: Connect the cables to the parallel board, and insert the board back to the unit by fixing two screws.



4. Mounting the Unit

When installing multiple units, please follow below chart.



NOTE: For proper air circulation to dissipate heat, allow a clearance of approx. 20 cm to the side and approx. 50 cm above and below the unit. Be sure to install each unit in the same level.

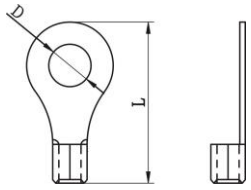
5. Wiring Connection

The cable size of each inverter is shown as below:

Recommended battery cable and terminal size for each inverter:

Model	Wire Size	Ring Terminal			Torque value
		Cable mm^2	Dimensions		
			D (mm)	L (mm)	
5KVA	1*4AWG	22	6.4	33.2	2~ 3 Nm
	2*8AWG	14	6.4	29.2	

Ring terminal:



WARNING: Be sure the length of all battery cables is the same. Otherwise, there will be voltage difference between inverter and battery to cause parallel inverters not working.

Recommended AC input and output cable size for each inverter:

Model	AWG no.	Torque
5KVA	8 AWG	1.4~1.6Nm

You need to connect the cables of each inverter together. Take the battery cables for example: You need to use a connector or bus-bar as a joint to connect the battery cables together, and then connect to the battery

terminal. The cable size used from joint to battery should be X times cable size in the tables above. "X" indicates the number of inverters connected in parallel.

Regarding AC input and output, please also follow the same principle.

CAUTION!! Please install the breaker at the battery and AC input side. This will ensure the inverter can be securely disconnected during maintenance and fully protected from over current of battery or AC input. The recommended mounted location of the breakers is shown in the figures in sections 5-1 and 5-2.

Recommended battery breaker specification for each inverter:

Model	One unit*
5KVA	100A/60VDC

*If you want to use only one breaker at the battery side for the whole system, the rating of the breaker should be X times current of 1 unit. "X" indicates the number of inverters connected in parallel.

Recommended AC input breaker specification for single-phase application:

Inverter # / Model	2 units	3 units	4 units	5 units	6 units
5KVA	100A/230VAC	150A/230VAC	200A/230VAC	250A/230VAC	300A/230VAC

Note 1: It's accepted to use 50A breaker for each unit in parallel system and each inverter should be installed a breaker in the AC input.

Note 2: In three-phase parallel system, you can use one 4-pole breaker. The accepted breaker rating is based on the phase current with the maximum units. Otherwise, please follow note 1 instruction.

Recommended battery capacity

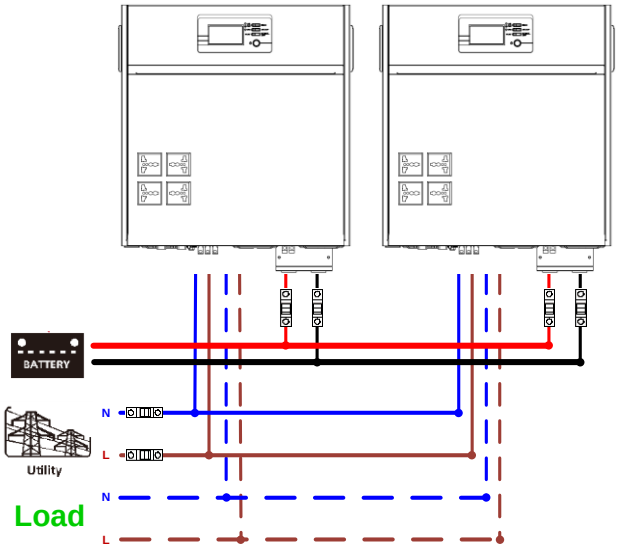
Inverter parallel numbers	2	3	4	5	6
Battery Capacity	400AH	600AH	800AH	1000AH	1200AH

WARNING! Be sure that all inverters will share the same battery bank. Otherwise, the inverters will transfer to fault mode.

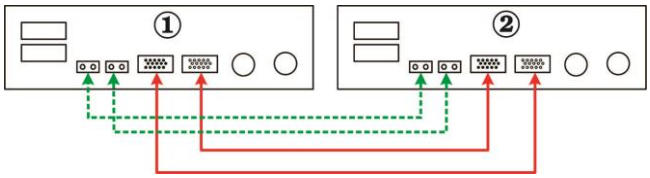
5-1. Parallel Operation in Single phase

Two inverters in parallel:

Power Connection

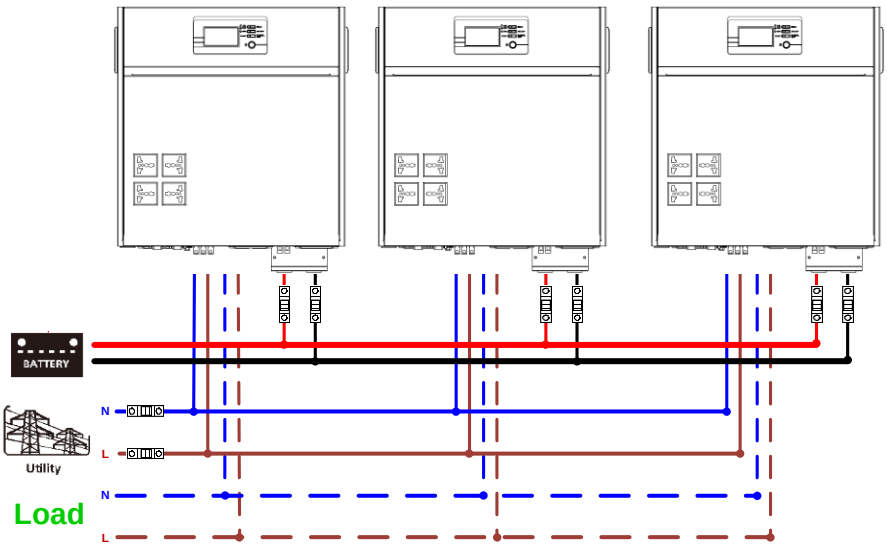


Communication Connection

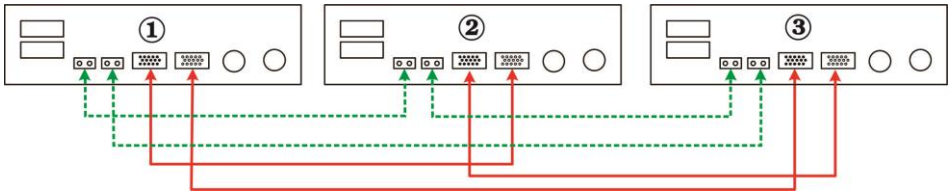


Three inverters in parallel:

Power Connection

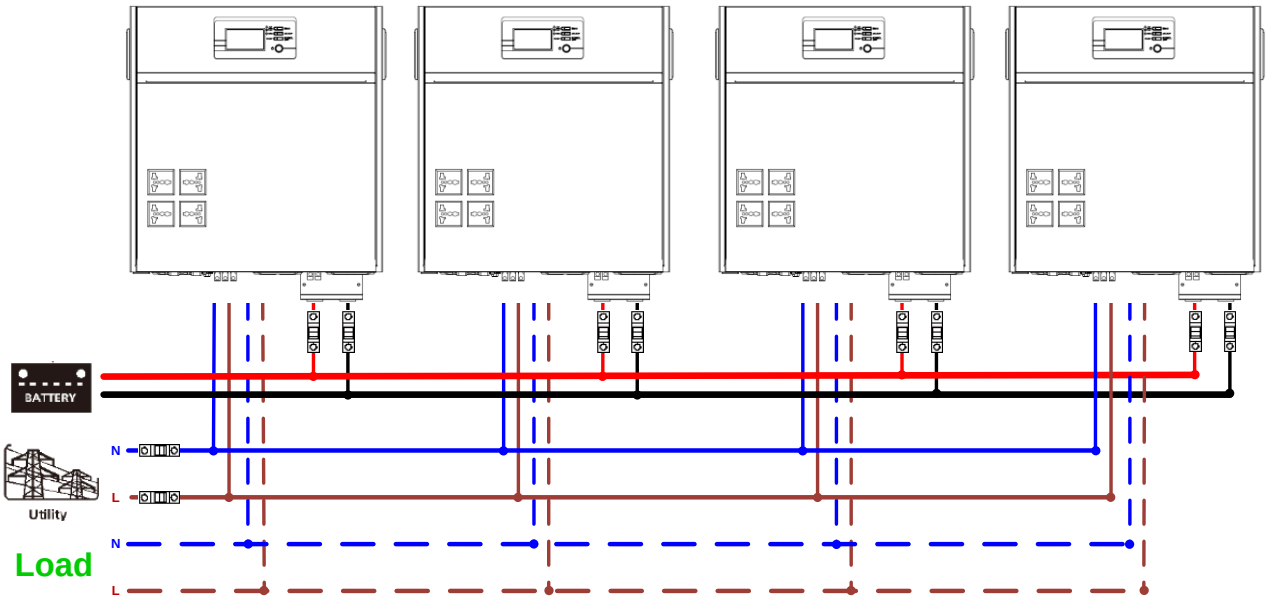


Communication Connection

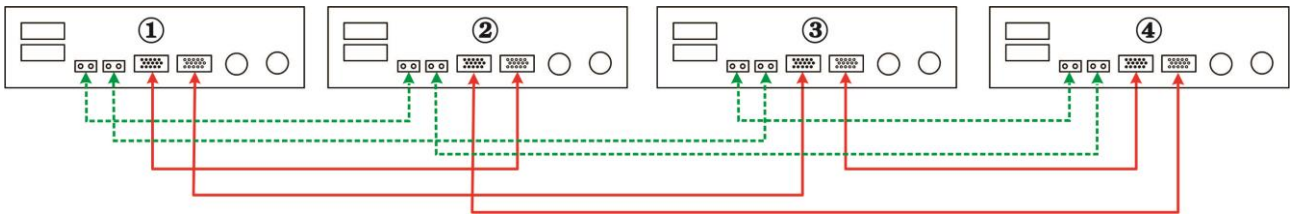


Four inverters in parallel:

Power Connection

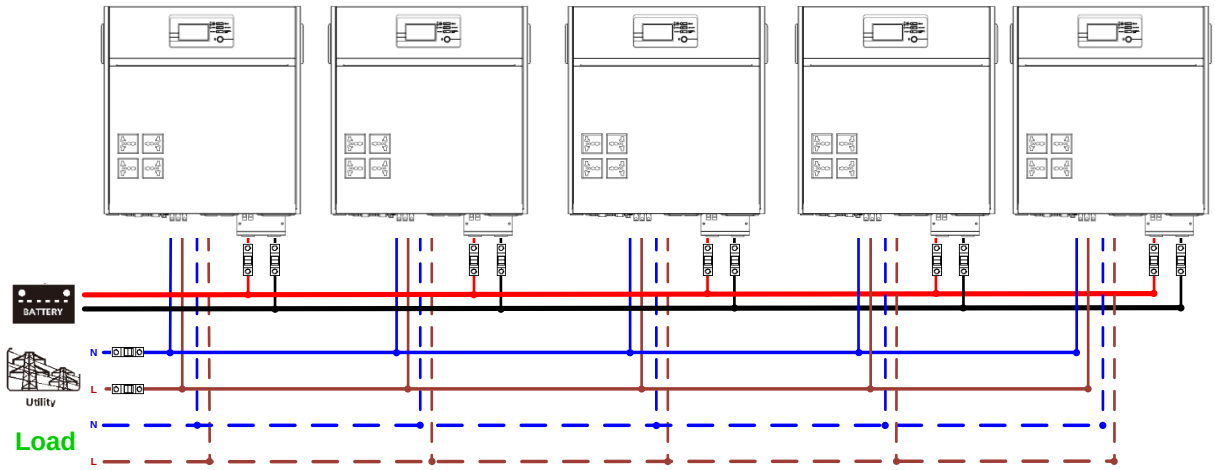


Communication Connection

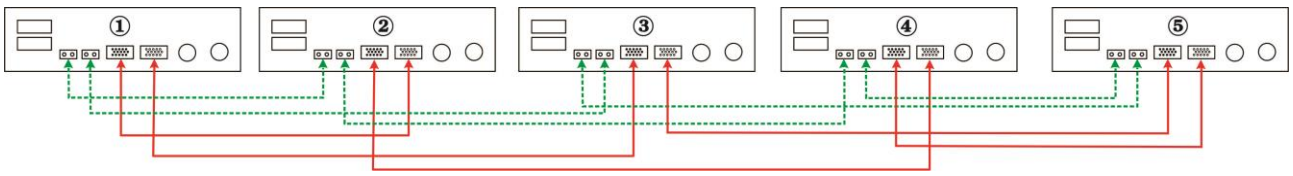


Five inverters in parallel:

Power Connection

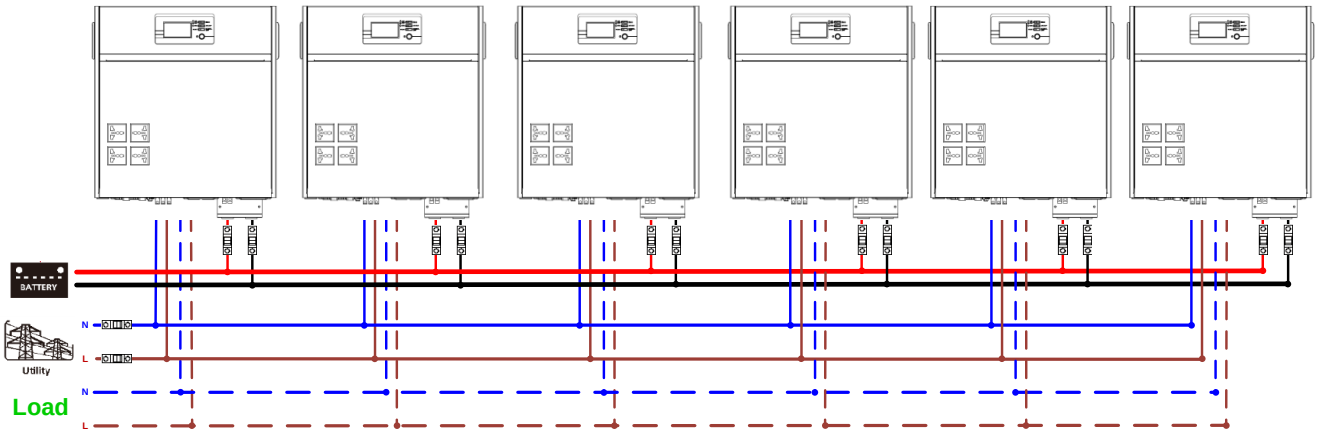


Communication Connection

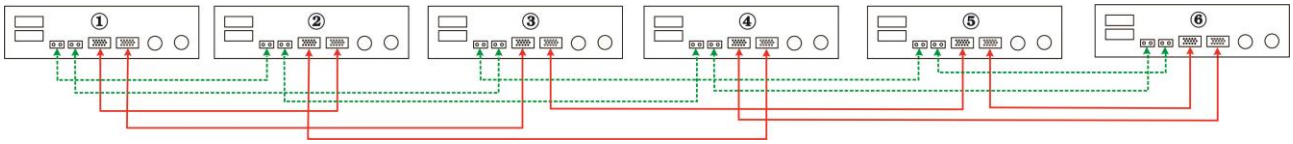


Six inverters in parallel:

Power Connection



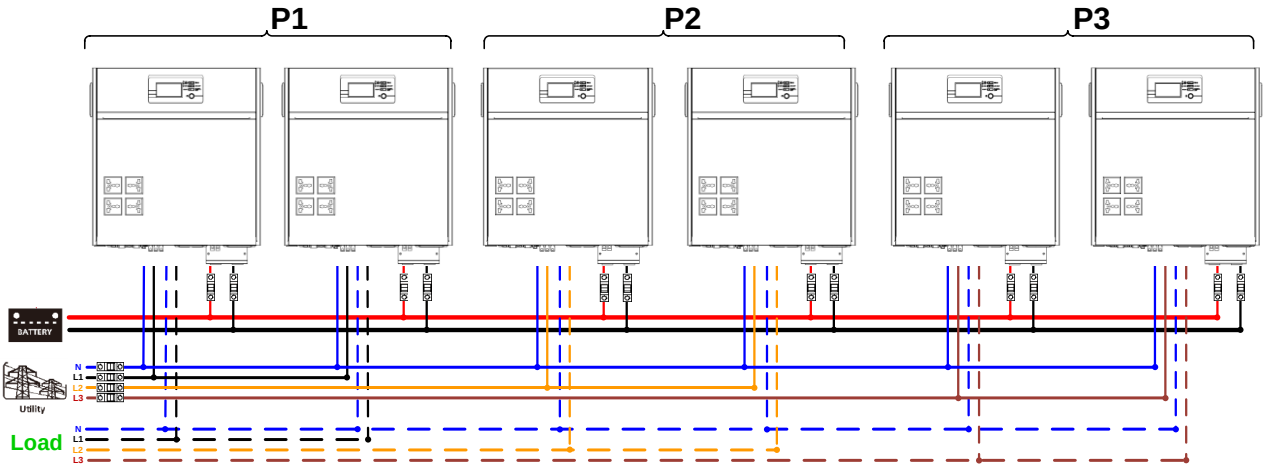
Communication Connection



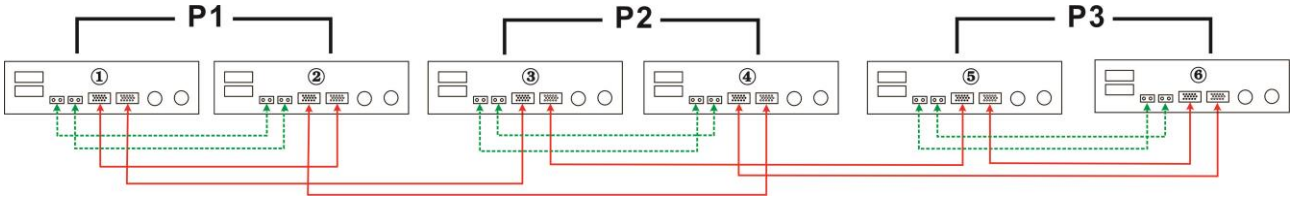
5-2. Support 3-phase equipment

Two inverters in each phase:

Power Connection

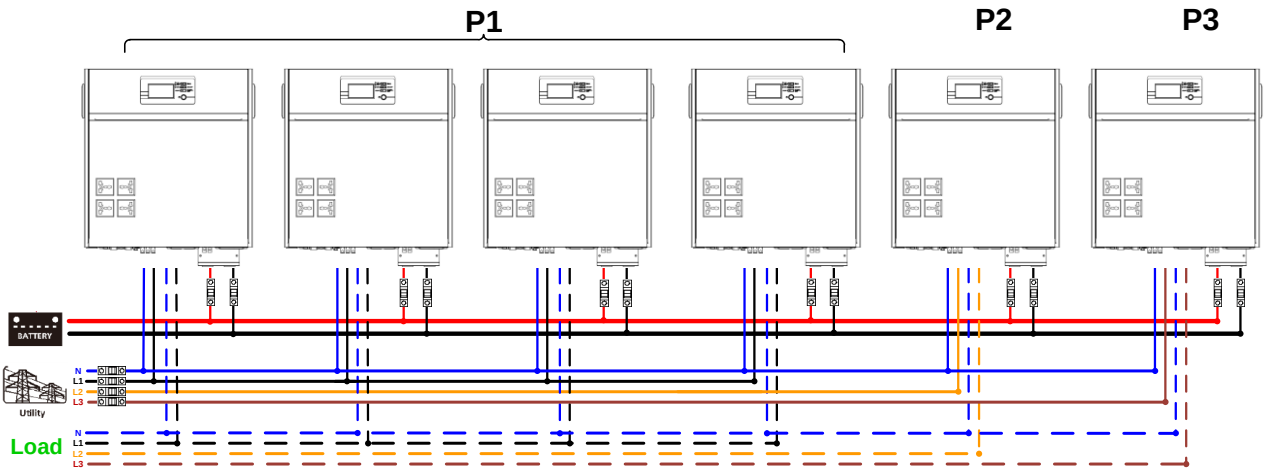


Communication Connection



Four inverters in one phase and one inverter for the other two phases:

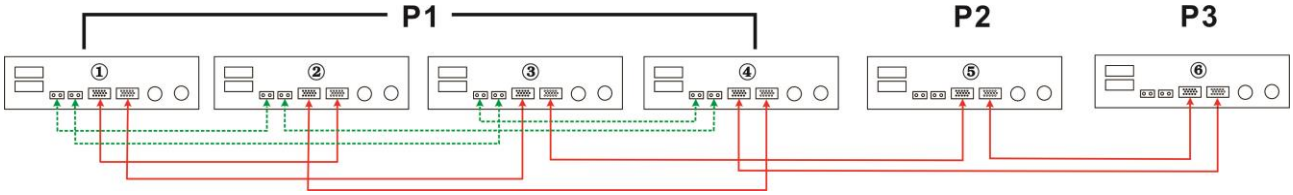
Power Connection



Note: It's up to customer's demand to pick 4 inverters on any phase.

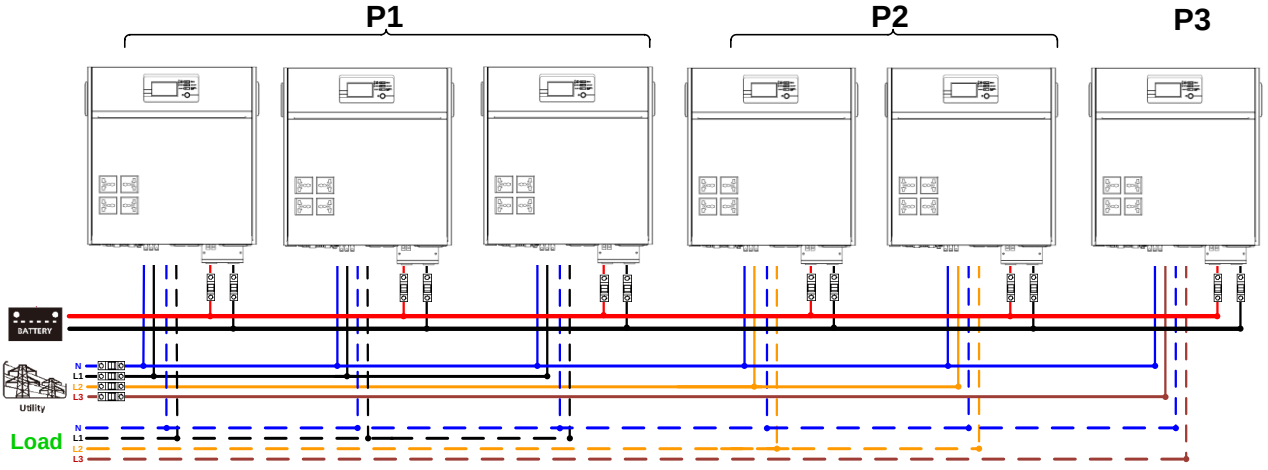
P1: L1-phase, P2: L2-phase, P3: L3-phase.

Communication Connection

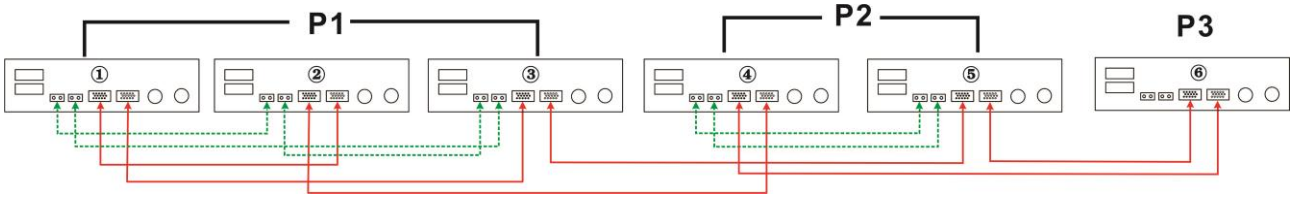


Three inverters in one phase, two inverters in second phase and one inverter for the third phase:

Power Connection

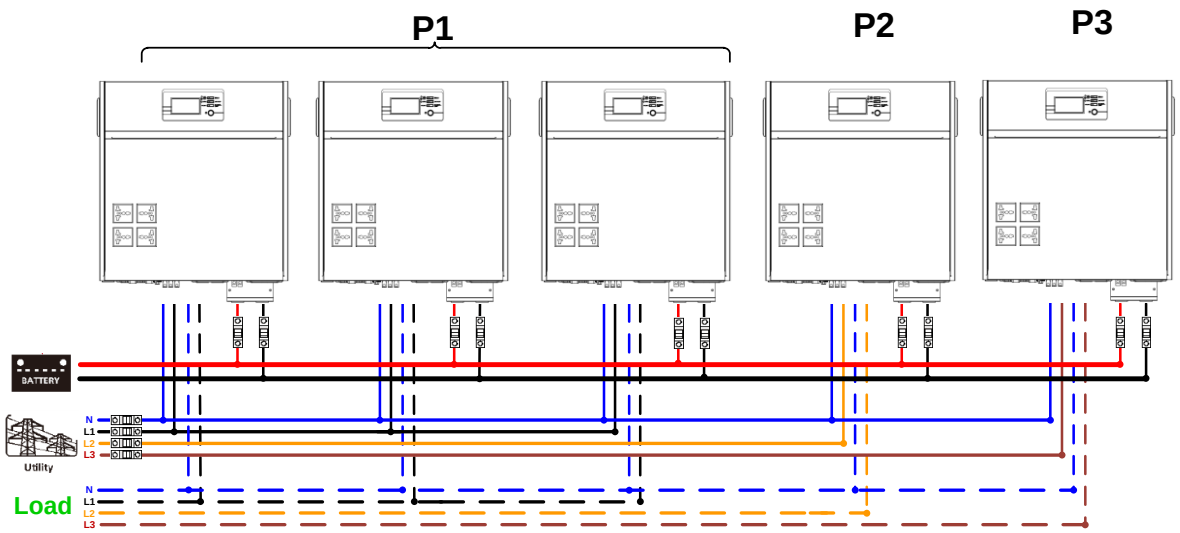


Communication Connection

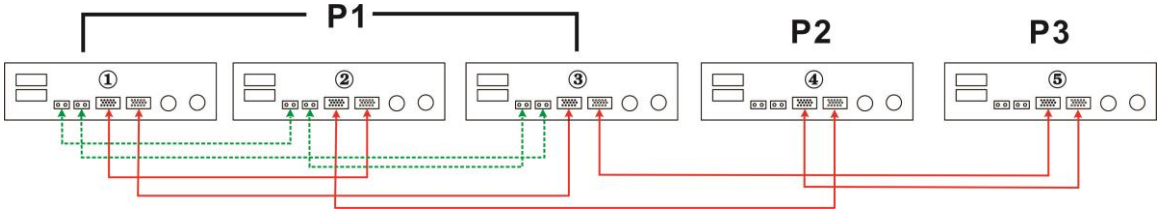


Three inverters in one phase and only one inverter for the remaining two phases:

Power Connection

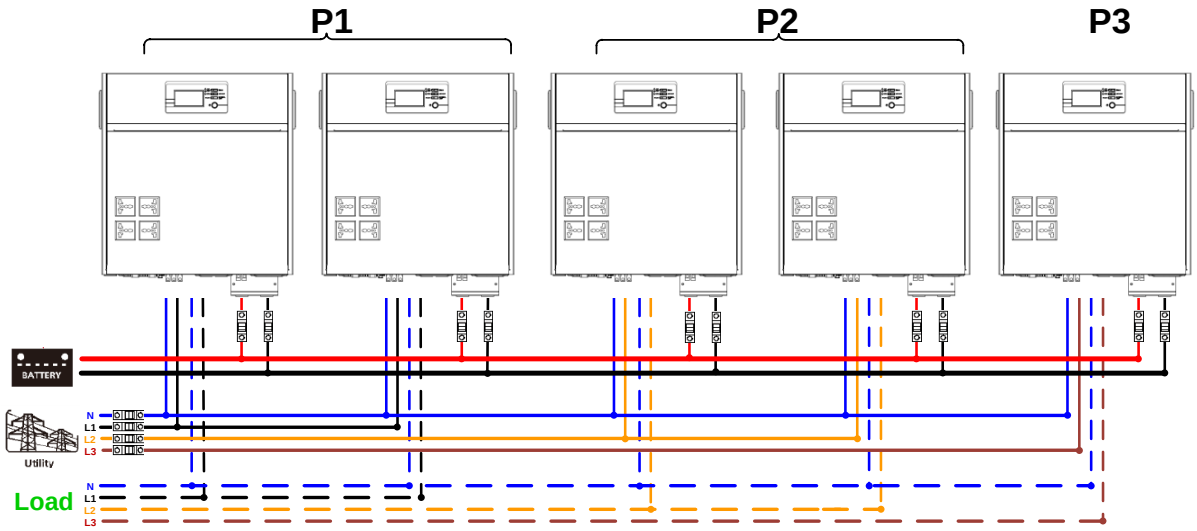


Communication Connection

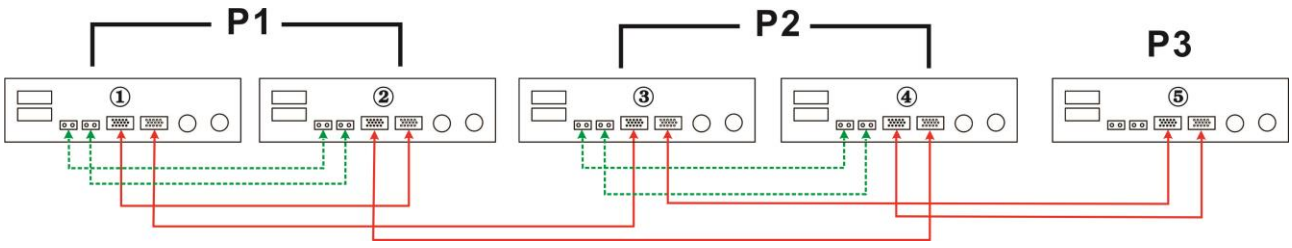


Two inverters in two phases and only one inverter for the remaining phase:

Power Connection

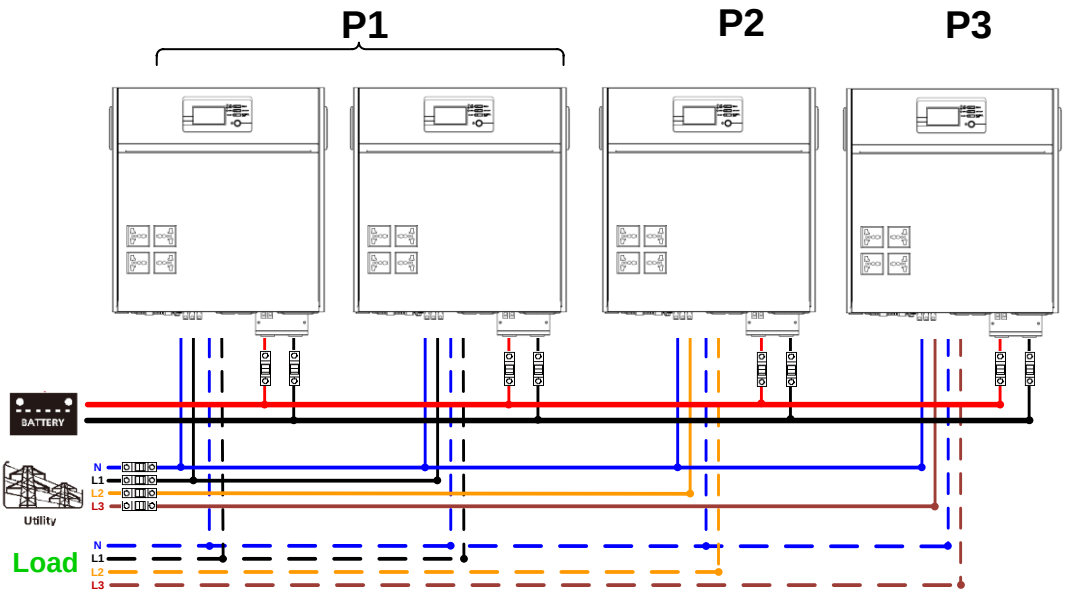


Communication Connection

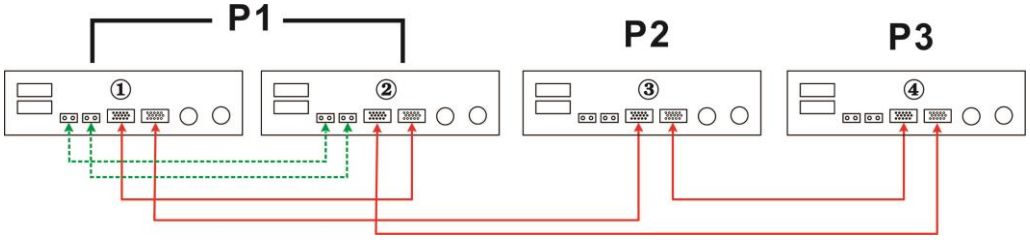


Two inverters in one phase and only one inverter for the remaining phases:

Power Connection

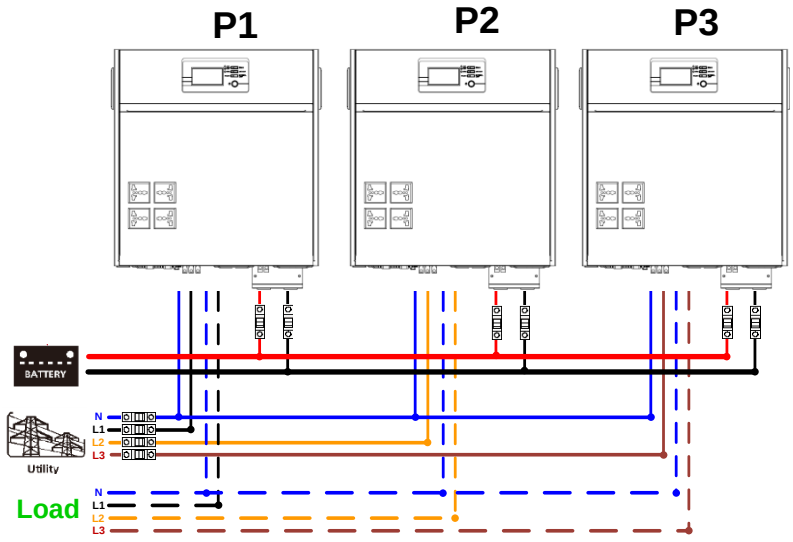


Communication Connection

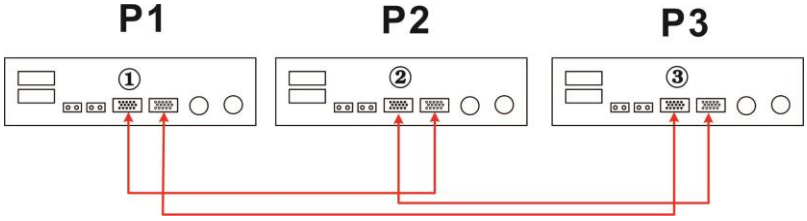


One inverter in each phase:

Power Connection



Communication Connection



WARNING: Do not connect the current sharing cable between the inverters which are in different phases. Otherwise, it may damage the inverters.

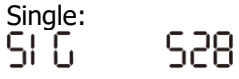
6. PV Connection

Please refer to user manual of single unit for PV Connection.

CAUTION: Each inverter should connect to PV modules separately.

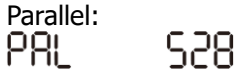
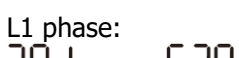
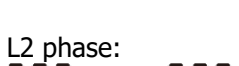
7. LCD Setting and Display

Setting Program:

<table>
<tr><th>Program</th><th>Description</th><th colspan="2">Selectable option</th></tr>
<tr><td rowspan="5">28</td><td rowspan="5">AC output mode
*This setting is only available when the inverter is in standby mode (Switch off).</td><td>Single:
  </td><td rowspan="5">When the units are used in parallel with single phase, please select “PAL” in program 28.

It is required to have at least 3 inverters or maximum 6 inverters to support three-phase equipment. It’s required to have at least one inverter in each phase or it’s up to four inverters in one phase. Please refers to 5-2 for detailed information.
Please select “3P1” in program 28 for the inverters connected to L1 phase, “3P2” in program 28 for the inverters connected to L2 phase and “3P3” in program 28 for the inverters connected to L3 phase.

Be sure to connect share current cable to units which are on the same phase.
Do NOT connect share current cable between units on different phases.

Besides, power saving function will be automatically disabled.</td></tr>
<tr><td>Parallel:
  </td></tr>
<tr><td>L1 phase:
  </td></tr>
<tr><td>L2 phase:
  </td></tr>
<tr><td>L3 phase:
  </td></tr>
<tr><td rowspan="2">30</td><td rowspan="2">PV judge condition (Only apply for setting “Solar first” in program 1: Output source priority)</td><td>One Inverter (Default):
  </td><td>When “ONE” is selected, as long as one of inverters has been connected to PV modules and PV input is normal, parallel or 3-phase system will continue working according to rule of “solar first” setting.
For example, two units are connected in parallel and set “SOL” in output source priority. If one of two units has connected to PV modules and PV input is normal, the parallel system will provide power to loads from solar or battery power. If both of them are not sufficient, the system will provide power to loads from utility.</td></tr>
<tr><td>All of Inverters:
</td><td>When “ALL” is selected, parallel or 3-phase system will continue working according to rule of “solar first” setting only when all of inverters are connected to PV modules.
For example, two units are connected in parallel and set “SOL” in output source priority. When selecting “ALL” in program 30, it’s necessary to have all inverters connected to PV modules and PV input is normal to allow the system to provide power to loads from solar and battery power. Otherwise, the system will provide power to loads from utility.</td></tr>
</table>

Fault code display:

Fault Code	Fault Event	Icon on
60	Power feedback protection	F60
71	Firmware version inconsistent	F71
72	Current sharing fault	F72
80	CAN fault	F80
81	Host loss	F81
82	Synchronization loss	F82
83	Battery voltage detected different	F83
84	AC input voltage and frequency detected different	F84
85	AC output current unbalance	F85
86	AC output mode setting is different	F86

8. Commissioning

Parallel in single phase

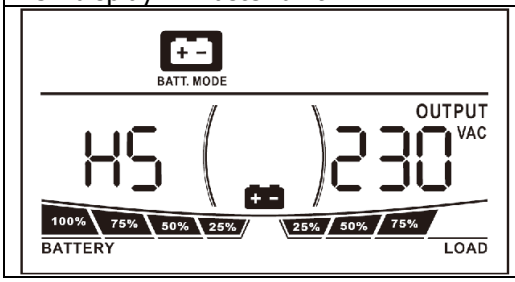
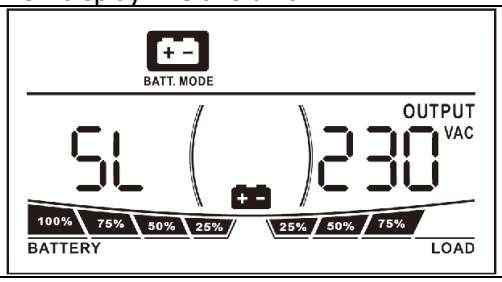
Step 1: Check the following requirements before commissioning:

- Correct wire connection
- Ensure all breakers in Line wires of load side are open and each Neutral wires of each unit are connected together.

Step 2: Turn on each unit and set "PAL" in LCD setting program 28 of each unit. And then shut down all units.

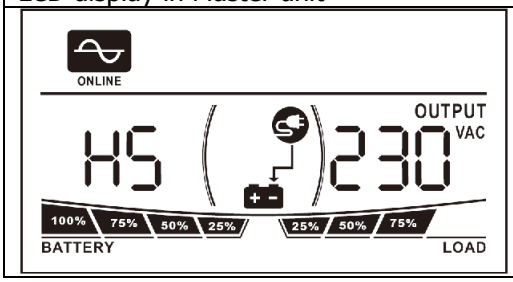
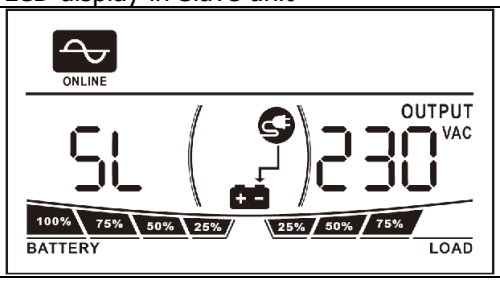
NOET: It's necessary to turn off switch when setting LCD program. Otherwise, the setting cannot be programmed.

Step 3: Turn on each unit.

LCD display in Master unit	LCD display in Slave unit
	

NOTE: Master and slave units are randomly defined.

Step 4: Switch on all AC breakers of Line wires in AC input. It's better to have all inverters connect to utility at the same time. If not, it will display fault 82 in following-order inverters. However, these inverters will automatically restart. If detecting AC connection, they will work normally.

LCD display in Master unit	LCD display in Slave unit
	

Step 5: If there is no more fault alarm, the parallel system is completely installed.

Step 6: Please switch on all breakers of Line wires in load side. This system will start to provide power to the load.

Support three-phase equipment

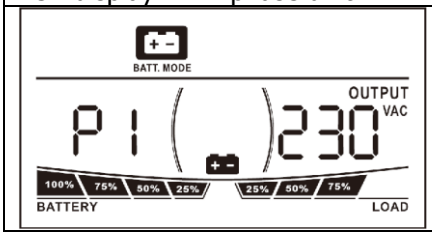
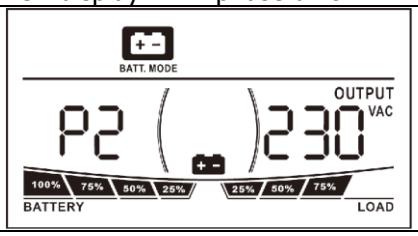
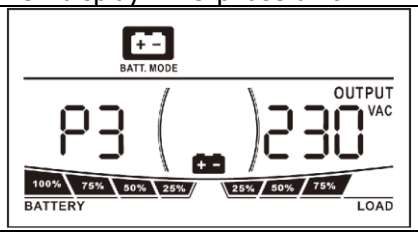
Step 1: Check the following requirements before commissioning:

- Correct wire connection
- Ensure all breakers in Line wires of load side are open and each Neutral wires of each unit are connected together.

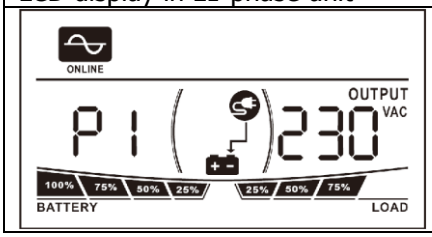
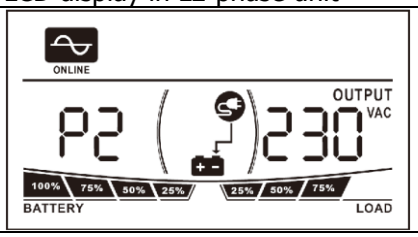
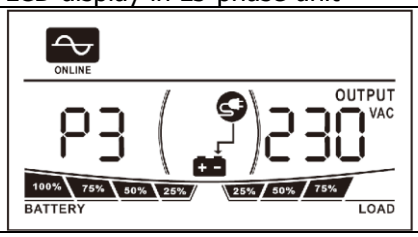
Step 2: Turn on all units and configure LCD program 28 as P1, P2 and P3 sequentially. And then shut down all units.

NOET: It's necessary to turn off switch when setting LCD program. Otherwise, the setting cannot be programmed.

Step 3: Turn on all units sequentially.

LCD display in L1-phase unit	LCD display in L2-phase unit	LCD display in L3-phase unit
		

Step 4: Switch on all AC breakers of Line wires in AC input. If AC connection is detected and three phases are matched with unit setting, they will work normally. If the sequences are not matched, it won't work in Line mode. You must exchange the wires of P2 & P3 or exchange the setting of P2 & P3.

LCD display in L1-phase unit	LCD display in L2-phase unit	LCD display in L3-phase unit
		

Step 5: If there is no more fault alarm, the system to support 3-phase equipment is completely installed.

Step 6: Please switch on all breakers of Line wires in load side. This system will start to provide power to the load.

Note 1: To avoid overload occurring, before turning on breakers in load side, it's better to have whole system in operation first.

Note 2: Transfer time for this operation exists. Power interruption may happen to critical devices, which cannot bear transfer time.

9. Trouble shooting

Situation		Solution
Fault Code	Fault Event Description	
60	Current feedback into the inverter is detected.	1. Restart the inverter. 2. Check if L/N cables are not connected reversely in all inverters. 3. For parallel system in single phase, make sure the sharing cables are connected in all inverters. For supporting three-phase system, make sure the sharing cables are connected in the inverters in the same phase, and disconnected in the inverters in different phases. 4. If the problem remains, please contact your installer.
71	The firmware version of each inverter is not the same.	1. Update all inverter firmware to the same version. 2. Check the version of each inverter via LCD setting and make sure the CPU versions are same. If not, please contact your instraller to provide the firmware to update. 3. After updating, if the problem still remains, please contact your installer.
72	The output current of each inverter is different.	1. Check if sharing cables are connected well and restart the inverter. 2. If the problem remains, please contact your installer.
80	CAN data loss	1. Check if communication cables are connected well and restart the inverter. 2. If the problem remains, please contact your installer.
81	Host data loss	
82	Synchronization data loss	
83	The battery voltage of each inverter is not the same.	1. Make sure all inverters share same groups of batteries together. 2. Remove all loads and disconnect AC input and PV input. Then, check battery voltage of all inverters. If the values from all inverters are close, please check if all battery cables are the same length and same material type. Otherwise, please contact your installer to provide SOP to calibrate battery voltage of each inverter. 3. If the problem still remains, please contact your installer.
84	AC input voltage and frequency are detected different.	1. Check the utility wiring conncetion and restart the inverter. 2. Make sure utility starts up at same time. If there are breakers installed between utility and inverters, please be sure all breakers can be turned on AC input at same time. 3. If the problem remains, please contact your installer.
85	AC output current unbalance	1. Restart the inverter. 2. Remove some excessive loads and re-check load information from LCD of inverters. If the values are different, please check if AC input and output cables are in the same length and material type. 3. If the problem remains, please contact your installer.
86	AC output mode setting is different.	1. Switch off the inverter and check LCD setting #28. 2. For parallel system in single phase, make sure no 3P1, 3P2 or 3P3 is set on #28. For upporting three-phase system, make sure no "PAL" is set on #28. 3. If the problem remains, please contact your installer.

Appendix II: Approximate Back-up Time Table

Model	Load (VA)	Backup Time @ 24Vdc 100Ah (min)	Backup Time @ 24Vdc 200Ah (min)
3KVA	300	449	1100
	600	222	525
	900	124	303
	1200	95	227
	1500	68	164
	1800	56	126
	2100	48	108
	2400	35	94
	2700	31	74
	3000	28	67

Model	Load (VA)	Backup Time @ 48Vdc 100Ah (min)	Backup Time @ 48Vdc 200Ah (min)
5KVA	500	613	1288
	1000	268	613
	1500	158	402
	2000	111	271
	2500	90	215
	3000	76	182
	3500	65	141
	4000	50	112
	4500	44	100
	5000	40	90

Note: Backup time depends on the quality of the battery, age of battery and type of battery.
Specifications of batteries may vary depending on different manufacturers.