

# User Manual

## **EPS II 3KVA/5KVA/6KVA INVERTER / CHARGER**

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# 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 are provided as over-current and reversed connection 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-functional inverter/charger, combining functions of inverter and battery charger to offer uninterruptible power for office and home appliances. Its comprehensive LCD display offers user-configurable parameters, such as battery charging current, and acceptable inputs voltage by setting easy-accessible buttons to fit different application.

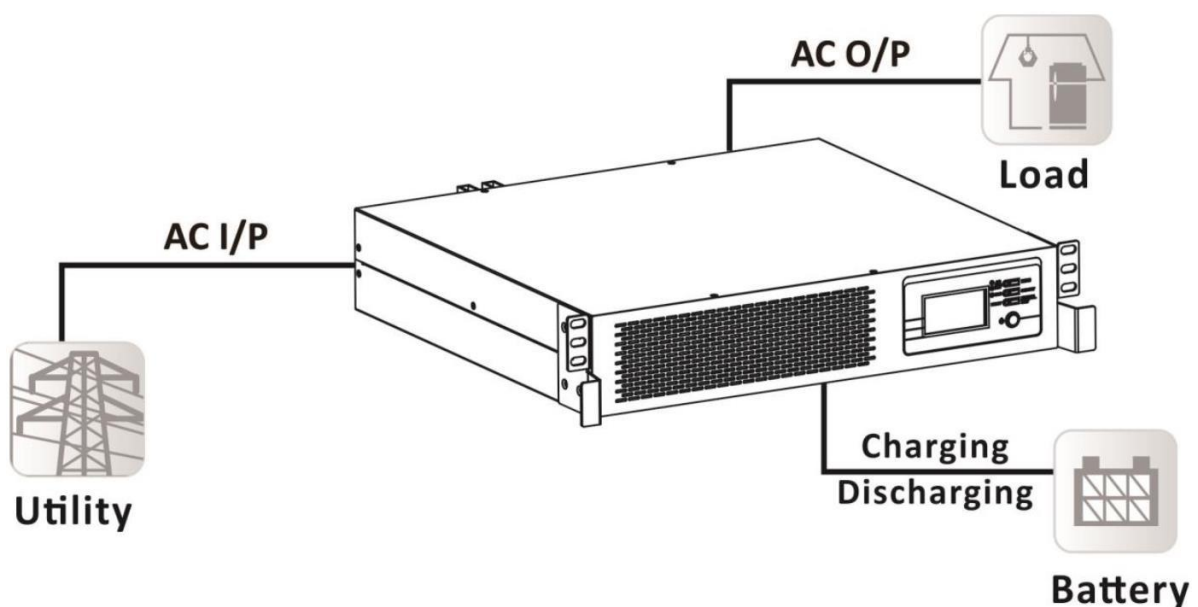
## Features

- Pure sine wave inverter
- Configurable battery charging current based on applications via LCD setting
- Compatible with mains voltage or generator power
- Auto restart while AC is recovering
- Overload/ Over temperature/ short circuit protection
- Smart battery charger designed for optimized battery performance
- Cold start function
- Reverse battery connection protection
- Utility start function

## Basic System Architecture

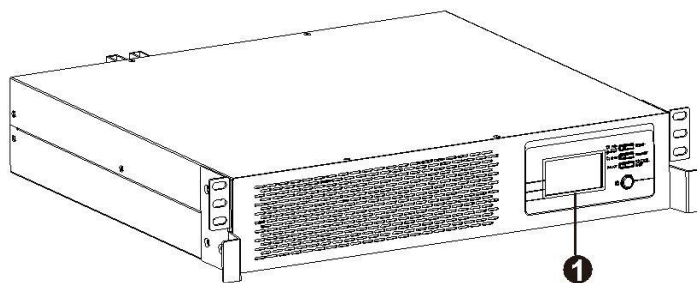
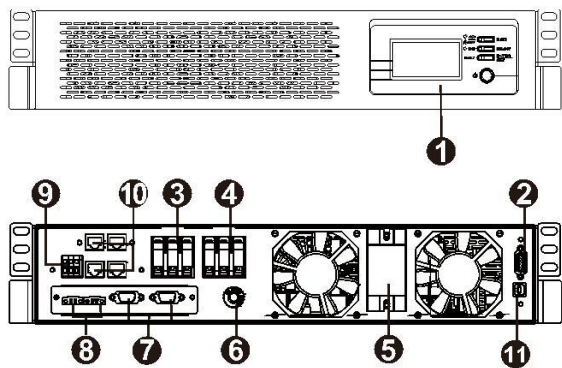
The following illustration shows basic application for this inverter/charger and this system should include generator or utility to form a complete running system. Consult with your system integrator for other possible system architectures depending on your requirements.

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



System Diagram

## Product Overview



1. Operation panel
2. RS-232 communication port
3. AC input terminal
4. AC output terminal
5. Battery input
6. Circuit breaker
7. Parallel communication ports
8. Share current ports
9. Dry contact
10. Communication ports
11. USB communication port

# 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 the package:

- The unit x 1
- User manual x 1
- Parallel cable x 2
- Software CD x 1

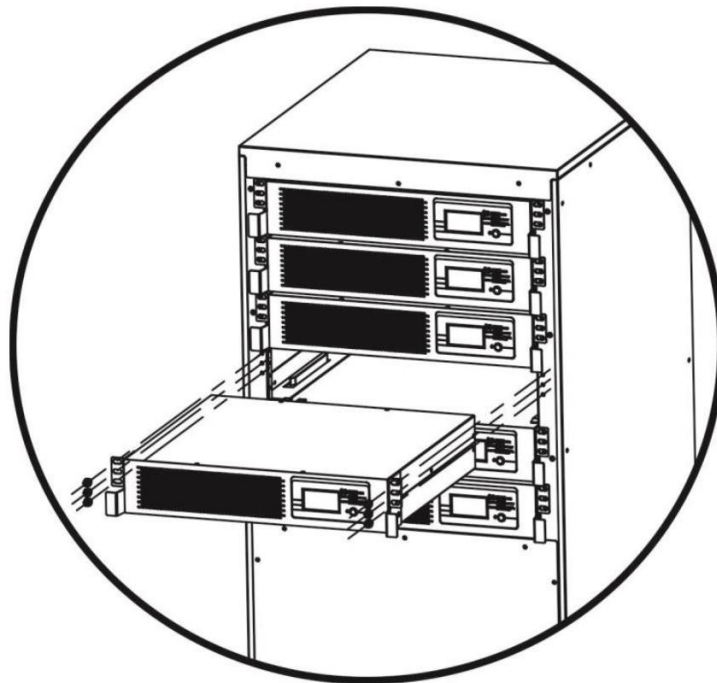
## Installation

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 40°C to ensure optimal operation.

## Rack Mounting

Please follow the diagram below to install the Inverter module in a 19-inch bay (with a depth of 600mm) at the desired height in the upright cabinet. Secure the device adequately and fix it to the cabinet with six screws.



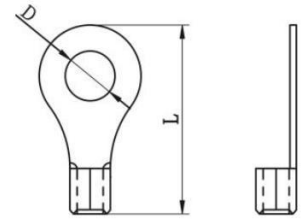
# Battery Connection

**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 the table below to select proper amperage, required fuse or breaker size.

**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 cable and terminal size as recommended below.

**Ring terminal:**

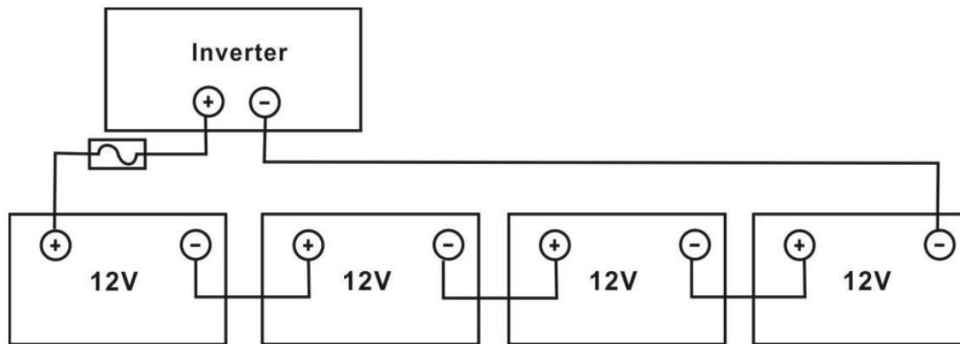


## Recommended battery cable and terminal size:

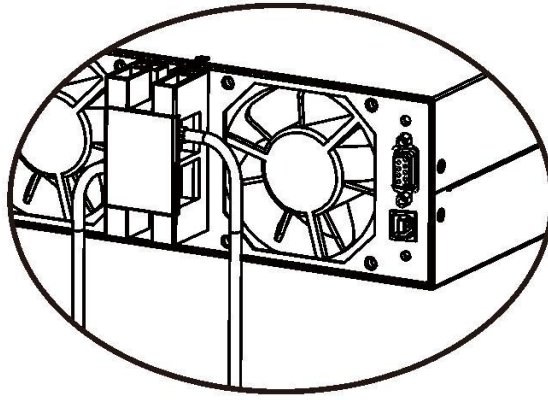
Model	Typical Amperage	Battery capacity	Wire Size	Ring Terminal			Torque value
				Cable mm <sup>2</sup>	Dimensions		
					D (mm)	L (mm)	
3KVA	80A	200AH	1*4AWG	22	6.4	33.2	2.5~3 Nm
			2*6AWG	28	6.4	29.2	
5KVA	137A	200AH	1*4AWG	22	6.4	33.2	2.5~3 Nm
			2*8AWG	14	6.4	29.2	
6KVA	140A	200AH	1*4AWG	22	6.4	33.2	2.5~3 Nm
			2*8AWG	14	6.4	29.2	


## Please follow the steps below to implement battery connection:


1. Assemble battery ring terminal based on recommended battery cable and terminal size.
2. Connect all battery packs as the diagram below. It's suggested to connect battery with at least 200Ah capacity.



3. Insert the ring terminal of battery cable flatly into battery connector of inverter and make sure the bolts are tightened with torque of 2.5-3 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. For 3KVA model, the recommended spec of AC breaker is 30A. For 5KVA model and 6KVA model, the recommended spec of AC breaker is 50A.

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

**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 cable size as recommended below.

### Suggested cable requirement for AC wires

Model	Gauge	Torque Value
3KVA	12 AWG	1.4~ 1.6Nm
5KVA	10 AWG	1.4~ 1.6Nm
6KVA	10 AWG	1.4~ 1.6Nm

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

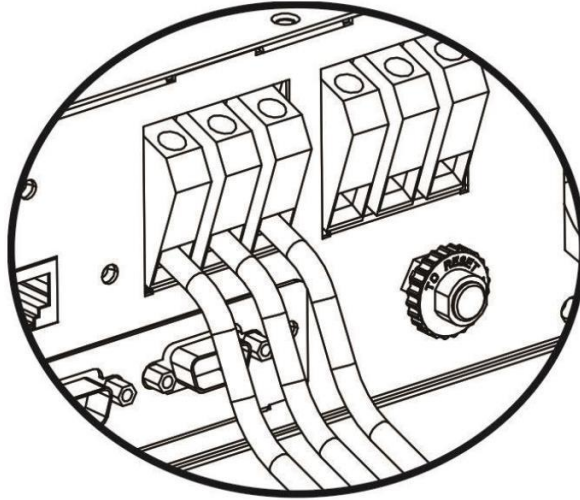
1. Before making AC input/output connection, be sure to disconnect DC protector or breaker on battery terminal first.
2. Remove insulation sleeve 10mm for six conductors.
3. Insert AC input wires according to polarities indicated on terminal block and tighten the terminal screws. Be sure to connect PE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

 → **Ground (yellow-green)**



**L→LINE (brown or black)**

**N→Neutral (blue)**



**WARNING:**

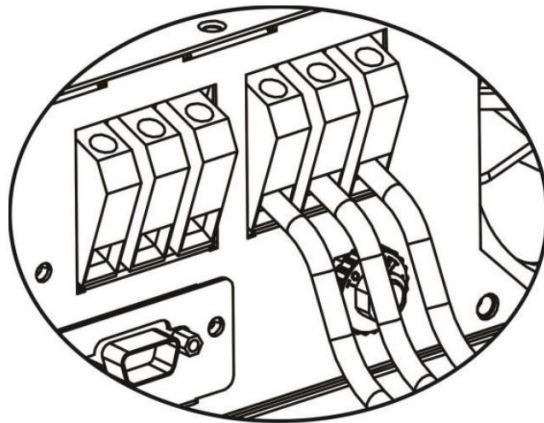
Be sure that AC power source is disconnected before attempting to fix the wire of the unit.

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)**



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 with manufacturer of air conditioner to see if it's equipped with time-delay function before installation. Otherwise, this inverter/charger will detect overload fault and cut off output to protect your appliance but sometimes it still causes internal damage to the air conditioner.

## Communication Connection

The inverter is equipped with two sets of RS-485 Modbus communication ports. RS-485-1 is for general communication with personal computer. It will provide advanced communication and monitoring options. RS-485-2 is for use with Li-battery. For detailed operation, please check your local dealer or installer.

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 in the CD.

### Dry Contact Signal

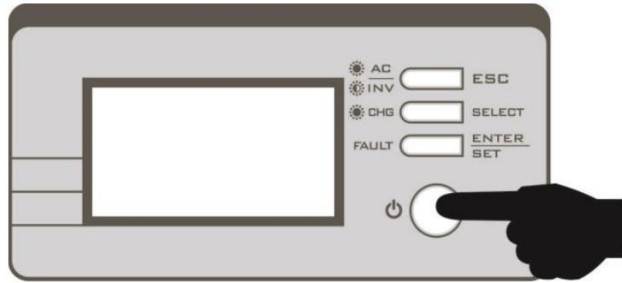
There is one dry contact (3A/250VAC) available on the rear panel. It could be used to deliver signal to connect external device based on different working mode.

Unit Status	Condition	Dry contact port	
		NC & C	NO & C
Power Off	Unit is off and no output is powered.	Close	Open
Power On	Output is powered from Utility.	Close	Open
	Output is powered from Battery.	Open	Close



# OPERATION

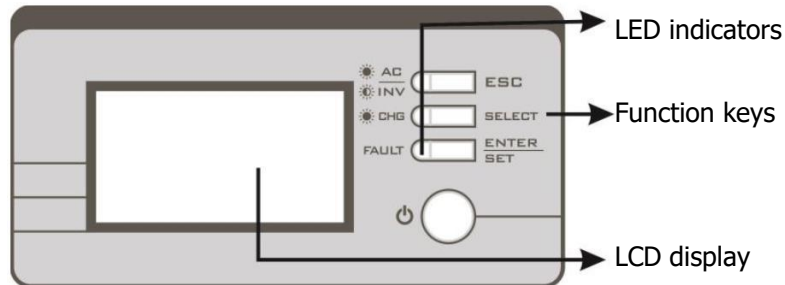
## Power ON/OFF



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 indicators, three function keys and a LCD display, indicating the operating status and input/output power information.



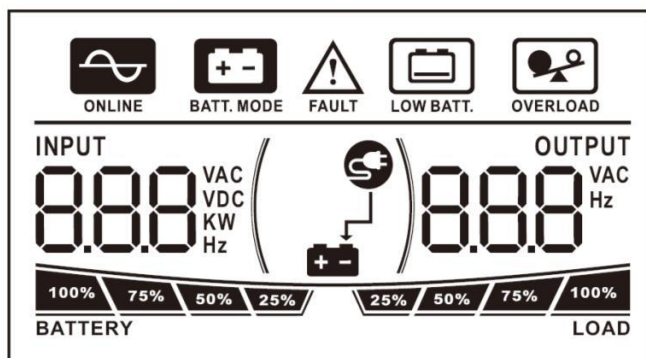
### LED Indicators

LED Indicator		Messages	
☀ AC / ☀ INV	Green	Solid On	Output is powered by utility in Line mode.
		Flashing	Output is powered by battery 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	
<b>Input Source Information</b>		
	Indicates input voltage, input frequency and battery voltage, charging power or setting value.	
<b>Output Information</b>		
	Indicates output voltage, output frequency, setting program NO or fault code.	
	Indicates percentage of load	
<b>Battery Information</b>		
	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	
	2 ~ 2.083V/cell	
	2.083 ~ 2.167V/cell	
	> 2.167 V/cell	
Floating mode. Batteries are fully charged.		
In battery mode, it will present battery capacity.		
Load Percentage	Battery Voltage	LCD Display
Load >50%	< 1.717V/cell	
	1.717V/cell ~ 1.8V/cell	
	1.8 ~ 1.883V/cell	
	> 1.883 V/cell	

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

### Load Information

 OVERLOAD	Indicates unit is overload.			
 LOAD	Indicates the load level by 0-24%, 25-50%, 50-74% and 75-100%.			
	0%~25%	25%~50%	50%~75%	75%~100%
	 LOAD	 LOAD	 LOAD	 LOAD

### Mode Operation Information

 ONLINE	Indicates the load is supplied by utility power.
 BATT. MODE	Indicates the load is supplied by battery
 FAULT	Indicates alarm or fault happened.
	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 "SELECT" button to select setting programs. And then, press "ENTER" button to confirm the selection or ESC button to exit.

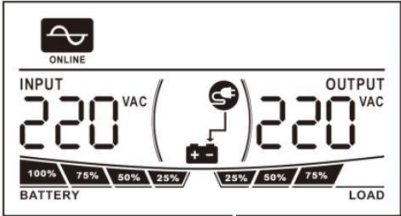
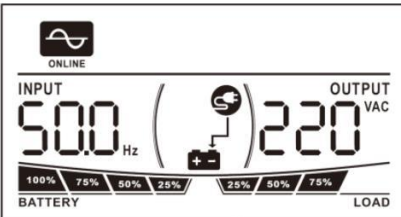
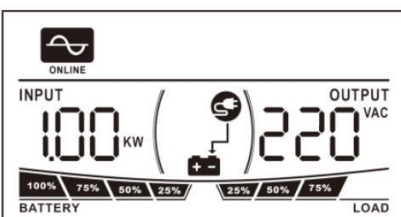
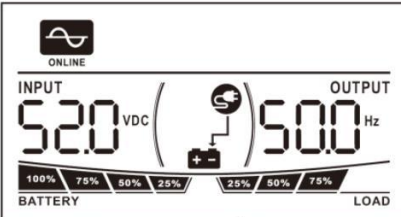

### Setting Programs:

Program	Description	Selectable option	
00	Exit setting mode	Escape ESC 00	
02	Output voltage	220V (default) 220 02	230V 230 02
		240V 240 02	
03	Output frequency	50Hz (default) 50 <sub>Hz</sub> 03	60Hz 60 <sub>Hz</sub> 03
04	Maximum utility charging current	2A 2A 04	10A (default) 10A 04
		20A 20A 04	30A 30A 04
		40A 40A 04	50A 50A 04
		60A 60A 04	
05	Bulk charging voltage (C.V voltage)	Default setting: 56.4V 56.4 <sup>VDC</sup> 05	
		This program can be set up. Setting range is from 48.0V to 58.4V for 48V model. Each click increment 0.1V.	
06	Floating charging voltage	Default setting: 54V 54.0 <sup>VDC</sup> 06	
		This program can be set up. Setting range is from 48.0V to 58.4V for 48V model. Each click increment 0.1V.	
07	Low DC cut-off voltage	Default setting: 42V 42.0 <sup>VDC</sup> 07	
		This program can be set up. Setting range is from 40.0V to 48.0V for 48V model. Each click increment 0.1V. Low DC cut-off voltage will be fixed to setting value no matter what percentage of load is connected.	
09	Power saving mode enable/disable	Saving mode disable (default) 5d5 09	If disabled, no matter connected load is low or high, the output (on/off status) of inverter will not be affected.
		Saving mode enable 5e7 09	If enabled, the output of inverter will be off when connected load is pretty low or not detected.

Program	Description	Selectable option	
10	Auto restart when overload occurs	Restart disable (default) Lfd 10	Restart enable LFE 10
11	Auto restart when temperature is too high	Restart disable (default) tfd 11	Restart enable tFE 11
12	Alarm control	Alarm on (default) bOn 12	Alarm off bOf 12
13	Auto return to default display screen	Return to default display screen (default) ESP 13	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.
		Stay at latest screen tEP 13	If selected, the display screen will stay at the latest screen user finally switches.
14	Backlight control	Backlight on (default) LON 14	Backlight off LOF 14
15	Beeps while primary source is interrupted	Alarm on (default) aOn 15	Alarm off aOf 15
16	Record Fault code	Record enable FEOn 16	Record disable (default) FdS 16
17	Setting communications ID	Default setting: 001 001 17	
		Setting range is from 000 to 255. Increment of each click is 1.	
18	Setting communications baud rate	2400 24 18	4800 48 18
		9600 (default) 96 18	19200 192 18
19	Setting communications stop bit	01 (default) 01 19	02 02 19
20	Setting communications check bit	00 (default) n0 20	01 Odd 20
		02 E4n 20	

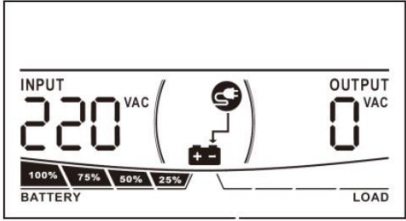
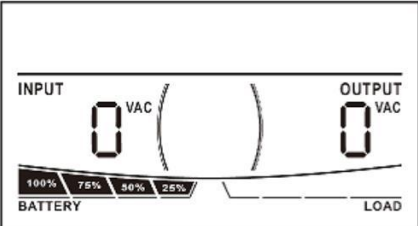
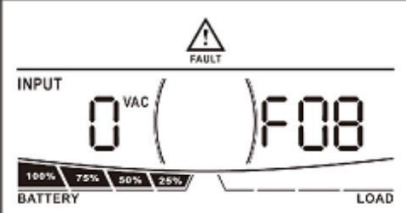
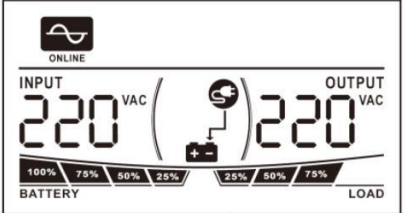
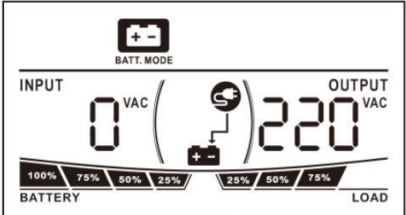
## Display Setting

To switch display of the LCD information in turn, press "SELECT" key. The selectable information is switched to display in order as below: input voltage/output voltage, input frequency, Utility charging power, battery voltage/output frequency and main CPU Version.

Selectable information	LCD display
Input voltage/Output voltage (Default Display Screen)	<p>Input Voltage=220V, output voltage=220V</p>  <p>The LCD display shows 'ONLINE' at the top left. Below it, 'INPUT 220 VAC' is displayed on the left and 'OUTPUT 220 VAC' on the right. A battery icon with a plus sign is in the center. At the bottom, there are two progress bars: 'BATTERY' on the left and 'LOAD' on the right, both with markers for 100%, 75%, 50%, and 25%.</p>
Input frequency	<p>Input frequency=50Hz</p>  <p>The LCD display shows 'ONLINE' at the top left. Below it, 'INPUT 50.0 Hz' is displayed on the left and 'OUTPUT 220 VAC' on the right. A battery icon with a plus sign is in the center. At the bottom, there are two progress bars: 'BATTERY' on the left and 'LOAD' on the right, both with markers for 100%, 75%, 50%, and 25%.</p>
Utility charging power	<p>Utility charging power =1000W</p>  <p>The LCD display shows 'ONLINE' at the top left. Below it, 'INPUT 100 KW' is displayed on the left and 'OUTPUT 220 VAC' on the right. A battery icon with a plus sign is in the center. At the bottom, there are two progress bars: 'BATTERY' on the left and 'LOAD' on the right, both with markers for 100%, 75%, 50%, and 25%.</p>
Battery voltage/ Output frequency	<p>Battery voltage =52.0V, output frequency = 50.0Hz</p>  <p>The LCD display shows 'ONLINE' at the top left. Below it, 'INPUT 52.0 VDC' is displayed on the left and 'OUTPUT 50.0 Hz' on the right. A battery icon with a plus sign is in the center. At the bottom, there are two progress bars: 'BATTERY' on the left and 'LOAD' on the right, both with markers for 100%, 75%, 50%, and 25%.</p>
Main CPU version checking	<p>Main CPU version 1.00</p>  <p>The LCD display shows 'ONLINE' at the top left. Below it, 'U1' is displayed on the left and '100' on the right. A battery icon with a plus sign is in the center. At the bottom, there are two progress bars: 'BATTERY' on the left and 'LOAD' on the right, both with markers for 100%, 75%, 50%, and 25%.</p>







## Description of Operating Mode

Operation mode	Description	LCD display
<p>Standby mode / Power saving mode</p> <p><b>Note:</b></p> <p>*Standby mode: The inverter is not turned on yet but at this time, the inverter can charge battery without AC output.</p> <p>*Power saving mode: If enabled, the output of inverter will be off when connected load is pretty low or not detected.</p>	<p>No output is supplied by the unit but it still can charge batteries.</p>	<p>Charging by utility.</p>  <p>No charging.</p> 
<p>Fault mode</p> <p><b>Note:</b></p> <p>*Fault mode: Errors are caused by errors inside circuit or external reasons such as high temperature, output short-circuit and so on.</p>	<p>No output and No charging</p>	<p>No charging.</p> 
<p>Line Mode</p>	<p>The unit will provide output power from the mains. It will also charge the battery at line mode.</p>	<p>Charging by utility.</p> 
<p>Battery Mode</p>	<p>The unit will provide output power from battery</p>	<p>Power from battery only.</p> 

## 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 too high.	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

## 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	 BATTERY
Low battery	Beep once every second	 LOW BATT.
Overload	Beep once every 0.5 second	 OVERLOAD

# SPECIFICATIONS

**Table 1 Line Mode Specifications**

INVERTER MODEL	3KVA	5KVA	6KVA
<b>Input Voltage Waveform</b>	Sinusoidal (utility or generator)		
<b>Nominal Input Voltage</b>	220Vac		
<b>Low Loss Voltage</b>	170Vac±3V		
<b>Low Loss Return Voltage</b>	180Vac±3V		
<b>High Loss Voltage</b>	255Vac±3V		
<b>High Loss Return Voltage</b>	245Vac±3V		
<b>Max AC Input Voltage</b>	300Vac		
<b>Nominal Input Frequency</b>	50Hz / 60Hz (Auto detection)		
<b>Low Loss Frequency</b>	47.5±1Hz		
<b>Low Loss Return Frequency</b>	48±1Hz		
<b>High Loss Frequency</b>	52.5±1Hz		
<b>High Loss Return Frequency</b>	52±1Hz		
<b>Output Short Circuit Protection</b>	Line mode: Circuit Breaker; Battery mode: Electronic Circuits		
<b>Efficiency (Line Mode)</b>	>97% ( Rated R load, battery full charged )		
<b>Transfer Time *</b>	10ms typical		

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

**Table 2 Inverter Mode Specifications**

INVERTER MODEL	3KVA	5KVA	6KVA
<b>Rated Output Power</b>	3KVA/3KW	5KVA/5KW	6KVA/5.1KW
<b>Output Voltage Waveform</b>	Pure Sine Wave		
<b>Output Voltage Regulation</b>	220Vac±5%		
<b>Output Frequency</b>	60Hz or 50Hz		
<b>Peak Efficiency</b>	90%		
<b>Overload Protection</b>	5s@≥150% load; 1 min@125%~150% load; 5 min.@110%~125%		
<b>Surge Capacity</b>	2* rated power for 5 seconds		
<b>Nominal DC Input Voltage</b>	48Vdc		
<b>Cold Start Voltage</b>	46.0Vdc		
<b>Low DC Warning Voltage</b> @ load < 20% @ 20% ≤ load < 50% @ load ≥ 50%	44.0Vdc 42.8Vdc 40.4Vdc		
<b>Low DC Warning Return Voltage</b> @ load < 20% @ 20% ≤ load < 50% @ load ≥ 50%	46.0Vdc 44.8Vdc 42.4Vdc		
<b>Low DC Cut-off Voltage</b> @ load < 20% @ 20% ≤ load < 50% @ load ≥ 50%	42.0Vdc 40.8Vdc 38.4Vdc		
<b>High DC Recovery Voltage</b>	58Vdc		
<b>High DC Cut-off Voltage</b>	60Vdc		
<b>No Load Power Consumption</b>	<50W		
<b>Saving Mode Power Consumption</b>	<15W		

**Table 3 Charge Mode Specifications**

Utility Charging Mode			
INVERTER MODEL	3KVA	5KVA	6KVA
<b>Charging Current (UPS)</b> @ Nominal Input Voltage	Default: 30A, Max.: 60A		
<b>Bulk Charging Voltage</b>	56.4Vdc		
<b>Floating Charging Voltage</b>	54Vdc		
<b>Charging Algorithm</b>	3-Step		
<b>Charging Curve</b>			

**Table 4 General Specifications**

INVERTER MODEL	3KVA	5KVA	6KVA
<b>Safety Certification</b>	CE		
<b>Operating Temperature Range</b>	0°C to 40°C		
<b>Storage temperature</b>	-15°C~ 60°C		
<b>Dimension (D*W*H), mm</b>	400 x 438 x 86.3		
<b>Net Weight, kg</b>	8.7	9.2	9.2

# 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 at fault.	Check if AC breaker is at fault and AC wiring is connected well.
	Green LED is flashing.	Insufficient quality of AC power. (Shore or Generator)	Check if AC wires are too thin and/or too long.
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 the components inside converter is over 120°C.	Check whether the air flow of the unit is blocked or whether the ambient temperature is too high.
	Fault code 02	Temperature of component inside inverter 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 meet the requirements.
	Fault code 01	Fan fault	Replace the fan.
	Fault code 06/58	Abnormal output (Inverter voltage is lower than 190Vac or is higher than 260Vac)	1. Reduce the connected load. 2. Return it to repair center
	Fault code 08/09/53/57	Internal components failed.	Return it to repair center.
	Fault code 51	Over current or surge.	Restart the unit. If the error happens again, please return it 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 burnt out.	If the battery is connected well, please return it to repair center.	

# Appendix I: Parallel function

## 1. Introduction

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

1. Parallel operation in single phase with up to 9 units. The maximum supported output power for 3KVA is 27KW/27KVA and for 5KVA is 45KW/45KVA and for 6KVA is 45.9KW/54KVA.
2. Nine units work together at its maximum to support three-phase equipment. Seven units support one phase at its maximum. For 3KVA, the maximum supported output power is 27KW/27KVA and one phase can be up to 21KW/21KVA. For 5KVA, the maximum supported output power is 45KW/45KVA and one phase can be up to 35KW/35KVA. For 6KVA, the maximum supported output power is 45.9KW/54KVA and one phase can be up to 35.7KW/42KVA.

**NOTE:** If this unit is bundled with shared current cable and parallel cable, this inverter is supported parallel operation at default. If not, please purchase parallel kit and install this unit according to the following instructions by professional technical personnel from local dealer.

## 2. Package Contents

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

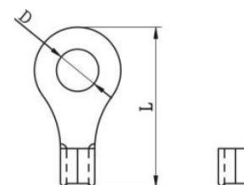


Parallel communication cable



Current sharing cable

Ring terminal:



## 3. 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 <sup>2</sup>	Dimensions		
			D (mm)	L (mm)	
3KVA	1*4AWG	22	6.4	33.2	2~ 3 Nm
	2*6AWG	28	6.4	29.2	
5KVA	1*4AWG	22	6.4	33.2	2~ 3 Nm
	2*8AWG	14	6.4	29.2	
6KVA	1*4AWG	22	6.4	33.2	2~ 3 Nm
	2*8AWG	14	6.4	29.2	

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

### Recommended cable size for AC input and output each inverter:

Model	AWG no.	Torque
3KVA	12 AWG	1.4~1.6Nm
5KVA	10 AWG	1.4~1.6Nm
6KVA	10 AWG	1.4~1.6Nm

You need to connect the cables of each inverter. Take the battery cables for example: You need to use a connector or bus-bar as a joint to connect the battery cables, and then connect it to the battery terminal. The cable size used from joint to battery should be X times to the 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 side of battery and AC input. This will ensure the inverter securely is 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 chart in sections 4-1 and 4-2.

**Recommended specification of battery breaker for each inverter:**

Model	One unit*
3KVA	100A/80VDC
5KVA	150A/80VDC
6KVA	150A/80VDC

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

**Recommended specification of AC input breaker for single-phase application:**

Inverter # Model	2 units	3 units	4 units	5 units	6 units	7 units	8 units	9 units
3KVA	100A	150A	200A	250A	300A	350A	400A	450A
5KVA	100A	150A	200A	250A	300A	350A	400A	450A
6KVA	100A	150A	200A	250A	300A	350A	400A	450A

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

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

**Recommended battery capacity**

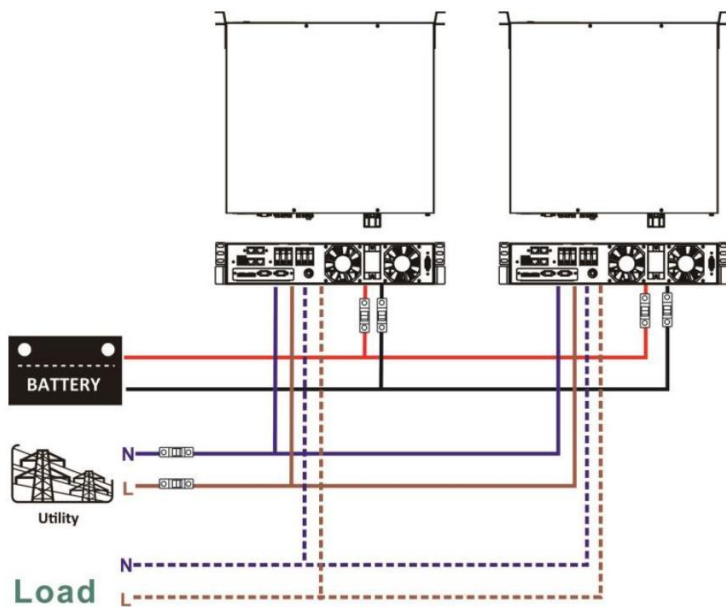
Inverter parallel numbers	2	3	4	5	6	7	8	9
Battery Capacity	400AH	600AH	800AH	1000AH	1200AH	1400AH	1600AH	1800AH
Recommended total charging current	80A	120A	160A	200A	240A	280A	320A	360A

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

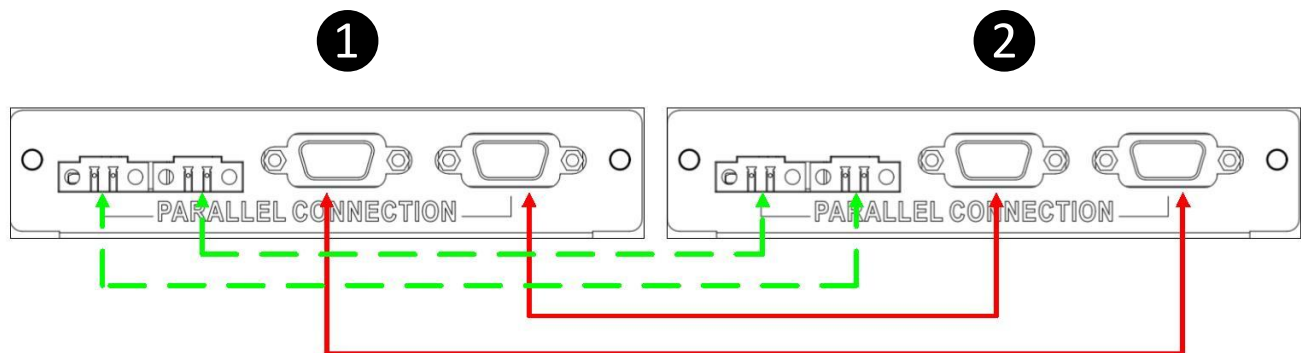
## 4-1. Parallel Operation in Single phase

Two inverters in parallel:

### Power Connection

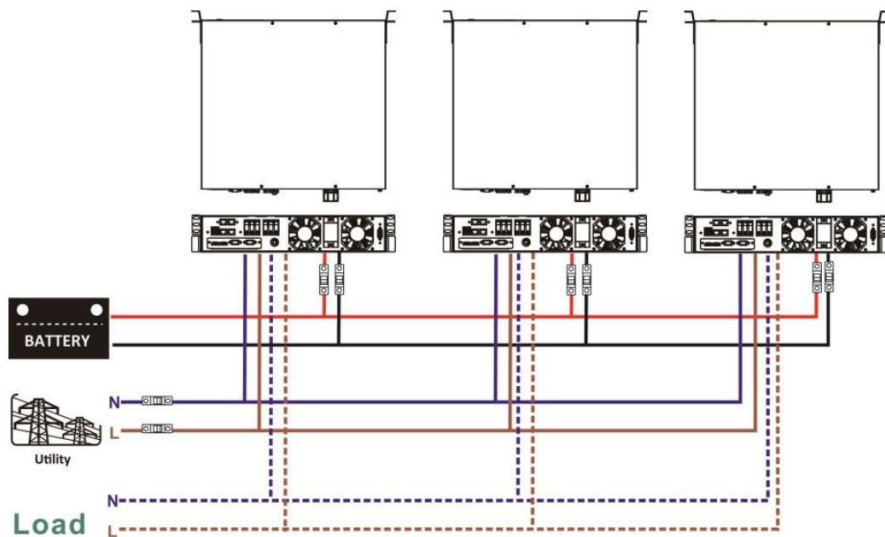


### Communication Connection



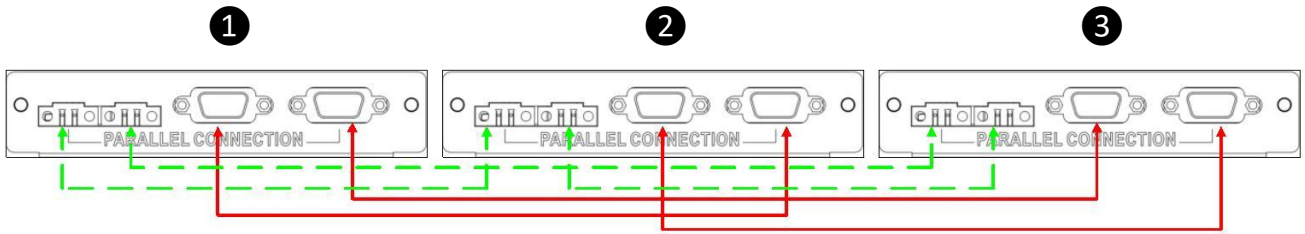
Three inverters in parallel:

### Power Connection



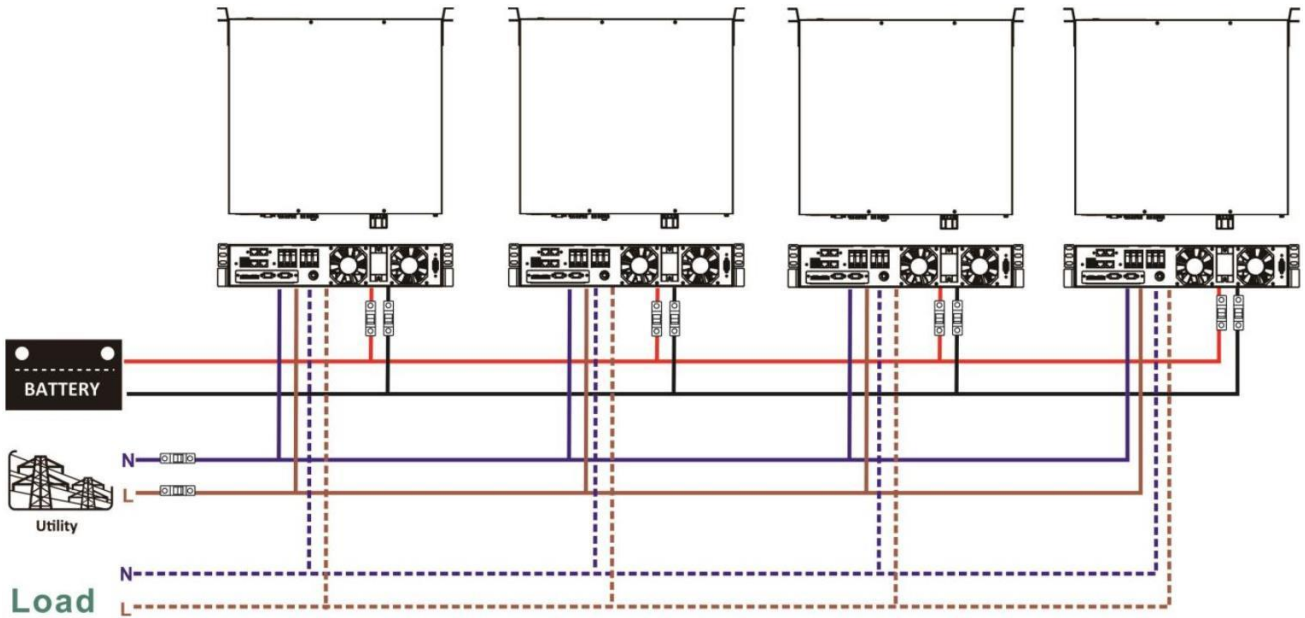


### Communication Connection

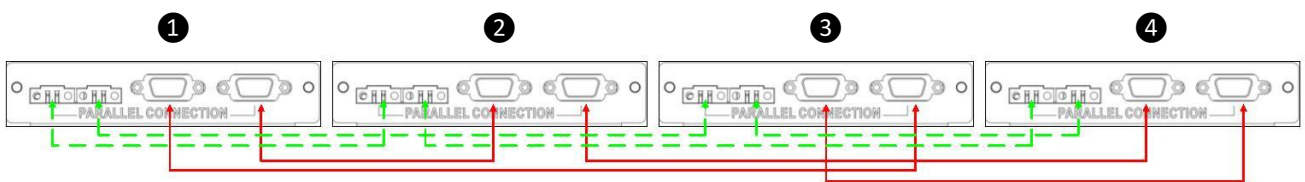


Four inverters in parallel:

### Power Connection

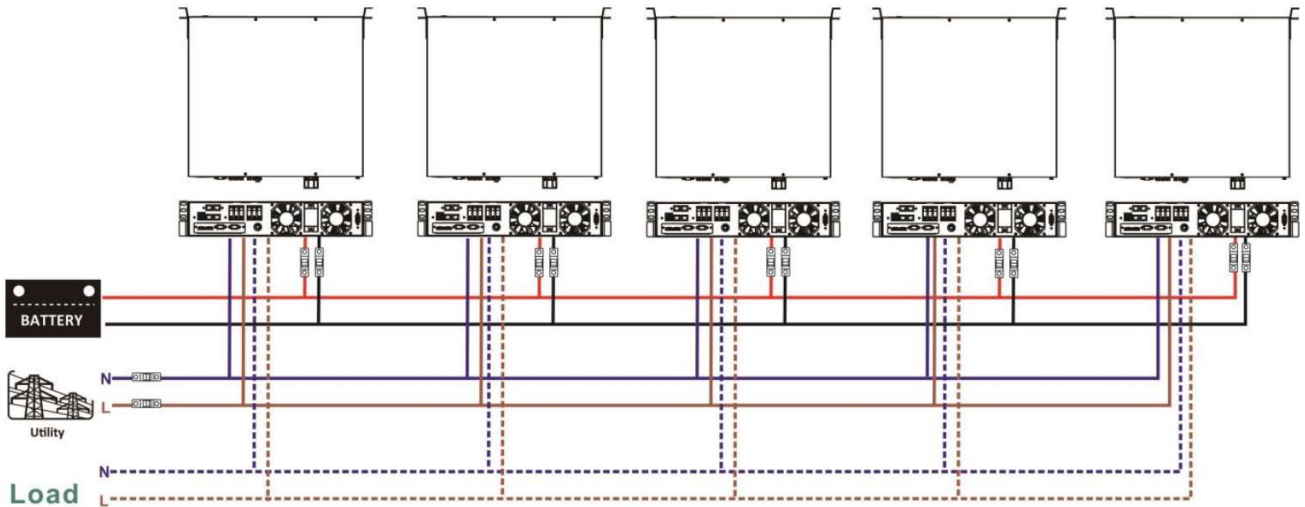


### Communication Connection

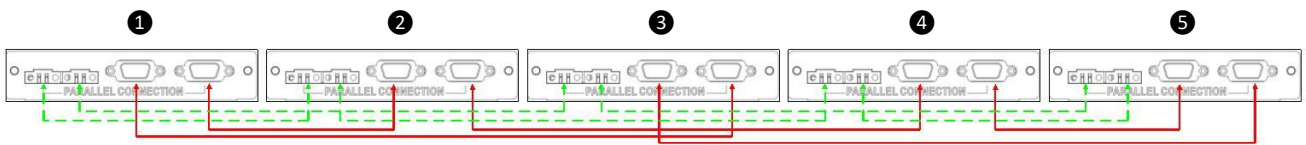


Five inverters in parallel:

### Power Connection

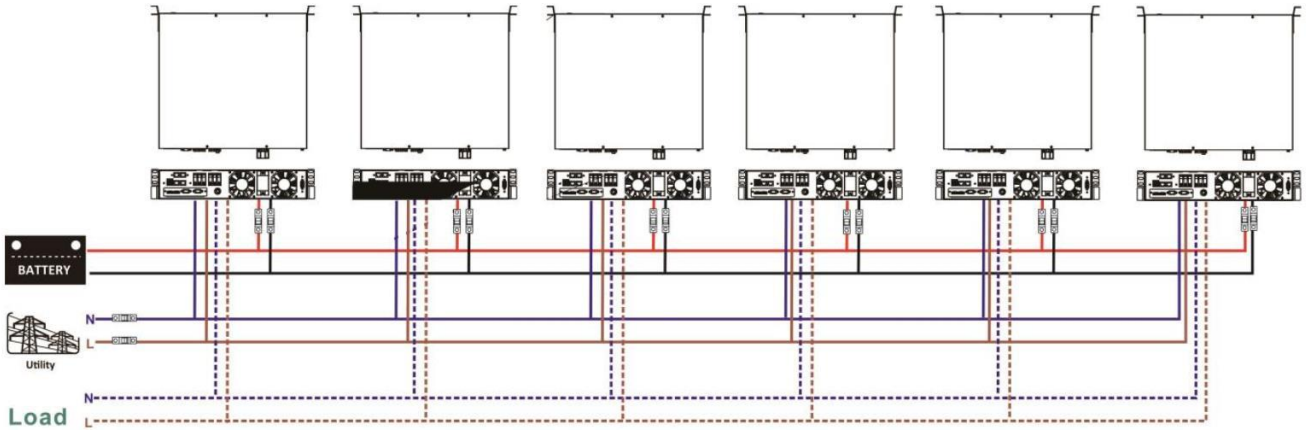


## Communication Connection

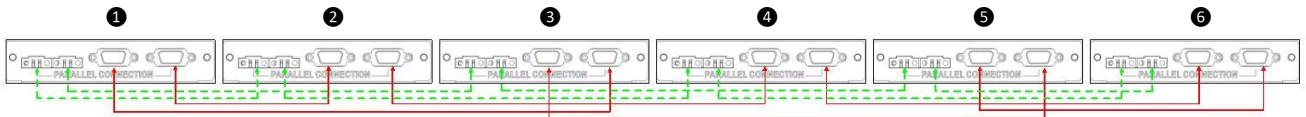


Six inverters in parallel:

## Power Connection

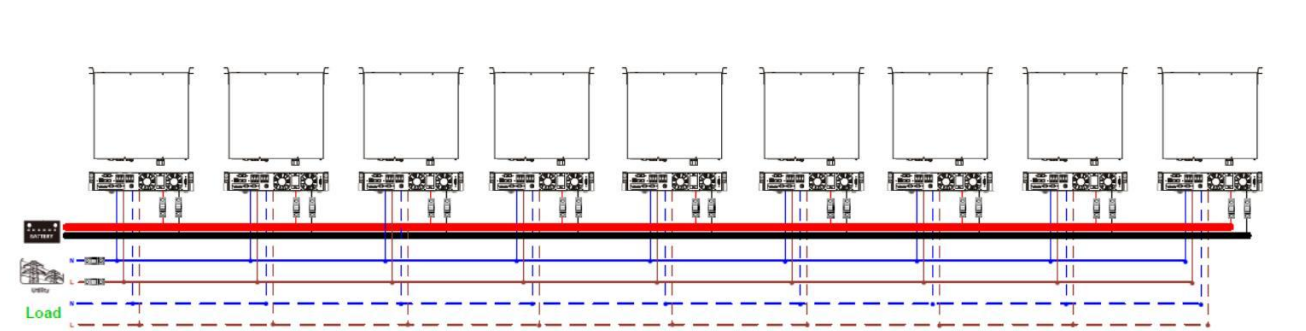


## Communication Connection



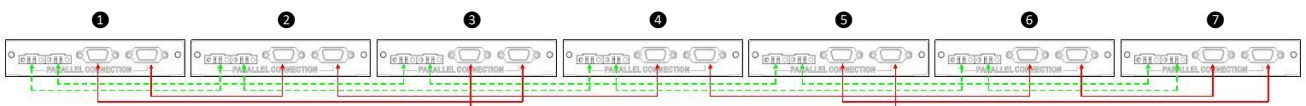
Seven to nine inverters in parallel:

## Power Connection

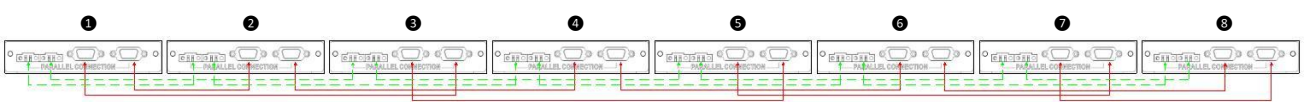


## Communication Connection

➤ Seven inverters in parallel



➤ Eight inverters in parallel



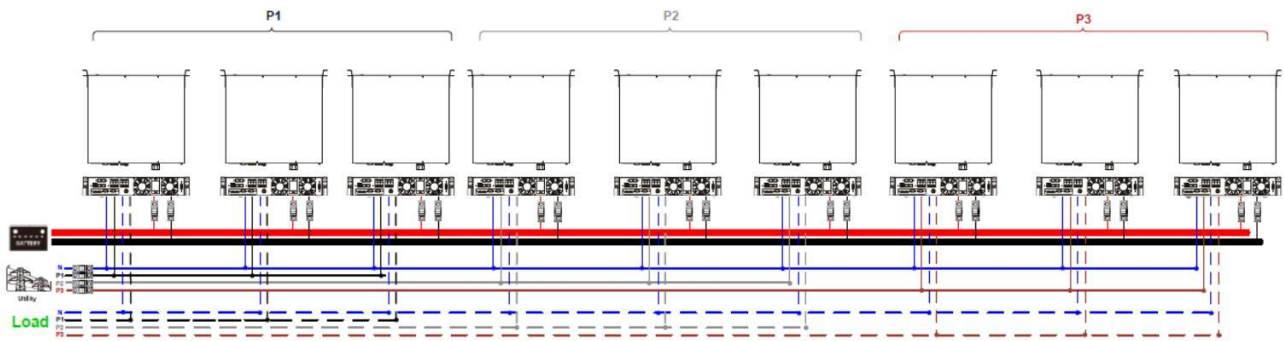
➤ Nine inverters in parallel



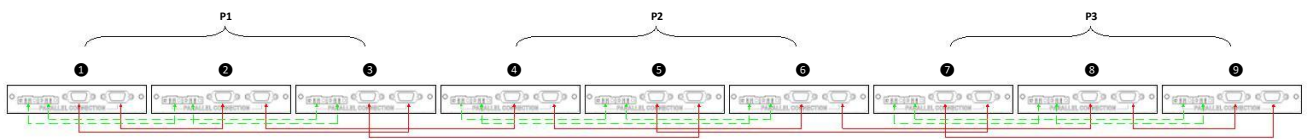
## 4-2. Support 3-phase equipment

Three inverters in each phase:

### Power Connection

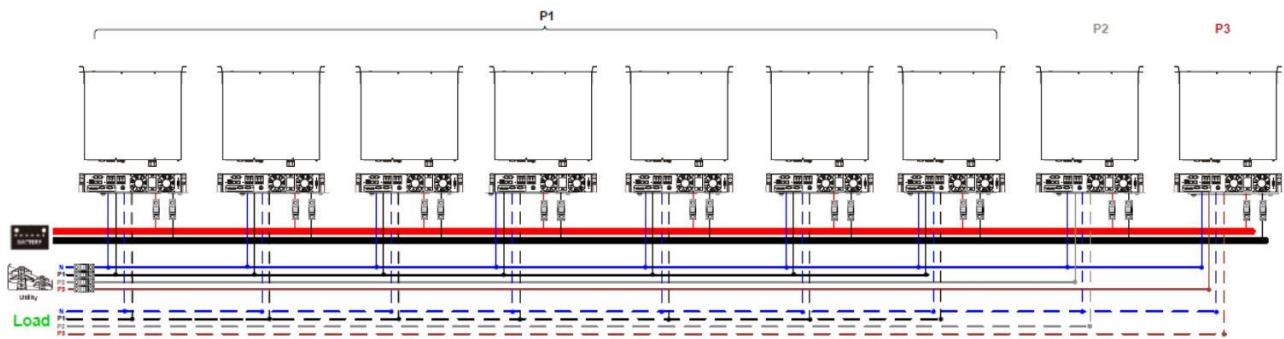


### Communication Connection



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

### Power Connection



**Note:** It's up to customer's demand to pick 7 inverters on any phase.

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

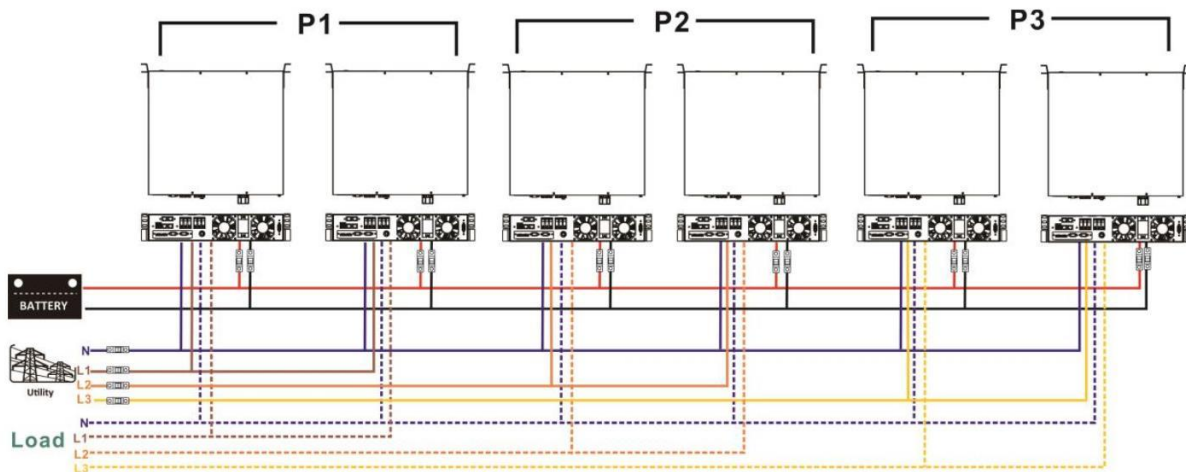
### Communication Connection



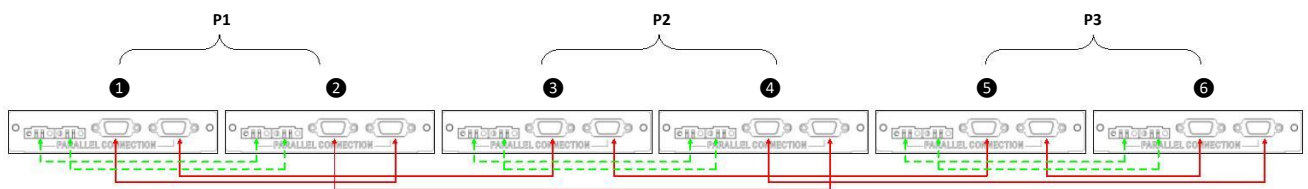
**Note:** If there is only one unit in one phase, it is not necessary to connect the current sharing cable.

Two inverters in each phase:

**Power Connection**

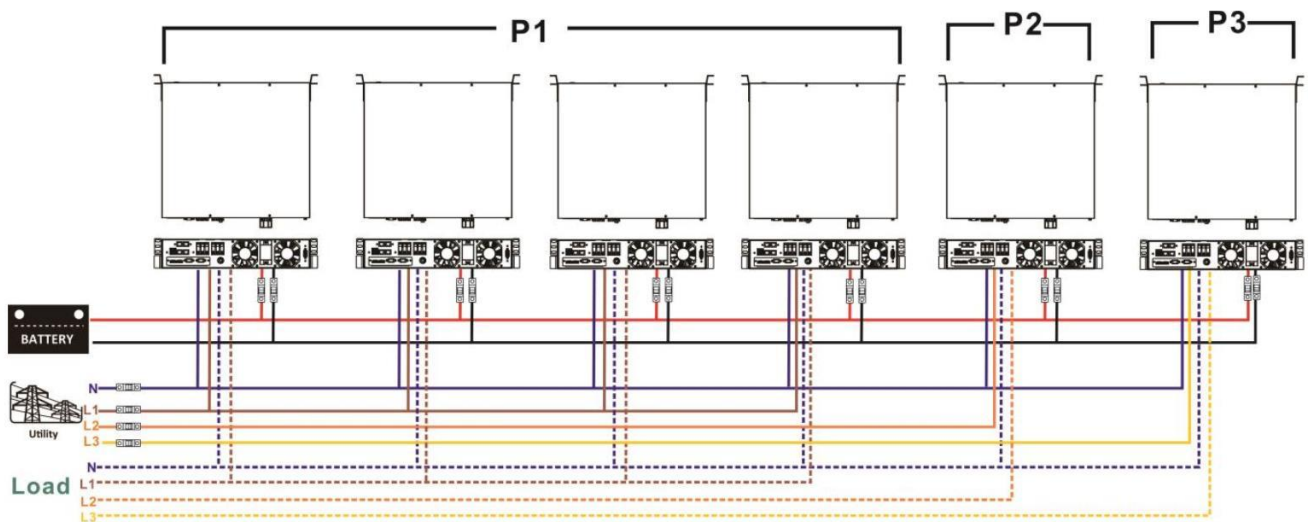


**Communication Connection**



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

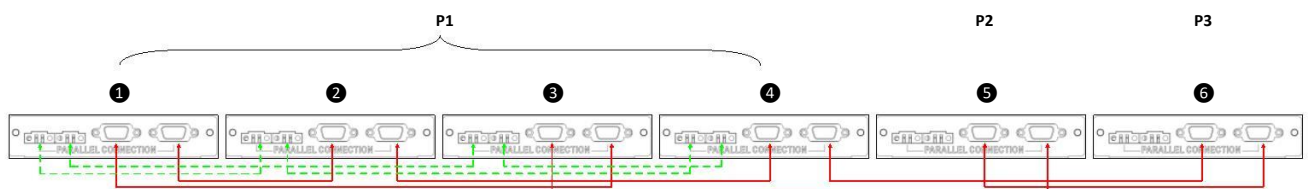
**Power Connection**



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

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

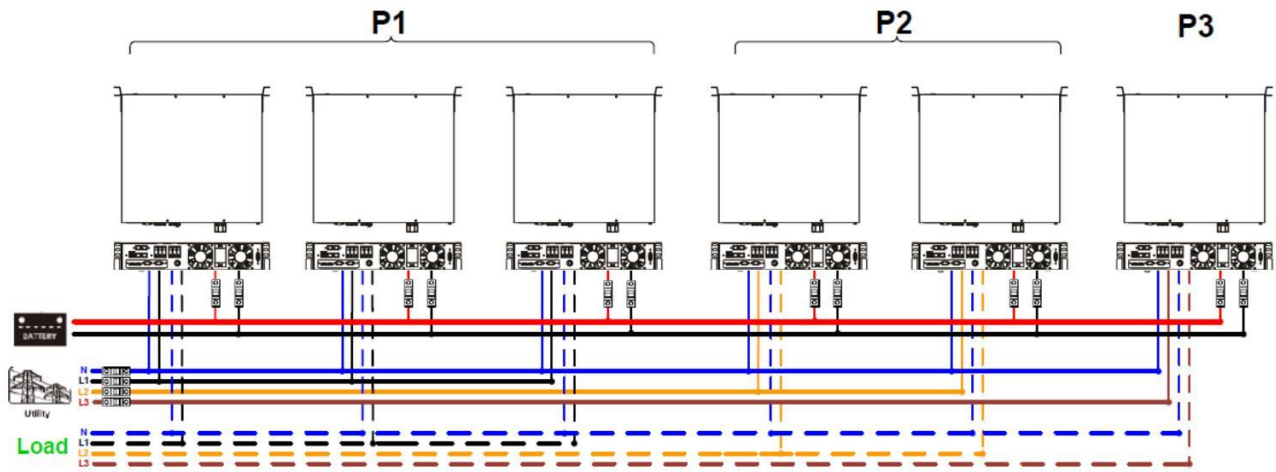
**Communication Connection**



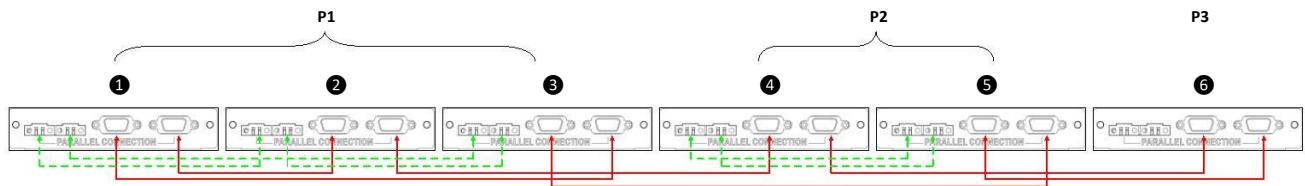


Three inverters in one phase, two inverters in second phase and one inverter for the third phase:

**Power Connection**

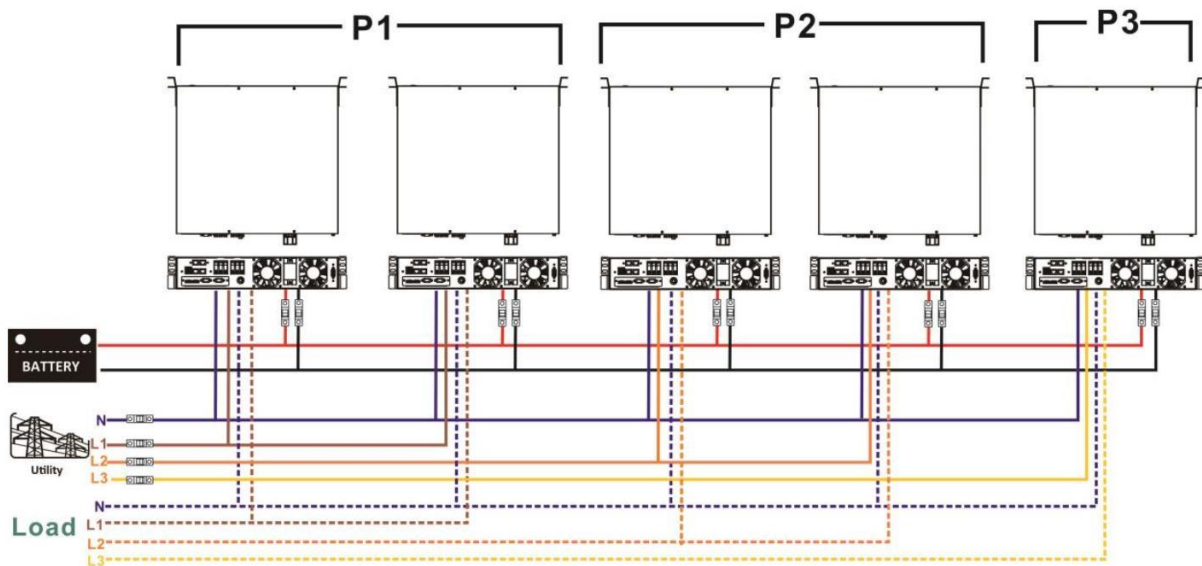


**Communication Connection**

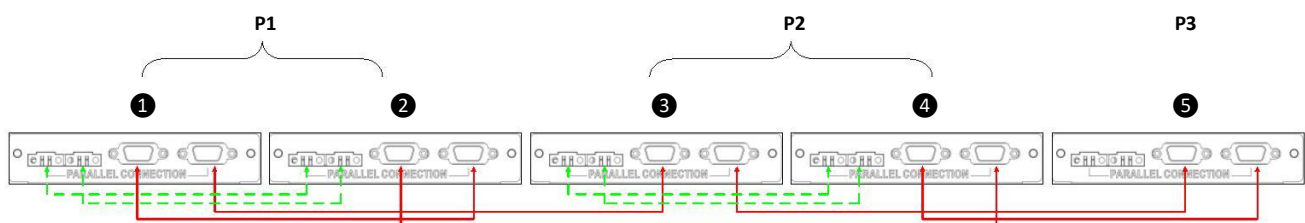


Two inverters in two phases and only one inverter for the remaining phase:

**Power Connection**

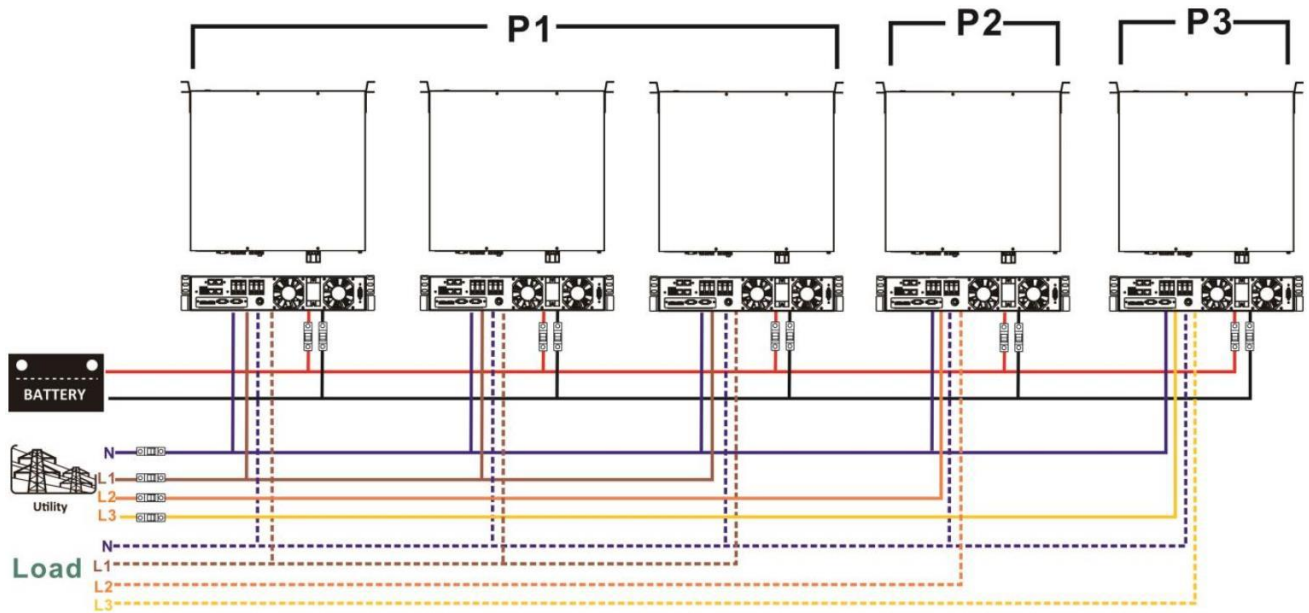


**Communication Connection**

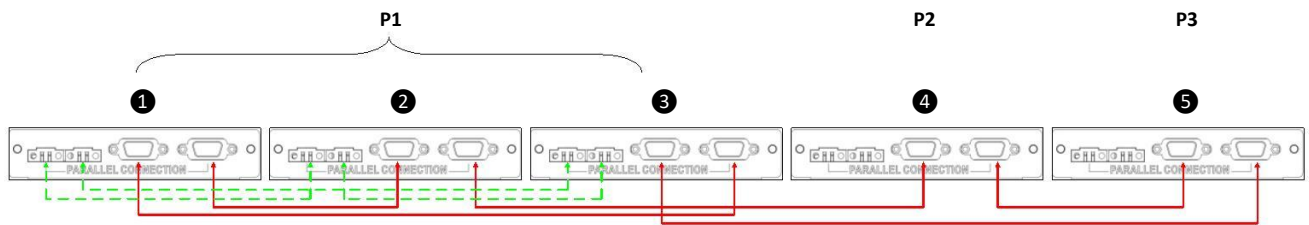


Three inverters in one phase and only one inverter for the remaining phases:

**Power Connection**

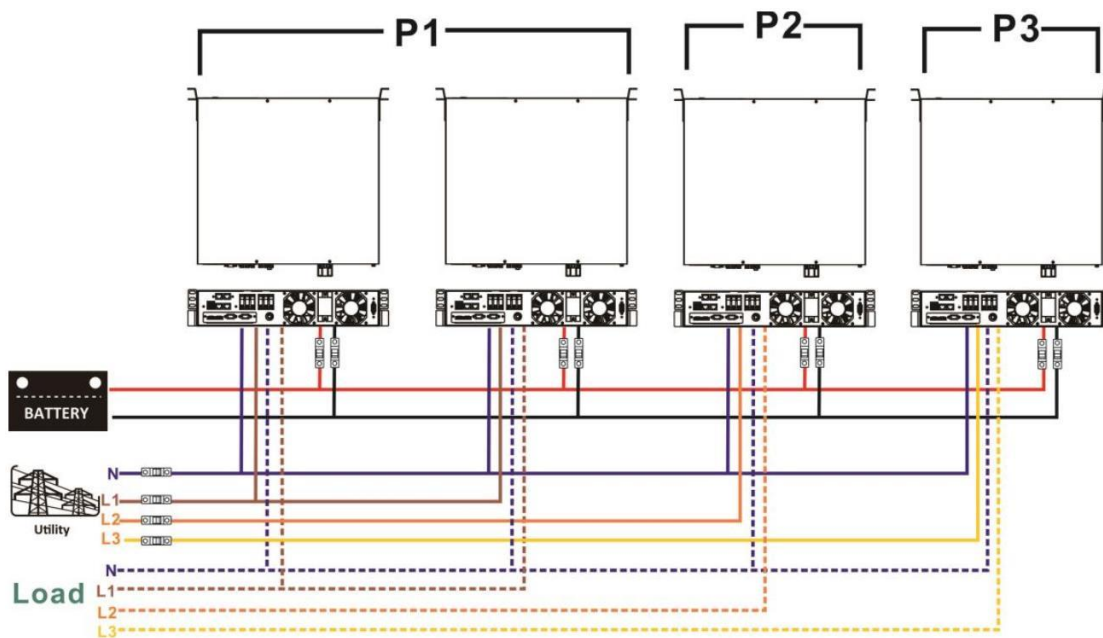


**Communication Connection**

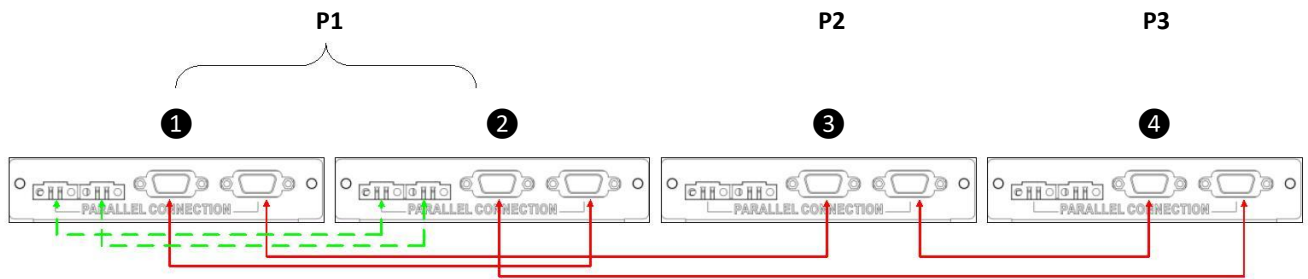


Two inverters in one phase and only one inverter for the remaining phases:

**Power Connection**

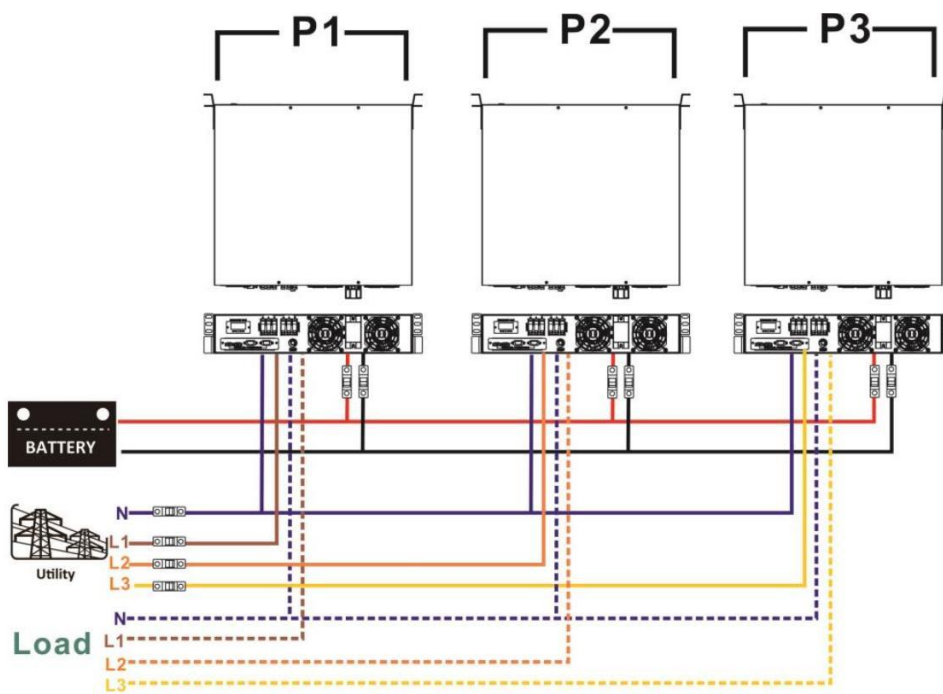


## Communication Connection

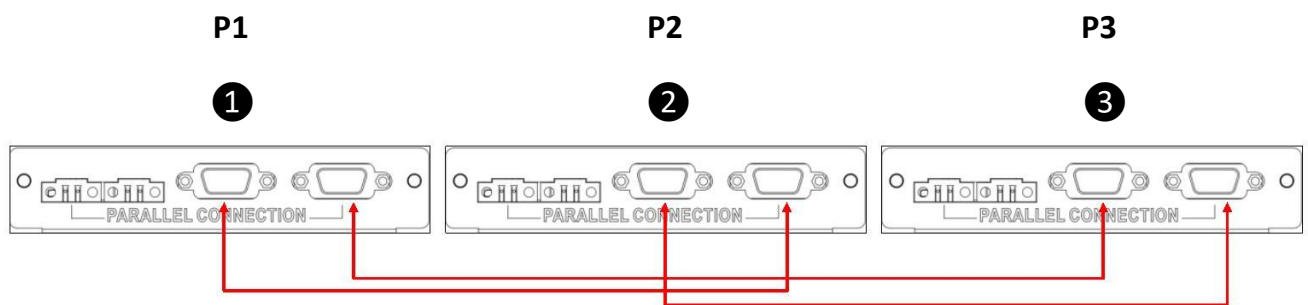


One inverter in each phase:

## Power Connection



## Communication Connection



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

## 5. LCD Setting and Display

### Setting Program:

Program	Description	Selectable option	
01	AC output mode *This setting is only available when the inverter is in standby mode (Switch off).	Single: S1C      01	When the units are used in parallel with single phase, please select "PAL" in program 01.  It is required to have at least 3 inverters or maximum 9 inverters to support three-phase equipment. It's required to have at least one inverter in each phase or it's up to seven inverters in one phase. Please refers to 4-2 for detailed information.
		Parallel: PAL      01	Please select "3P1" in program 01 for the inverters connected to L1 phase, "3P2" in program 01 for the inverters connected to L2 phase and "3P3" in program 01 for the inverters connected to L3 phase.
		L1 phase: 3P1      01	Be sure to connect current sharing cable to units which are on the same phase. Do NOT connect current sharing cable between units in different phases.
		L2 phase: 3P2      01	Besides, power saving function will be <u>automatically disabled</u> .
		L3 phase: 3P3      01	
30	PV judge condition (Only apply for setting "Solar first" in program 1: Output source priority)	One Inverter (Default): ONE      530	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 <u>power to loads from utility</u> .
		All of Inverters: ALL      530	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.



**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

**6. Commissioning**

**Parallel in single phase**

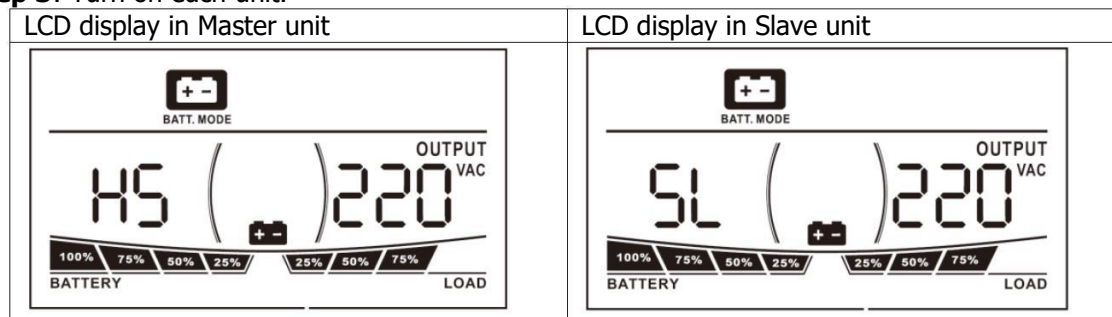
**Step 1:** Check the following requirements before commissioning:

- 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 01 of each unit. And then shut down all units.

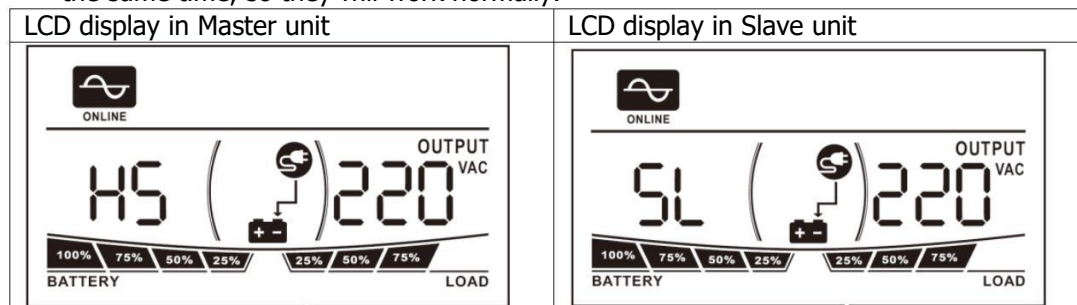
**NOET:** It's necessary to turn off switch when setting LCD program. Otherwise, the setting cannot be programmed.

**Step 3:** Turn on each unit.



**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, so they will work normally.



**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 at load side are open and each neutral wires of each unit are connected.

**Step 2:** Turn on all units and configure LCD program 01 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 matched with the setting in the unit, they will work normally. If the sequences do not match, 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 at 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.

## 7. Trouble shooting

Situation		Solution
Fault Code	Fault Event Description	
60	Current feedback into the inverter is detected.	<ol style="list-style-type: none"> <li>Restart the inverter.</li> <li>Check if L/N cables are not connected reversely in all inverters.</li> <li>For parallel system in single phase, make sure the sharing current cables are connected in all inverters. For supporting three-phase system, make sure the sharing current cables connected the inverters in the same phase, and disconnected the inverters in different phases.</li> <li>If the problem remains, please contact your installer.</li> </ol>
71	The firmware version of each inverter is not the same.	<ol style="list-style-type: none"> <li>Update the firmware of all inverter to the same version.</li> <li>Check the version of each inverter via LCD setting and make sure the CPU versions are the same. If not, please contact your instraller to update the firmware.</li> <li>If the problem still remains after the firmwzre is updated, please contact your installer.</li> </ol>
72	The output current of each inverter is different.	<ol style="list-style-type: none"> <li>Check if shared cables are well connected and restart the inverter.</li> <li>If the problem remains, please contact your installer.</li> </ol>
80	CAN data loss	<ol style="list-style-type: none"> <li>Check if communication cables are connected well and restart the inverter.</li> <li>If the problem remains, please contact your installer.</li> </ol>
81	Host data loss	
82	Synchronization data loss	
83	The battery voltage of each inverter is not the same.	<ol style="list-style-type: none"> <li>Make sure all inverters share the same groups of batteries.</li> <li>Remove all loads and disconnect AC input and PV input. Then, check battery voltage of all inverters. If the values from all inverters are different, please check if all battery cables are in the same length and same type of material. Otherwise, please contact your installer for an SOP to calibrate the battery voltage of each inverter.</li> <li>If the problem still remains, please contact your installer.</li> </ol>
84	AC input voltage and frequency are detected different.	<ol style="list-style-type: none"> <li>Check the utility wiring connction and restart the inverter.</li> <li>Make sure utility starts 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.</li> <li>If the problem remains, please contact your installer.</li> </ol>
85	AC output current unbalance	<ol style="list-style-type: none"> <li>Restart the inverter.</li> <li>Remove some excessive loads and re-check load information from LCD of inverters.</li> <li>If the problem remains, please contact your installer.</li> </ol>
86	AC output mode setting is different.	<ol style="list-style-type: none"> <li>Switch off the inverter and check LCD setting #01.</li> <li>For parallel system in single phase, make sure no 3P1, 3P2 or 3P3 is set on #01. For supporting three-phase system, make sure no "PAL" is set on #01.</li> <li>If the problem remains, please contact your installer.</li> </ol>

## Appendix II: Approximate Back-up Time Table

Model	Load (W)	Backup Time @ 48Vdc 100Ah (min)	Backup Time @ 48Vdc 200Ah (min)
3KVA	300	1054	2107
	600	491	1054
	900	291	668
	1200	196	497
	1500	159	402
	1800	123	301
	2100	105	253
	2400	91	219
	2700	71	174
	3000	63	155

Model	Load (W)	Backup Time @ 48Vdc 100Ah (min)	Backup Time @ 48Vdc 200Ah (min)
5KVA/6KVA	400	613	1288
	800	268	613
	1200	158	402
	1600	111	271
	2000	90	215
	2400	76	182
	2800	65	141
	3200	50	112
	3600	44	100
	4000	40	90
	5000	30	70

**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.