POWER SOLID

5KW
ONLINE SOLAR UPS

PS-P0U5KW#48PV

USER MANUAL

WWW.POWERSOLID.VN

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 solar UPS, please follow required spec to select appropriate cable size. It's very important to correctly operate this solar UPS.
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 protection for the battery supply.
11. GROUNDING INSTRUCTIONS -This solar UPS 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 solar UPS back to local dealer or service center for maintenance.

Standard

*** Safety**	
IEC/EN 62040-2	
*** EMI**	
Conducted Emission..... :IEC/EN 62040-2	Category C2
Radiated Emission..... :IEC/EN 62040-2	Category C2
*** EMS**	
ESD..... :IEC/EN 61000-4-2	Meets the requirements of Performance Criterion B
RS..... :IEC/EN 61000-4-3	Meets the requirements of Performance Criterion A
EFT..... :IEC/EN 61000-4-4	Meets the requirements of Performance Criterion A
SURGE..... :IEC/EN 61000-4-5	Meets the requirements of Performance Criterion B
CS..... :IEC/EN 61000-4-6	Meets the requirements of Performance Criterion A
Power-frequency Magnetic field..... :IEC/EN 61000-4-8	Meets the requirements of Performance Criterion A
Low Frequency Signals..... :IEC/EN 61000-2-2	Meets the requirements of Performance Criterion A

INTRODUCTION

This is a multi-function solar UPS, combining functions of inverter, MPPT solar charger and battery charger to offer uninterruptible power support with portable size. 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 output
- Built-in MPPT solar charge controller
- Configurable input voltage range for 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
- Zero-transfer Time

Basic System Architecture

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

- Utility.
- PV modules

Consult with your system integrator for other possible system architectures depending on your requirements. This solar UPS can power all kinds of appliances in home or office environment, including motor-type appliances such as tube light, fan, refrigerator and air conditioner.

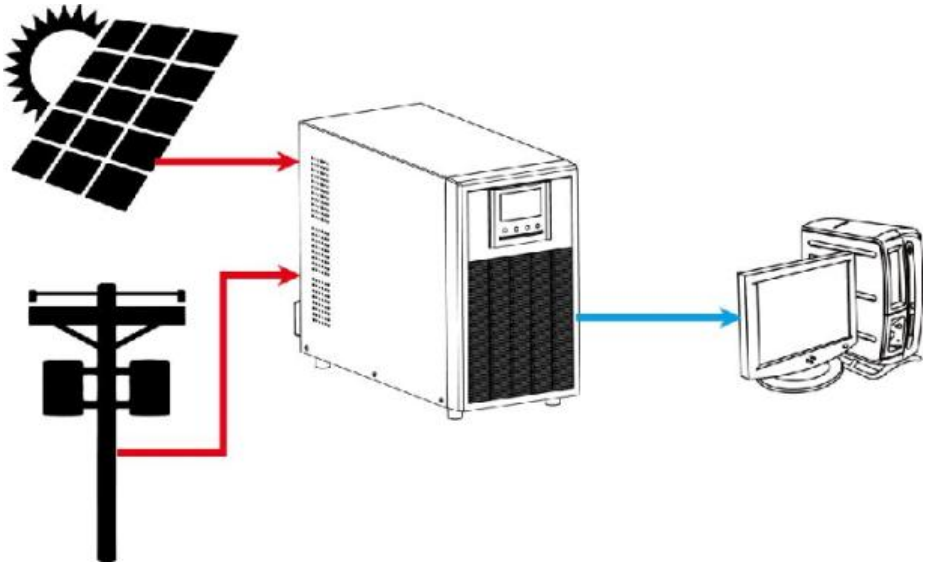
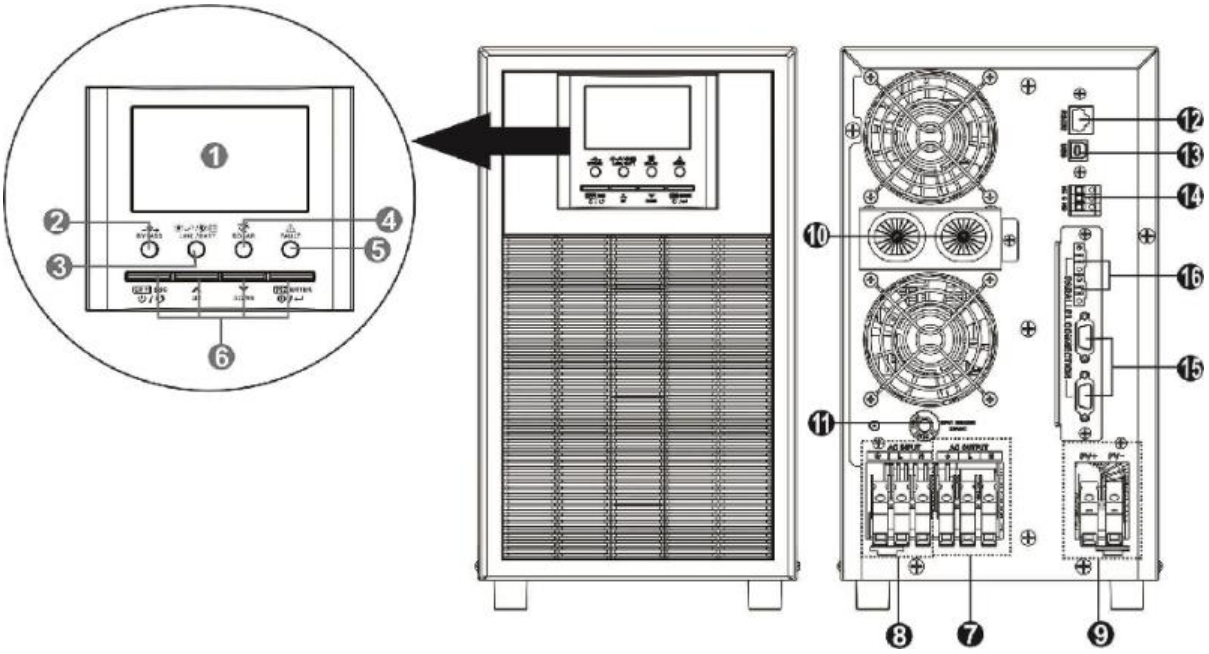


Figure 1 Hybrid Power System

Product Overview



1. LCD display
2. Bypass indicator
3. Status indicator
4. Solar indicator
5. Fault indicator
6. Function keys (Please refer to operation chapter for the detailed operation)
7. AC input
8. AC output
9. PV input
10. Battery input
11. Circuit breaker
12. RS-232 communication port
13. USB communication port
14. Dry contact
15. Parallel communication port (only for parallel model)
16. Current sharing port (only for parallel model)

NOTE: For parallel model installation and operation, please check Parallel Function chapter for the details.

INSTALLATION

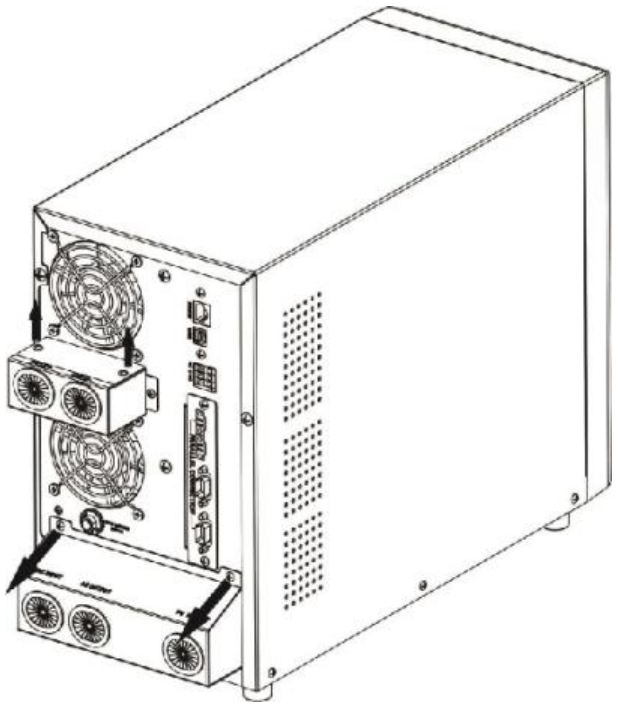
Unpacking and Inspection

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

Preparation

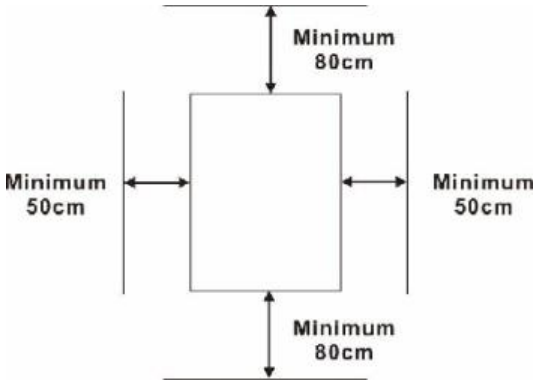
Before connecting all wirings, please take off bottom terminal and PV terminal covers by removing four screws as shown below.



UPS Placement

Consider the following points before selecting where to install the UPS:

- Do not put the UPS on flammable construction materials.
- It's requested to have a clearance of approx. 80 cm to the front and back of the unit and approx. 50 cm to the side.
- Dusty conditions on the unit may impair the performance of this UPS.
- The ambient temperature should be between 0°C and 55°C to ensure optimal operation.
- For proper operation, please use appropriate cables.

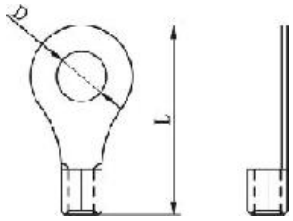


SUITABLE FOR INSTALLING ON CONCRETE OR OTHER NON-COMBUSTIBLE SURFACE ONLY.

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 UPS. 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:



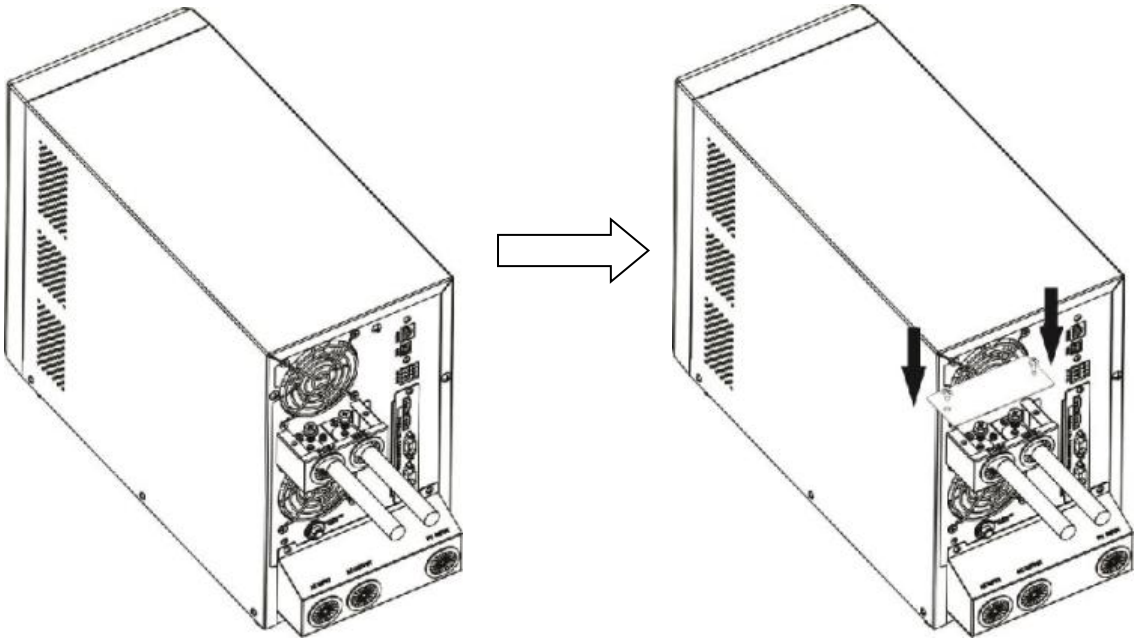
WARNING! All wiring must be performed by a qualified personnel.
WARNING! It's very important for system safety and efficient operation to use appropriate cable for battery connection. To reduce risk of injury, please use the proper recommended cable and terminal size as below.

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)	
5KW	137A	200AH	1*1/0AWG	60	6.4	49.7	2~3 Nm
			2*4AWG	44	6.4	49.7	

Please follow below steps to implement battery connection:

1. Assemble battery ring terminal based on recommended battery cable and terminal size.
2. Connect all battery packs as units requires. It's suggested to connect at least 200Ah capacity battery for 5KW model.
3. Insert the ring terminal of battery cable flatly into battery connector of UPS and make sure the bolts are tightened with torque of 2-3 Nm. Make sure polarity at both the battery and the UPS is correctly connected and ring terminals are tightly screwed to the battery terminals.
4. Then, put the top plate back to the terminal cover.



⚠	**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 UPS 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 UPS 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 50A for 5KW.

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 a qualified personnel.

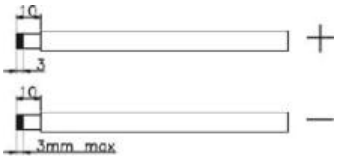
WARNING! It's very important for system safety and efficient operation to use appropriate cable for AC input connection. To reduce risk of injury, please use the proper recommended cable size as below.

Suggested cable requirement for AC wires

Model	Gauge	Torque Value
5KW	8 AWG	1.4~ 1.6Nm

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

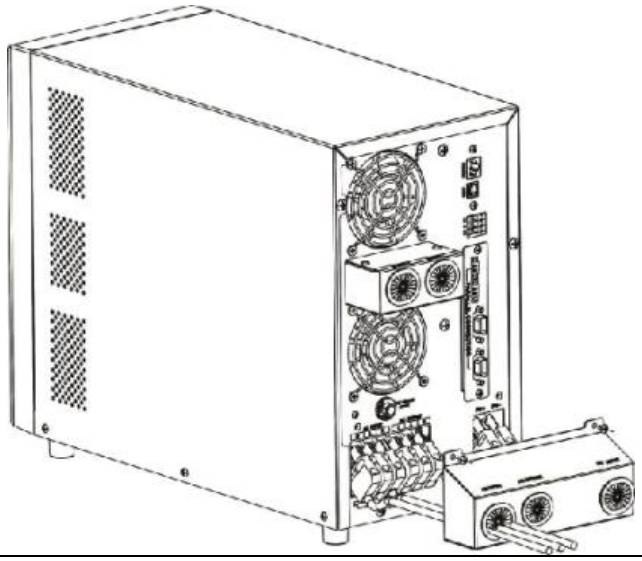
1. Before making AC input/output connection, be sure to open DC protector or disconnector first.
2. Remove insulation sleeve 10mm for six conductors. And shorten phase L and neutral conductor N 3 mm.
3. Insert AC input wires according to polarities indicated on terminal block and tighten the terminal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



⏚**→Ground (yellow-green)**

L→LINE (brown or black)

N→Neutral (blue)



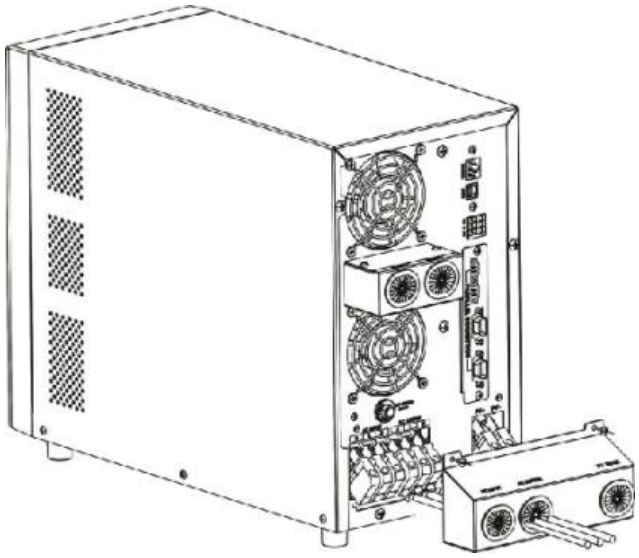
⚠	**WARNING:** Be sure that AC power source is disconnected before attempting to hardwire it to the unit.

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)



5. Make sure the wires are securely connected.

CAUTION: Important

Be sure to connect AC wires with correct polarity. If L and N wires are connected reversely, it may cause utility short-circuited when these UPSs are worked in parallel operation.

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 solar UPS will trigger 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 UPS and PV modules.

WARNING! All wiring must be performed by a qualified personnel.
WARNING! It'' 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
5KW	80A	6 AWG	1.2~1.6 Nm

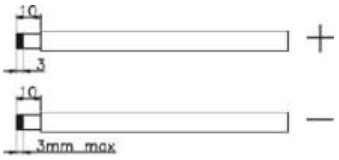
PV Module Selection:

When selecting proper PV modules, please be sure to consider below parameters:

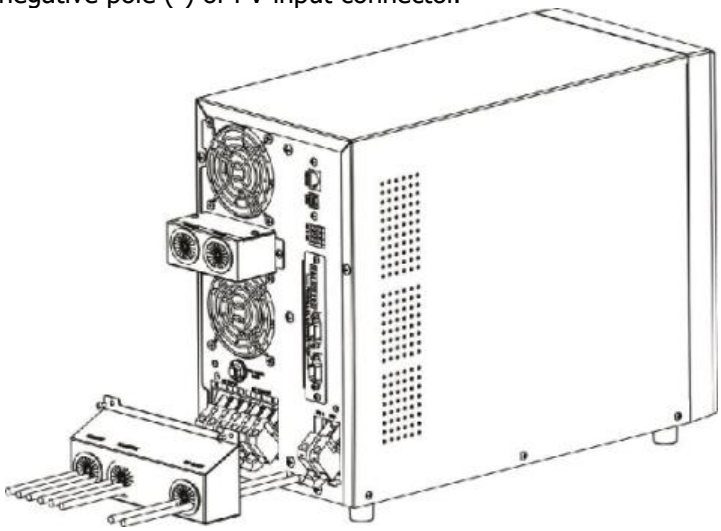
1. Open circuit Voltage (Voc) of PV modules not exceeds max. PV array open circuit voltage of inverter.
2. Open circuit Voltage (Voc) of PV modules should be higher than min. battery voltage.

Solar Charging Mode	
INVERTER MODEL	**5KW**
Max. PV Array Open Circuit Voltage	145Vdc
PV Array MPPT Voltage Range	60~115Vdc

Please follow below steps to implement PV module connection:



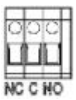
1. Remove insulation sleeve 10 mm for positive and negative conductors.
2. Check correct polarity of connection cable from PV modules and PV input connectors. Then, connect positive pole (+) of connection cable to positive pole (+) of PV input connector. Connect negative pole (-) of connection cable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



3. Make sure the wires are securely connected.
4. Then, screw back the terminal cover.

Dry Contact Signal

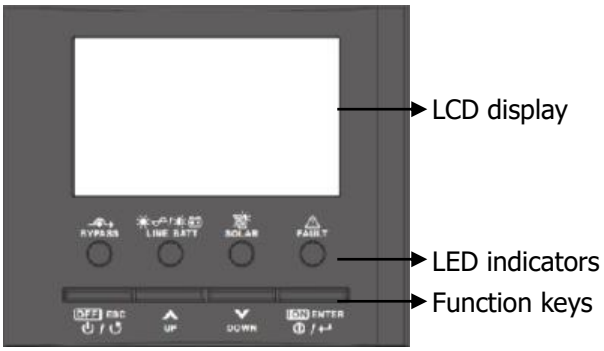
There is one dry contact (3A/250VAC) available on the rear panel. It could be used to deliver signal to external device when battery voltage reaches warning level.

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 power or Solar energy.	Program 01 set as USB (utility first)	Battery voltage < Low DC warning voltage	Open	Close
			Battery voltage > Setting value in Program 13 or battery charging reaches floating stage	Close	Open
		Program 01 is set as SBU (SBU priority) or SUB (solar first)	Battery voltage < Setting value in Program 12	Open	Close
			Battery voltage > Setting value in Program 13 or battery charging reaches floating stage	Close	Open

OPERATION

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



Function Keys

Key	Function	Operation
ON ENTER ⏻ / ↵	Turn on the UPS	Press and hold the key more than 1s.
	To confirm the selection	Click this key in setting mode
OFF ESC ⏻ / ↺	Turn off the UPS	Press and hold the key more than 1s.
	To exit setting mode	Click this key in setting mode
	Return to default display	Click this key in display mode
▲ UP	To go to previous selection	Click this key
▼ DOWN	To go to next selection	Click this key
▲ ▼ UP+DOWN	To enter setting mode	Press and hold the two keys simultaneous more than 1s in display mode

LED Indicators

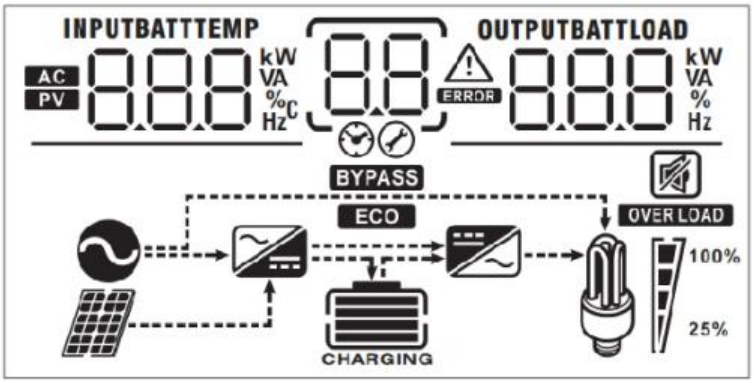
LED Indicator			Messages
BYPASS	Green	Solid On	Output is powered by utility in Bypass/ECO/Fault mode.
LINE BATT	Green	Solid On	Output is powered by utility in Line/ECO mode.
		Flashing	Output is powered by battery in battery mode.
SOLAR	Green	Solid On	the PV input
FAULT	Red	Solid On	Fault occurs in the UPS.
		Flashing	Warning condition occurs in the UPS.

There are 4 LEDs on front panel to show the UPS working status:

LED / Mode	BYPASS	LINE BATT	SOLAR	FAULT
UPS On	☀	☀	☀	☀
Bypass mode	☀	○	--	○
Line mode	○	☀	--	○
Battery mode	○	☀	--	○
ECO mode	☀	☀	--	○
Fault mode	--	○	--	☀
Warning mode	--	--	--	☀

Note: ☀ means LED is lit and Solid On, ☀ means LED is lit and flashing,○ means LED is faded, and -- means LED is lit or faded.

LCD Display Icons

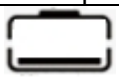


Icon	Function description
Input Source Information	
AC	Indicates the AC input.
PV	Indicates the PV input
INPUTBATT 8.8.8 kW VA %°C Hz	Indicate input voltage, input frequency, PV voltage, charger current, charger power, battery voltage.
Configuration Program and Fault Information	
88	Indicates the setting programs.
8.8 ERROR	Indicates the warning and fault codes. Warning: 8.8 flashing with warning code. Fault: 8.8 ERROR lighting with fault code
Output Information	
OUTPUTBATTLOAD 8.8.8 kW VA % Hz	Indicate output voltage, output frequency, load percent, load in VA, load in Watt and discharging current.
Battery Information	
CHARGING	Indicates battery level by 0-24%, 25-49%, 50-74% and 75-100% in battery mode and charging status in line mode.

In AC mode, it will present battery charging status.

Status	Battery voltage	LCD Display
Constant Current mode / Constant Voltage mode	<2V/cell	4 bars will flash in turns.
	2 ~ 2.083V/cell	Bottom bar will be on and the other three bars will flash in turns.
	2.083 ~ 2.167V/cell	Bottom two bars will be on and the other two bars will flash in turns.
	> 2.167 V/cell	Bottom three bars will be on and the top bar will flash.
Floating mode. Batteries are fully charged.		4 bars will be on.

In battery mode, it will present battery capacity.

Load Percentage	Battery Voltage	LCD Display
Load >50%	< 1.85V/cell	
	1.85V/cell ~ 1.933V/cell	
	1.933V/cell ~ 2.017V/cell	
	> 2.017V/cell	
Load < 50%	< 1.892V/cell	
	1.892V/cell ~ 1.975V/cell	
	1.975V/cell ~ 2.058V/cell	
	> 2.058V/cell	

Load Information

OVER LOAD	Indicates overload.			
	Indicates the load level by 0-24%, 25-49%, 50-74% and 75-100%.			
	0%~24%	25%~49%	50%~74%	75%~100%
				

Mode Operation Information

	Indicates unit connects to the mains.
	Indicates unit connects to the PV panel.
BYPASS	Indicates unit will work in Bypass mode
ECO	Indicates unit will work in ECO mode
	Indicates the utility charger circuit is working.
	Indicates the DC/AC inverter circuit is working.

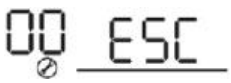
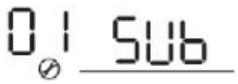
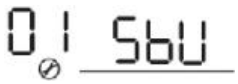
Mute Operation

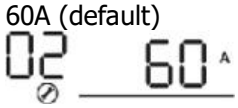
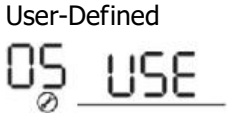
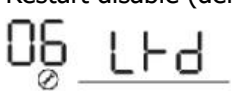
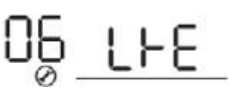
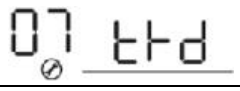
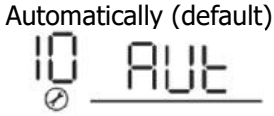
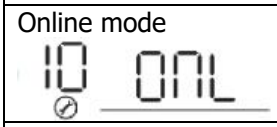
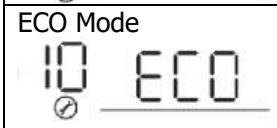
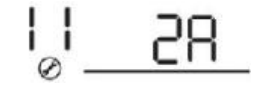
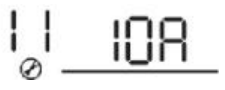
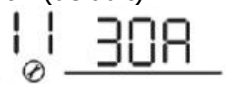
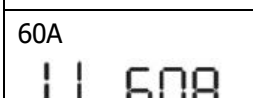
	Indicates unit alarm is disabled.

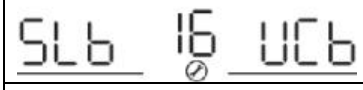
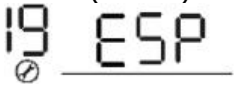
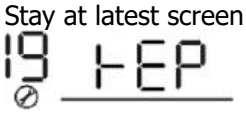
LCD Setting

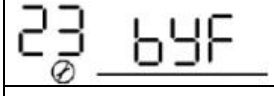
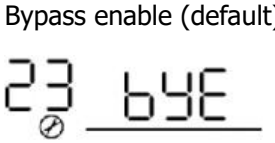
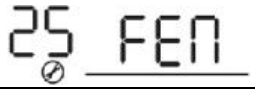
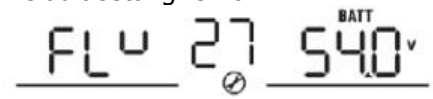
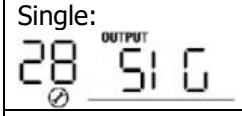
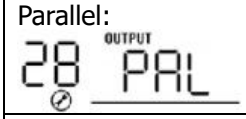
After pressing and holding ENTER button for 3 seconds, the unit will enter setting mode. Press "UP" or "DOWN" button to select setting programs. And then, press "ENTER" button to confirm the selection or ESC button to exit.

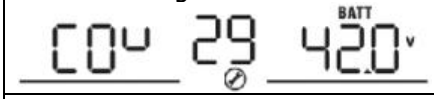
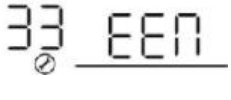
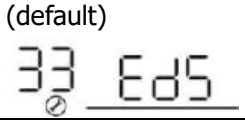
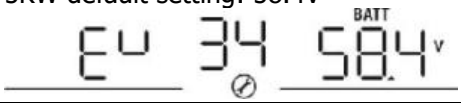
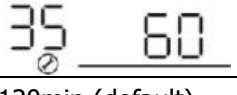
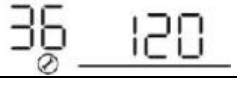
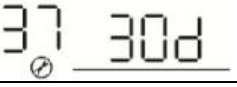
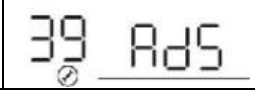
Setting Programs:

Program	Description	Selectable option	
00	Exit setting mode	Escape 	
01	Output source priority: To configure load power source priority	USB : Utility first (default) 	Utility will provide power to the loads as first priority. If Utility energy is unavailable, solar energy and battery provides power the loads.
		SUB: Solar first 	Solar energy provides power to the loads as first priority. If solar energy is not sufficient to power all connected loads, utility energy will supply power to the loads at the same time. Battery provides power to the loads only when solar and utility is not sufficient.
		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 or solar and battery is not sufficient.

02	Maximum charging current: To configure total charging current for solar and utility chargers. (Max. charging current = utility charging current + solar charging current)	60A (default) 	The setting range is from 10A to 140A and increment of each click is 10A.
05	Battery type	AGM (default) 	Flooded 
		User-Defined 	If "User-Defined" is selected, battery charge voltage and low DC cut-off voltage can be set up in program 26, 27 and 29.
06	Auto restart when overload occurs	Restart disable (default) 	Restart enable 
07	Auto restart when over temperature occurs	Restart disable (default) 	Restart enable 
09	Output frequency	50Hz (default) 	60Hz 
10	Operation Logic	Automatically (default) 	If selected and utility is available, UPS will work in line mode. Once utility frequency is unstable, UPS will work in bypass mode if bypass function is not forbidden in program 23.
		Online mode 	If selected, UPS will work in line mode when utility is available.
		ECO Mode 	If selected and bypass is not forbidden in program 23, UPS will work in ECO mode when utility is available.
11	Maximum utility charging current Note: If setting value in program 02 is smaller than that in program in 11, the UPS will apply charging current from program 02 for utility charger.	2A 	10A 
		20A 	30A (default) 
		40A 	50A 
		60A 	

12	Setting voltage point back to utility source when selecting "SBU" (SBU priority) or "SUB" (Solar first) in program 01	Default setting: 46.0V 	The setting range is from 44.0V to 57.0V and increment of each click is 1.0V.
13	Setting voltage point back to battery mode when selecting "SBU" (SBU priority) or "SUB" (Solar first) in program 01	The setting range is from 48.0V to 64.0V and increment of each click is 1.0V.	
		Battery fully charged 	54.0V (default) 
16	Solar energy priority: To configure solar energy priority for battery and load	SbL: Solar energy for battery first UCB: Allow utility to charge battery (Default) 	Solar energy charges battery first and allow the utility to charge battery.
		SbL: Solar energy for battery first UdC: Disallow utility to charge battery 	Solar energy charge battery first and disallow the utility to charge battery.
		SLb: Solar energy for load first UCb: Allow utility to charge battery 	Solar energy provides power to the load first and also allow the utility to charge battery.
		SLb: Solar energy for load first UdC: Disallow utility to charge battery 	Solar energy provides power to the load first and disallow the utility to charge battery.
18	Alarm control	Alarm on (default) 	Alarm off 
19	Auto return to default display screen	Return to default display screen (default) 	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 	If selected, the display screen will stay at latest screen user finally switches.

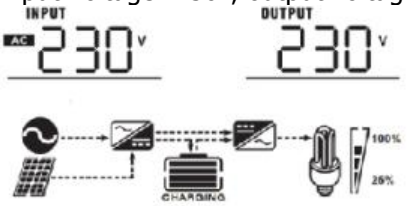
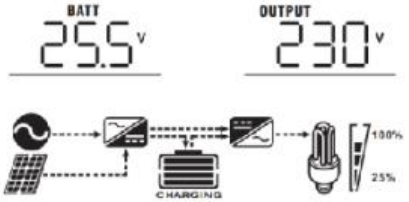
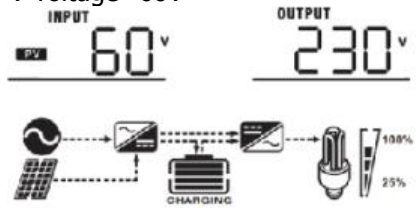
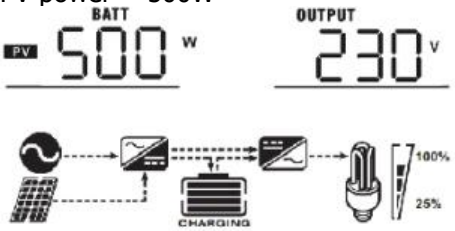
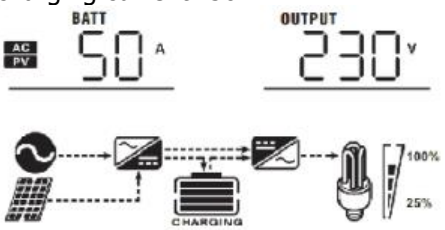
20	Backlight control	Backlight on (default) 	Backlight off 
22	Beeps while primary source is interrupted	Alarm on (default) 	Alarm off 
23	Bypass function:	Bypass Forbidden 	If selected, UPS won't work in bypass/ECO modes.
		Bypass disable 	If selected and power ON button is pressed on, UPS can work in bypass/ECO mode only if utility is available.
		Bypass enable (default) 	If selected and no matter power ON button is pressed on or not, UPS can work in bypass mode if utility is available.
25	Record Fault code	Record enable 	Record disable (default) 
26	Bulk charging voltage (C.V voltage)	Default setting: 56.4V 	
		If self-defined is selected in program 5, this program can be set up. Setting range is from 48.0V to 64.0V. Increment of each click is 0.1V.	
27	Floating charging voltage	Default setting: 54.0V 	
		If self-defined is selected in program 5, this program can be set up. Setting range is from 48.0V to 64.0V. Increment of each click is 0.1V.	
28	AC output mode *This setting is able to set up only when the UNS is in standby mode. Be sure that AC output is off status. Otherwise, please refer to chapter "Power ON/OFF" to press "ESC" button to turn off AC output.	Single: 	When the units are used in parallel with single phase, please select "PAL". It is required to have at least 3 UPS or maximum 6 UPS to support three-phase equipment. It's required to have at least one UPS in each phase or it's up to four UPS in one phase. Please refers to 5-2 for detailed information. Please select "3P1" in program 28 for the UPS connected to L1 phase, "3P2" in program 28 for
		Parallel: 	
		L1 phase: 	
		L2 phase: 	

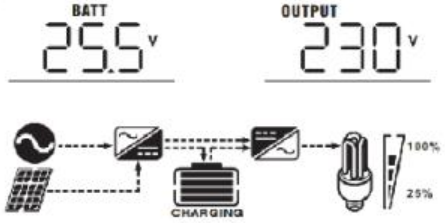
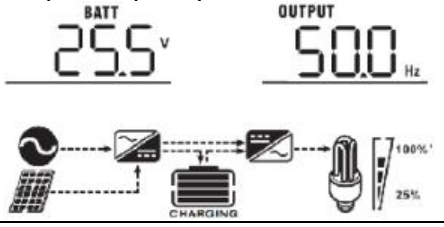
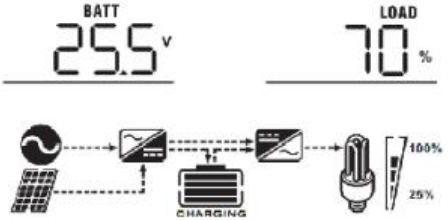
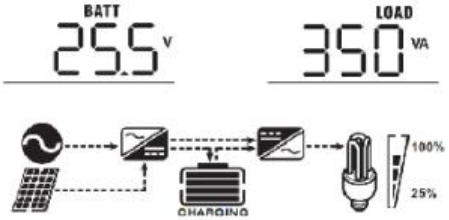
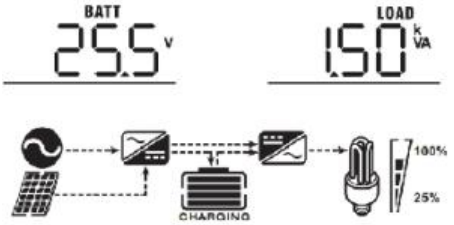
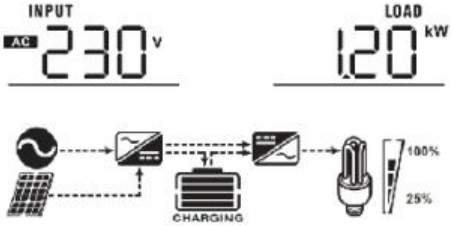
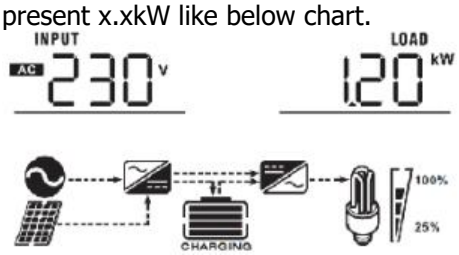
		L3 phase: 	the UPS connected to L2 phase and "3P3" in program 28 for the UPS connected to L3 phase. Be sure to connect share current cable to units which are on the same phase. Do NOT connect share current cable between units on different phases.
29	Low DC cut-off voltage	Default setting: 42.0V 	
		If self-defined is selected in program 5, this program can be set up. Setting range 40.0V to 54.0V. 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.	
32	Bulk charging time	auto-charging time (default) 	5min 
		If "User-Defined" is selected in program 05, this program can be set up. Setting range is from 5min to 900min. Increment of each click is 5min. Otherwise, Keeping auto-charging time.	
33	Battery equalization	Battery equalization enable 	Battery equalization disable (default) 
		If "Flooded" or "User-Defined" is selected in program 05, this program can be set up.	
34	Battery equalization voltage	5KW default setting: 58.4V 	
		Setting range is from 48.0V to 64.0V. Increment of each click is 0.1V.	
35	Battery equalized time	60min (default) 	Setting range is from 5min to 900min. Increment of each click is 5min.
36	Battery equalized timeout	120min (default) 	Setting range is from 5min to 900 min. Increment of each click is 5 min.
37	Equalization interval	30days (default) 	Setting range is from 0 to 90 days. Increment of each click is 1 day
39	Equalization activated immediately	Disable (default) 	Enable 

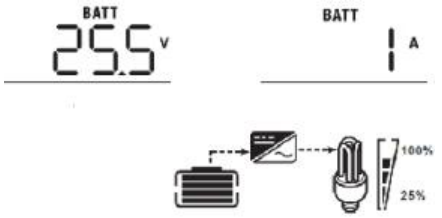
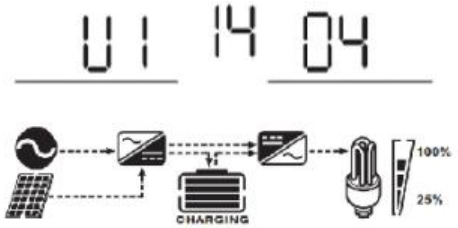
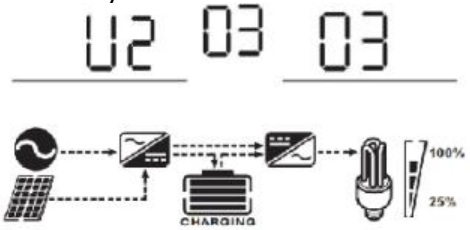
		If equalization function is enabled in program 33, this program can be set up. If "Enable" is selected in this program, it's to activate battery equalization immediately and LCD main page will shows "E9". If "Disable" is selected, it will cancel equalization function until next activated equalization time arrives based on program 37 setting. At this time, "E9" will not be shown in LCD main page.

Display Setting

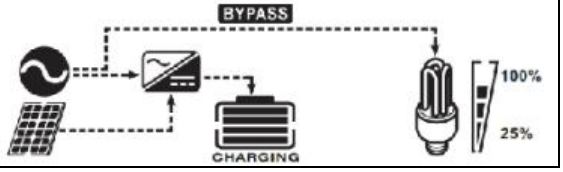
The LCD display information will be switched in turns by pressing "UP" or "DOWN" key. The selectable information is switched as below order: input voltage, input frequency, PV voltage, MPPT charging current, MPPT charging power, battery voltage, output voltage, output frequency, load percentage, load in VA, load in Watt, DC discharging current, main CPU Version and second CPU Version.

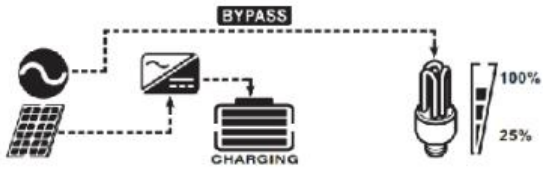
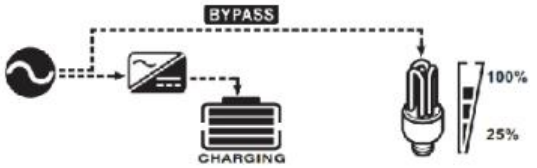
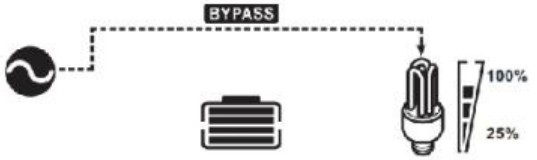
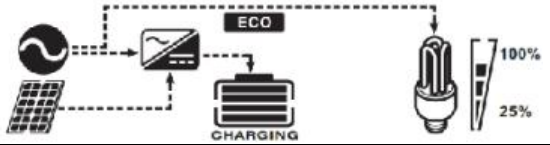
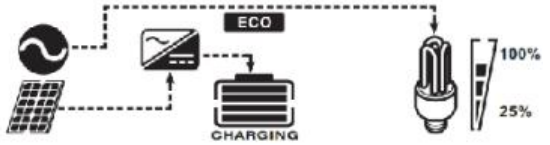
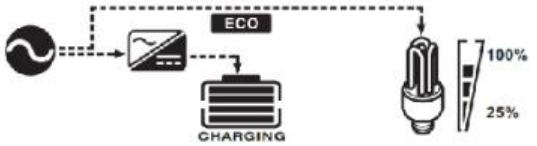
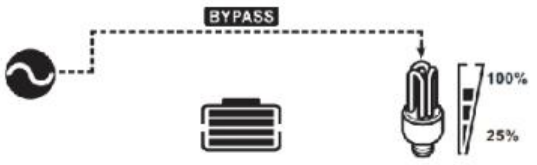
Selectable information	LCD display
Input voltage/Output voltage (Default Display Screen)	Input Voltage=230V, output voltage=230V 
Input frequency	Input frequency=50Hz 
PV voltage	PV voltage=60V 
PV power	PV power = 500W 
Charging current	charging current=50A 

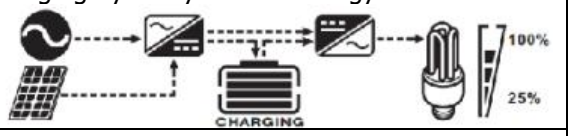
Battery voltage and output voltage	Battery voltage=25.5V, output voltage=230V 
Output frequency	Output frequency=50Hz 
Load percentage	Load percent=70% 
Load in VA	When connected load is lower than 1kVA, load in VA will present xxxVA like below chart.  When load is larger than 1kVA (≧1KVA), load in VA will present x.xkVA like below chart. 
Load in Watt	When load is lower than 1kW, load in W will present xxxW like below chart.  When load is larger than 1kW (≧1KW), load in W will present x.xkW like below chart. 

Battery voltage/DC discharging current	Battery voltage=25.5V, discharging current=1A 
Main CPU version checking.	Main CPU version 00014.04. 
Secondary CPU version checking	Secondary CPU version 00003.03 

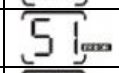
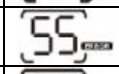
Operating Mode Description

Operation mode	Description	LCD display
Standby mode **Note:** *Standby mode: The UPS is not turned on yet but at this time, the UPS can charge battery without AC output.	No output is supplied by the unit but it still can charge batteries.	Charging by utility and PV energy. 
		Charging by utility. 
		Charging by PV energy. 
		No charging. 
Bypass Mode	The unit will provide output power from the utility. PV energy and utility can charge batteries.	Charging by utility and PV energy. 

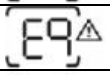
		Charging by PV 
		Charging by utility 
		No charging 
ECO Mode	The unit will provide output power from the utility. PV energy and utility can charge batteries.	Charging by utility and PV energy. 
		Charging by PV 
		Charging by utility 
		No charging 
Fault mode Note: *Fault mode: Errors are caused by inside circuit error or external reasons such as over temperature, output short circuited and so on.	Utility can bypass.	No charging and Bypass 
		No charging 

Line Mode	The unit will provide output power from the mains. It will also charge the battery at line mode.	Charging by utility and 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.	
02	Over temperature	
03	Battery voltage is too high	
04	Battery voltage is too low	
05	Output short circuited or over temperature is detected by internal converter components.	
06	Output voltage is too high.	
07	Overload time out	
08	Bus voltage is too high	
09	Bus soft start failed	
50	PFC over current	
51	OP over current	
52	Bus voltage is too low	
53	Inverter soft start failed	
55	Over DC voltage in AC output	
56	Battery is not connected	
57	Current sensor failed	
58	Output voltage is too low	
59	PV voltage is over limitation	

Warning Indicator

Warning Code	Warning Event	Audible Alarm	Icon flashing
01	Fan is locked when UPS is on.	Beep three times every second	
02	Over temperature	None	
03	Battery is over-charged	Beep once every second	
04	Low battery	Beep once every second	
07	Overload	Beep once every 0.5 second	
10	Output power derating	Beep twice every 3 seconds	
E9	Battery equalization	None	
bP	Battery is not connected	None	

Battery Equalization

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.

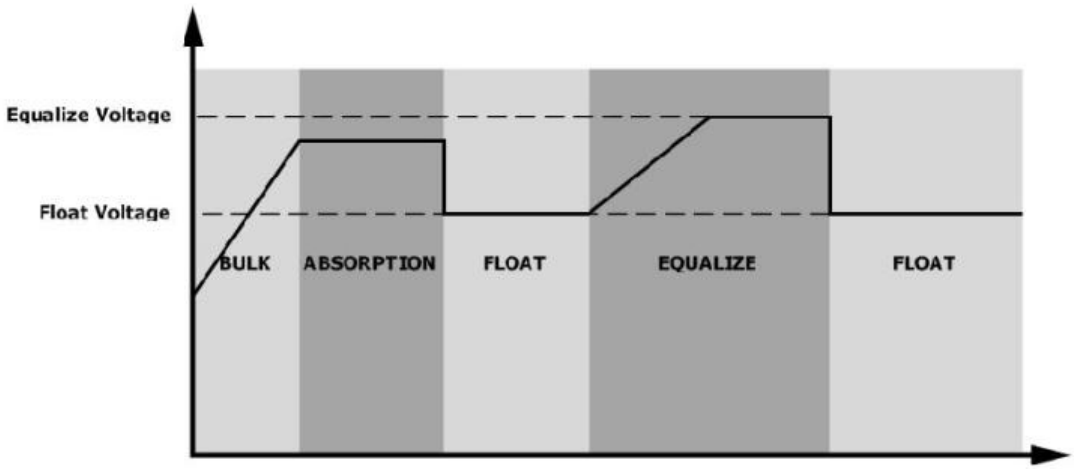
- **How to Apply Equalization Function**

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.

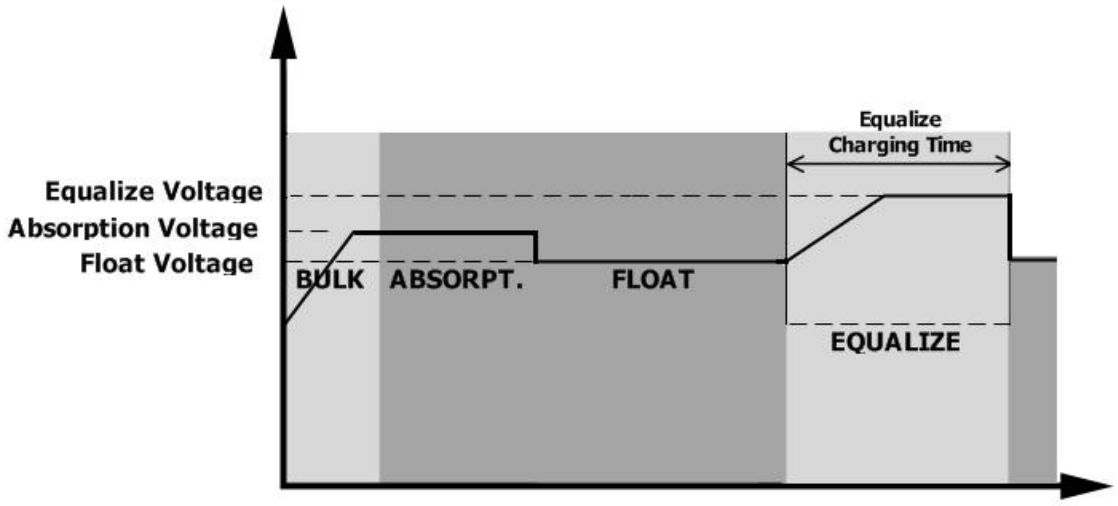
- **When to Equalize**

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.

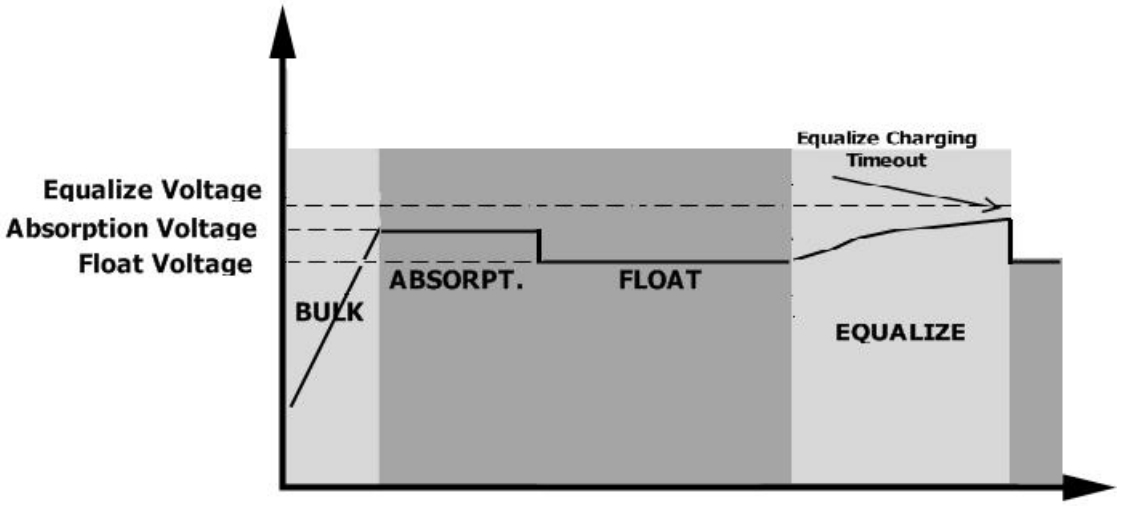


- **Equalize charging time and timeout**

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

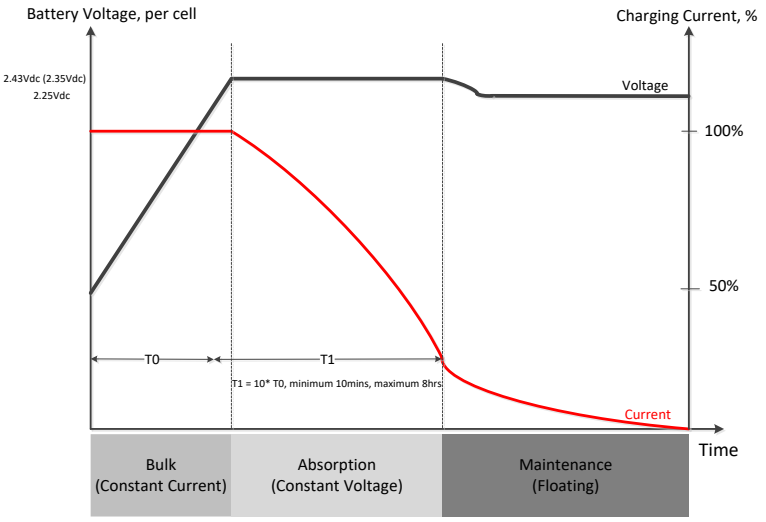
Table 1 Line Mode Specifications

MODEL	**5KW**
Input Voltage Waveform	Sinusoidal
Nominal Input Voltage	230Vac
Low Loss Voltage	110Vac±7V
Low Loss Return Voltage	120Vac±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	46(56)±1Hz
Low Loss Return Frequency	46.5(57)±1Hz
High Loss Frequency	54(64)±1Hz
High Loss Return Frequency	53(63)±1Hz
Power Factor	>0.98
Output Short Circuit Protection	Line mode: Circuit Breaker Battery mode: Electronic Circuits
Efficiency (Line Mode)	93% (Peak Efficiency)
Transfer Time	Line mode←→Battery mode 0ms Line mode / Battery mode ←→Bypass mode 4ms

Table 2 Battery Mode Specifications

MODEL	**5KW**
Rated Output Power	5KVA/5KW
Output Voltage Waveform	Pure Sine Wave
Output Voltage Regulation	230Vac±5%
Output Frequency	50Hz or 60Hz
Peak Efficiency	90%
Overload Protection	5s@≥150% load; 10s@105%~150% load
Surge Capacity	2* rated power for 5 seconds
Nominal DC Input Voltage	48Vdc
Operating Range	40Vdc -66Vdc
Cold Start Voltage	46Vdc
Low DC Warning Voltage @ load < 50% @ load ≥ 50%	 45.0Vdc 44.0Vdc
Low DC Warning Return Voltage @ load < 50% @ load ≥ 50%	 47.0Vdc 46.0Vdc
Low DC Cut-off Voltage @ load < 50% @ load ≥ 50%	 43.0Vdc 42.0Vdc
High DC Recovery Voltage	64Vdc
High DC Cut-off Voltage	66Vdc
No Load Power Consumption	<67W @48V

Table 3 Charge Mode Specifications

Utility Charging Mode		
MODEL		**5KW**
Charging Current @ Nominal Input Voltage		Default: 30A, max: 60A
Bulk Charging Voltage	**Flooded Battery**	58.4Vdc
	AGM / Gel Battery	56.4Vdc
Floating Charging Voltage		54Vdc
Overcharge Protection		66Vdc
Charging Algorithm		3-Step
Charging Curve		

Solar Charging Mode (MPPT type)	
MODEL	**5KW**
Rated Power	4000W
Maximum charging current	80A
Efficiency	98.0% max.
Max. PV Array Open Circuit Voltage	145Vdc
PV Array MPPT Voltage Range	60~115Vdc
Battery Voltage Accuracy	+/-0.3%
PV Voltage Accuracy	+/-2V
Charging Algorithm	3-Step
Joint Utility and Solar Charging	
Max Charging Current	140A
Default Charging Current	60A

Table 4 ECO/Bypass Mode Specifications

Bypass Mode	
MODEL	**5KW**
Input Voltage Waveform	Sinusoidal
Low Loss Voltage	176Vac±7V
Low Loss Return Voltage	186Vac±7V
High Loss Voltage	280Vac±7V
High Loss Return Voltage	270Vac±7V
Nominal Input Frequency	50Hz / 60Hz (Auto detection)
Low Loss Frequency	46(56)±1Hz
Low Loss Return Frequency	46.5(57)±1Hz
High Loss Frequency	54(64)±1Hz
High Loss Return Frequency	53(63)±1Hz

Table 5 General Specifications

MODEL	**5KW**
SCC type	**MPPT**
Parallel-able	YES
Communication	RS232 and USB
Safety Certification	CE
Operating Temperature Range	0°C to 55°C
Storage temperature	-15°C~ 60°C
Humidity	5% to 95% Relative Humidity (Non-condensing)
Dimension (D*W*H), mm	465*190*336
Net Weight, kg	16

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 UPS 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.
	Fault code 02	Internal temperature of UPS component is over 100°C.	Check whether the air flow of the unit is blocked or whether the ambient temperature is too high.
	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 50	PFC over current or surge.	Restart the unit, if the error happens again, please return to repair center.
	Fault code 51	OP over current or surge.	
	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.

PARALLEL FUNCTION

1. Introduction

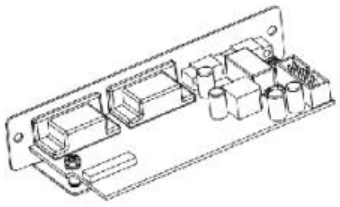
This UPS can be used in parallel with two different operation modes.

1. Parallel operation in single phase with up to 9 units. The maximum supported output power is 45KW/45KVA.
2. Maximum nine units work together to support three-phase equipment. Seven units support one phase maximum. The maximum supported output power is 45KW/45KVA and one phase can be up to 35KW/35KVA.

NOTE: If this unit is bundled with share current cable and parallel cable, this UPS is default supported parallel operation. You may skip section 3. 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:



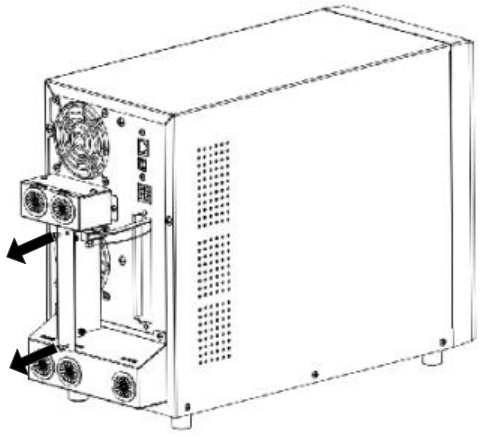
Parallel board

Parallel communication cable

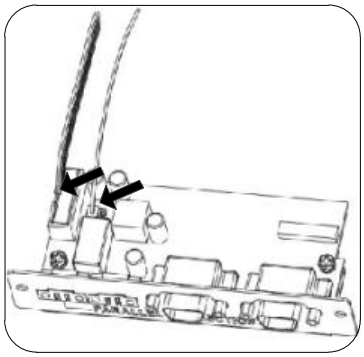
Current sharing cable

3. Parallel board installation

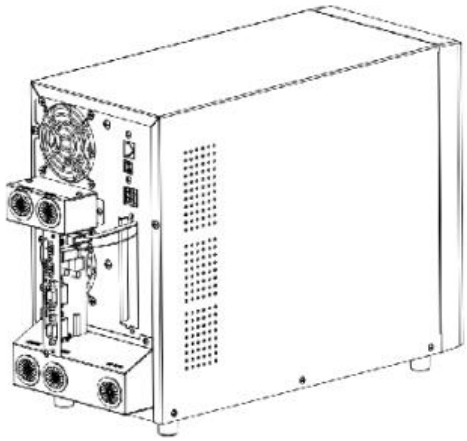
Step 1: Remove two screws, take out the parallel board, then remove 2-pin and 14-pin cables.



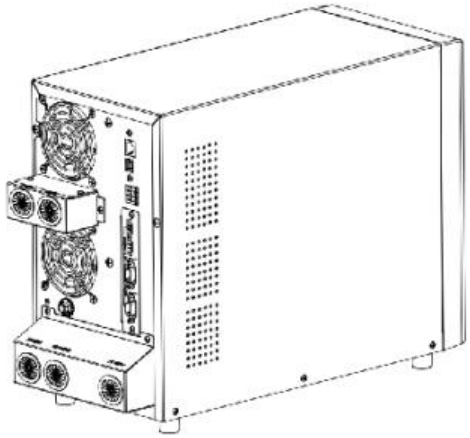
Step 2: Re-connect 2-pin and 14-pin to original position on new parallel board.



Step 3: Put new parallel board back to the unit.

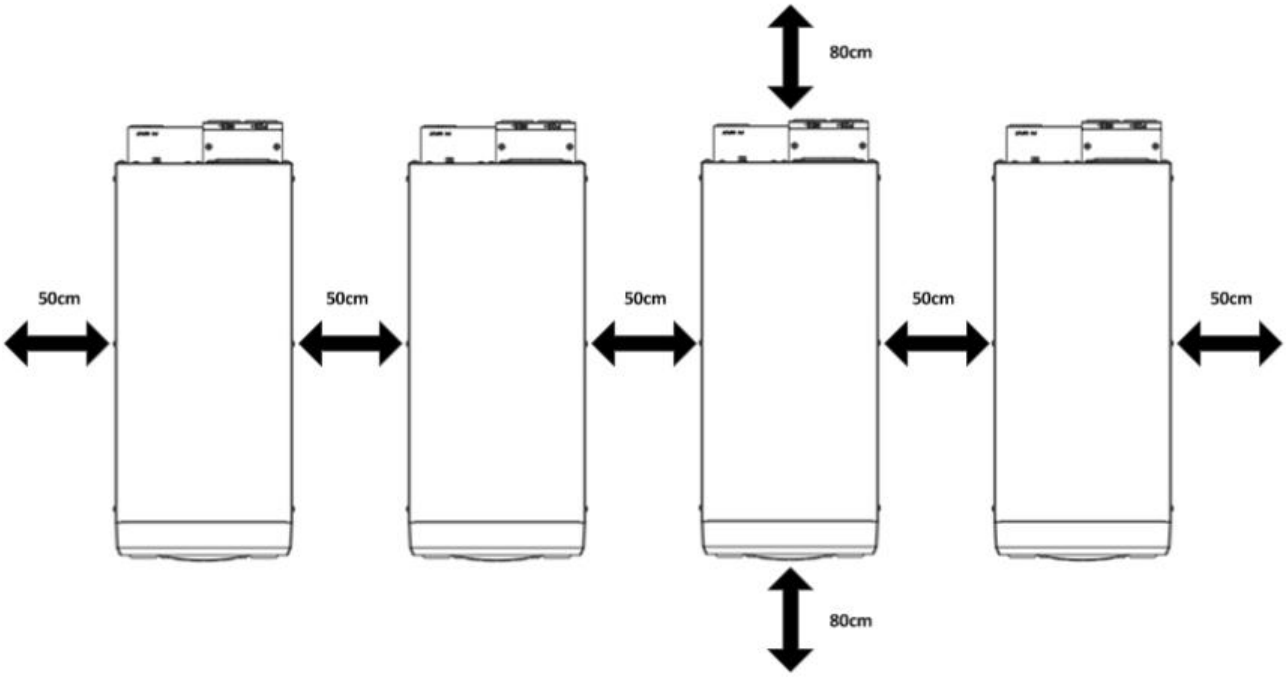


Step 4: Install new parallel board with 2 screws tightly. Now the UPS is providing parallel operation function.



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.

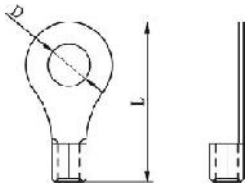
5. Wiring Connection

The cable size of each UPS is shown as below:

Recommended battery cable and terminal size for each UPS:

Model	Wire Size	Ring Terminal			Torque value
		Cable mm^2	Dimensions		
			D (mm)	L (mm)	
5KW	1*1/0AWG	60	6.4	49.7	2~ 3 Nm
	2 * 4AWG	44	6.4	49.7	

Ring terminal:



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

Recommended AC input and output cable size for each UPS:

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

You need to connect the cables of each UPS 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 UPS 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 UPS 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 5-1 and 5-2.

Recommended breaker specification of battery for each UPS:

Model	1 unit*
5KW	150A/80VDC

*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 UPS connected in parallel.

Recommended breaker specification of AC input with single phase:

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

Note1: Also, you can use 40A breaker for 3KW and 50A for 4KW/5KW for only 1 unit and install one breaker at its AC input in each UPS.

Note2: Regarding three-phase system, you can use 4-pole breaker directly and the rating of the breaker should be compatible with the phase current limitation from the phase with maximum units

Recommended battery capacity

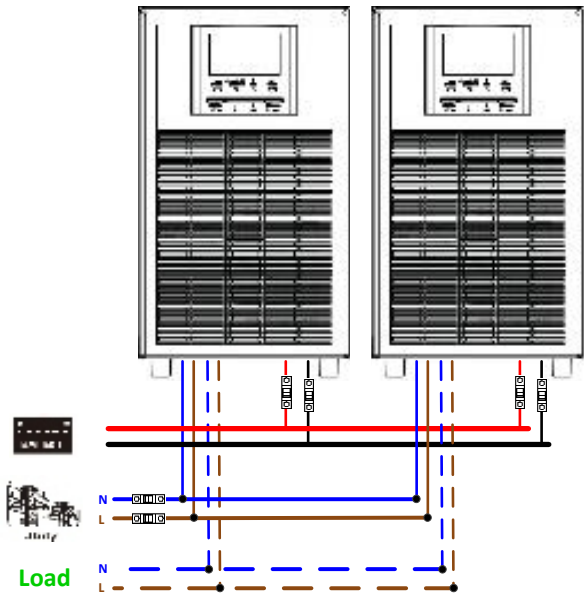
UPS parallel numbers	2	3	4	5	6	7	8	9
Battery Capacity	800AH	1200AH	1600AH	2000AH	2400AH	2800AH	3200AH	3600AH

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

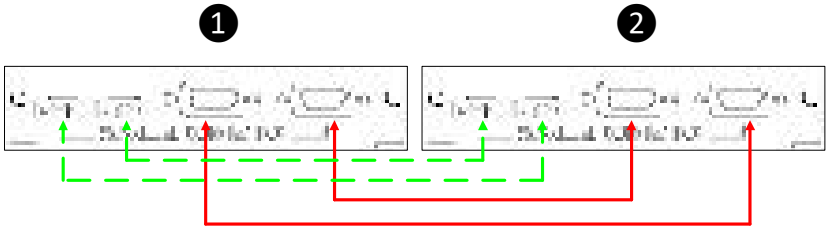
5-1. Parallel Operation in Single phase

Two UPS in parallel:

Power Connection

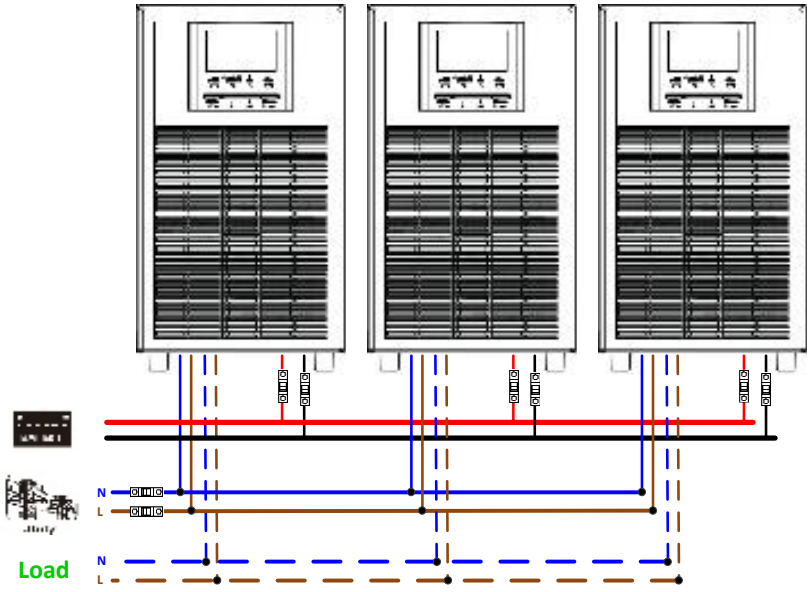


Communication Connection

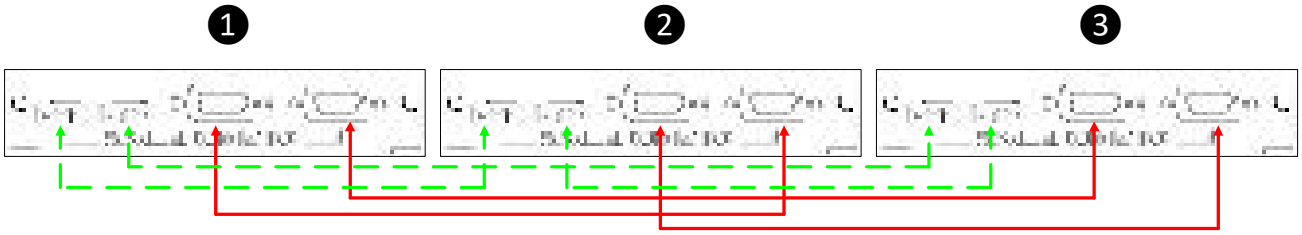


Three UPS in parallel:

Power Connection

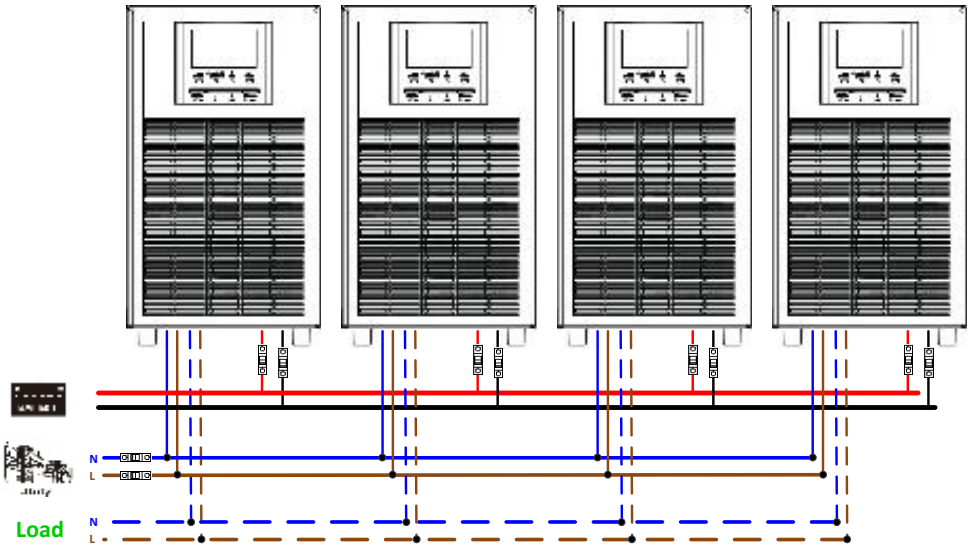


Communication Connection

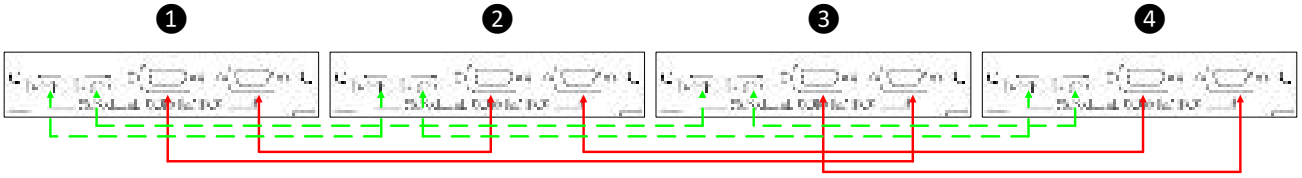


Four UPS in parallel:

Power Connection

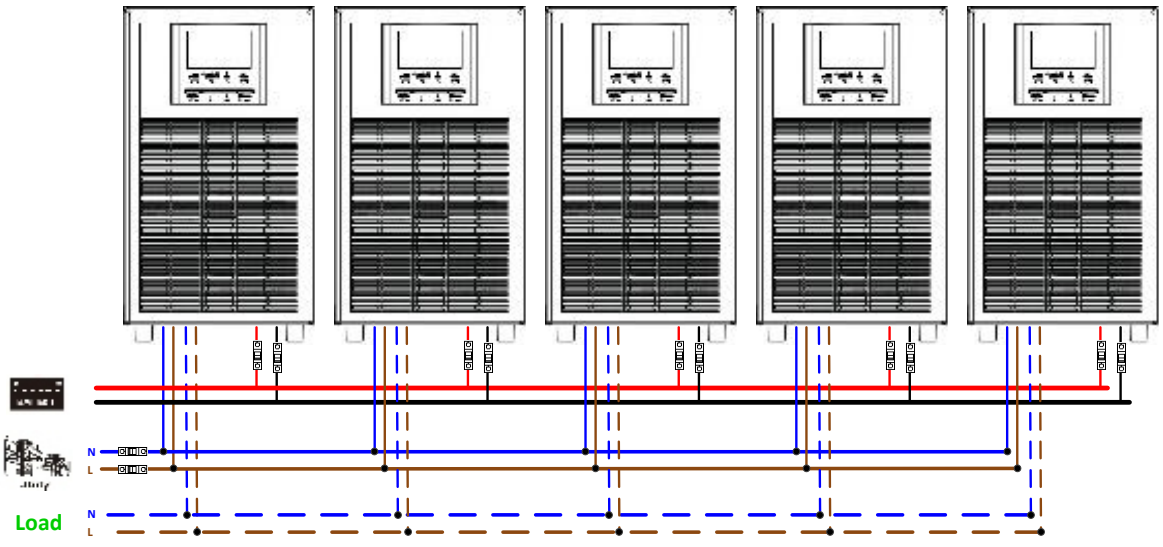


Communication Connection

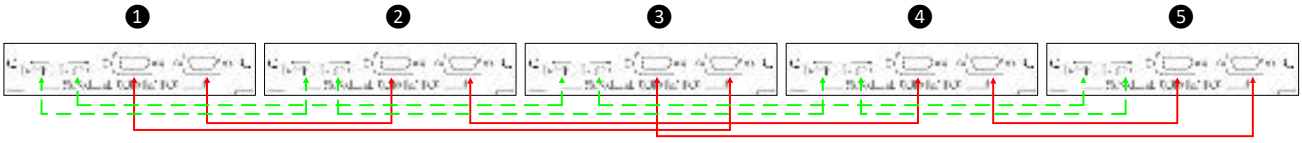


Five UPS in parallel:

Power Connection

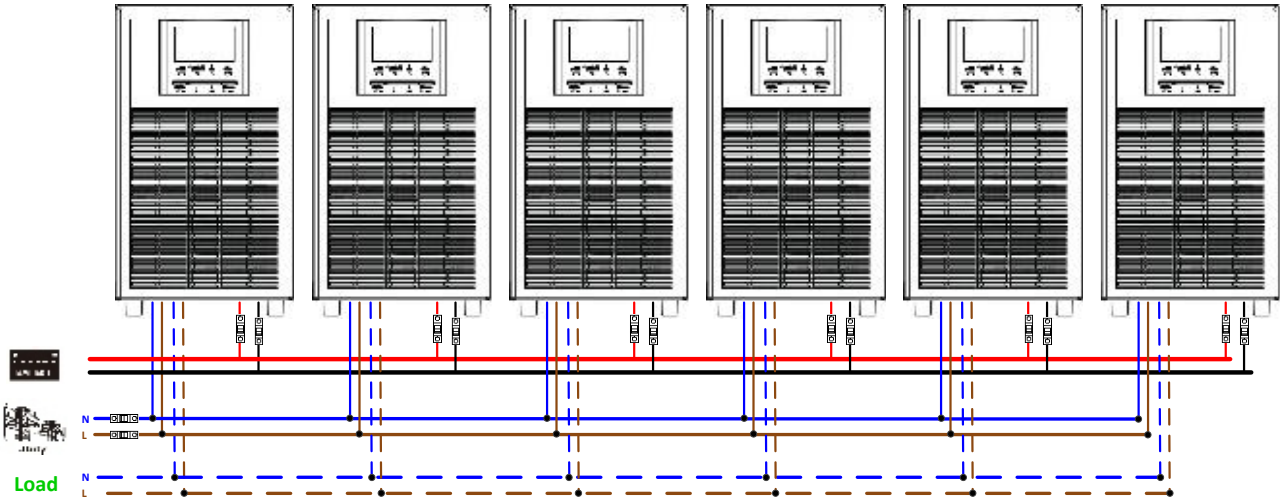


Communication Connection

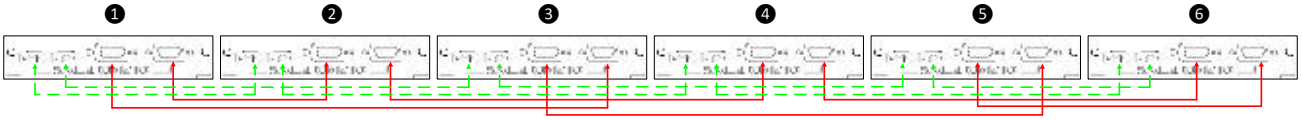


Six UPS in parallel:

Power Connection

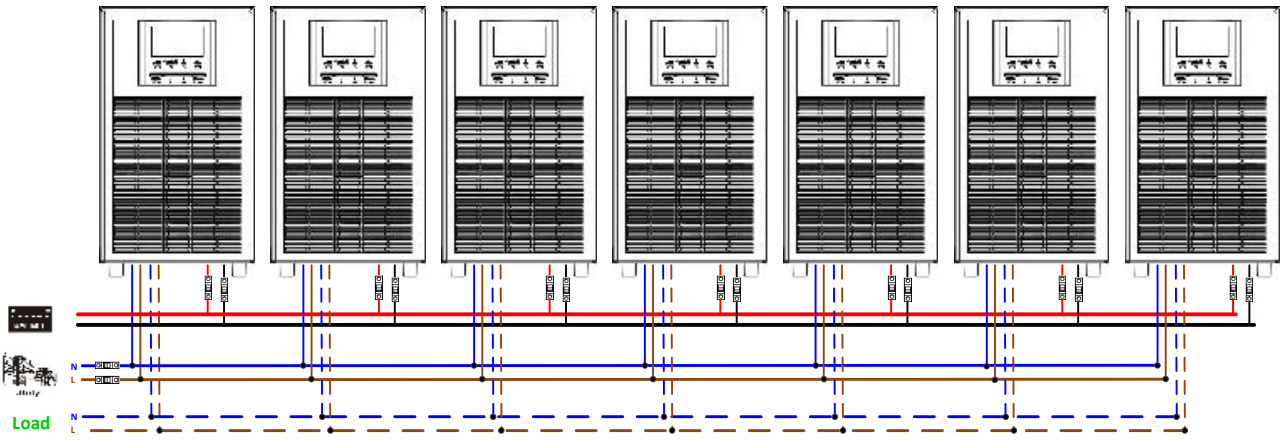


Communication Connection

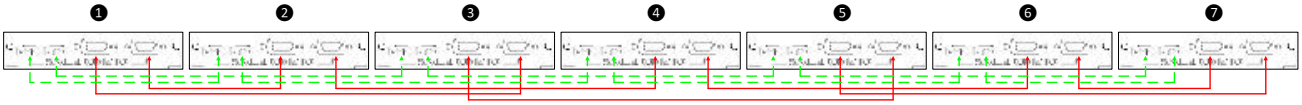


Seven UPS in parallel:

Power Connection

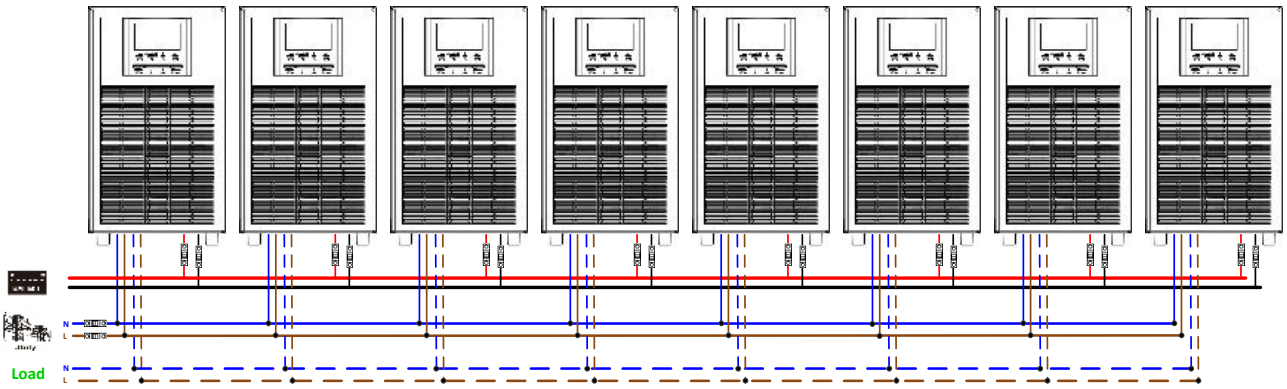


Communication Connection

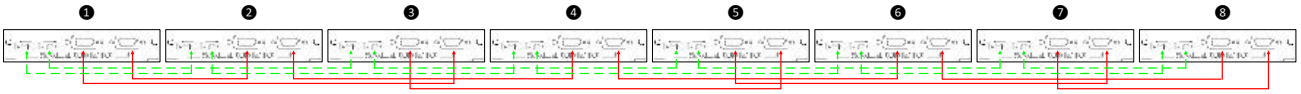


Eight UPS in parallel:

Power Connection

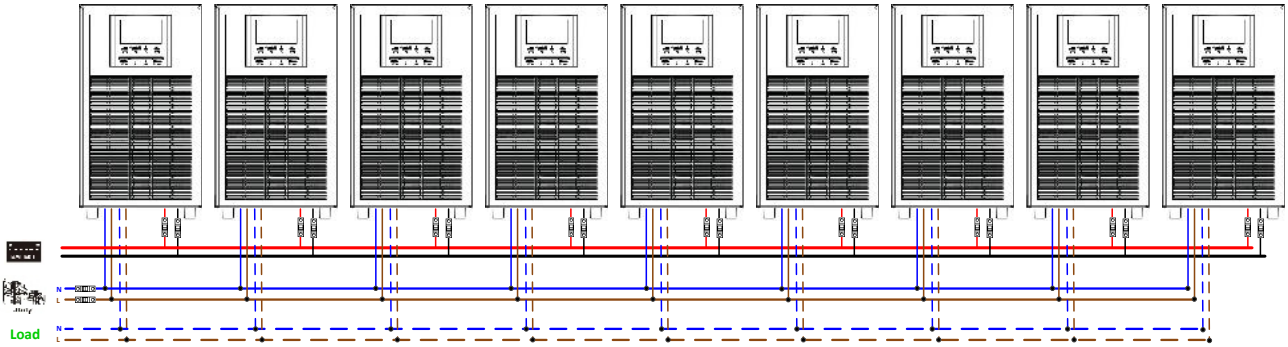


Communication Connection

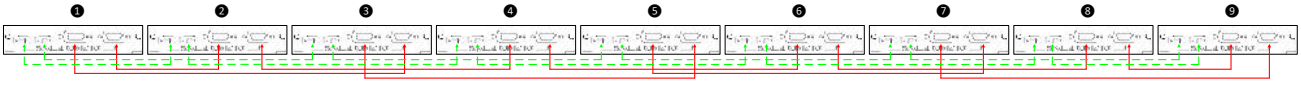


Nine UPS in parallel:

Power Connection



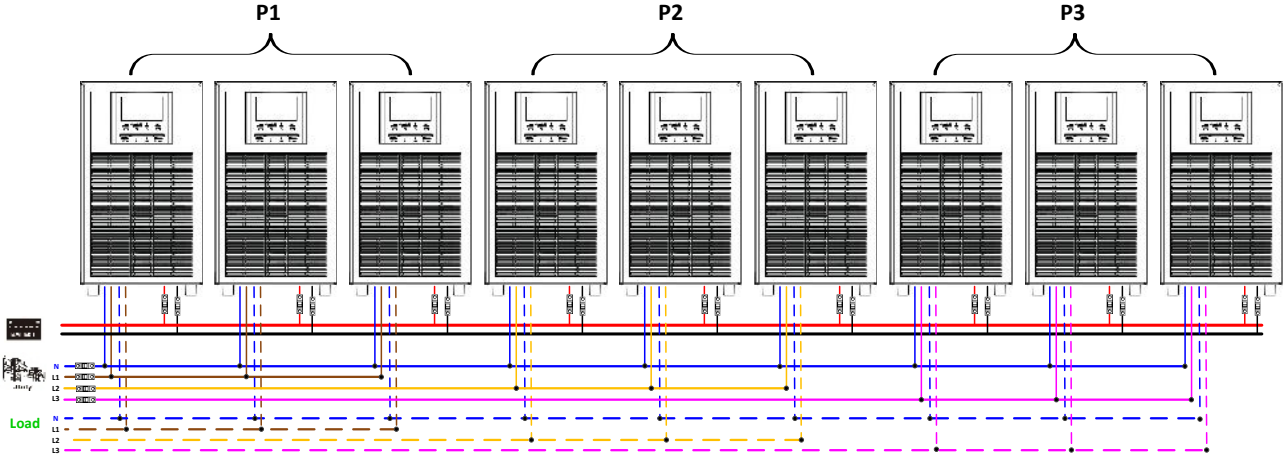
Communication Connection



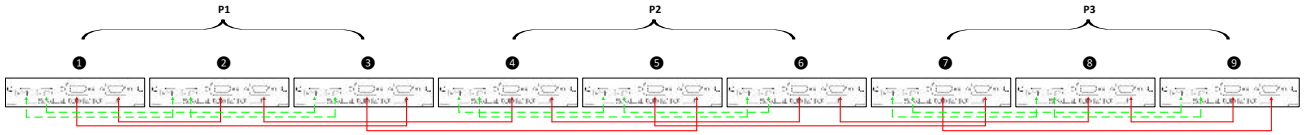
5-2. Support 3-phase equipment

Three UPS in each phase:

Power Connection

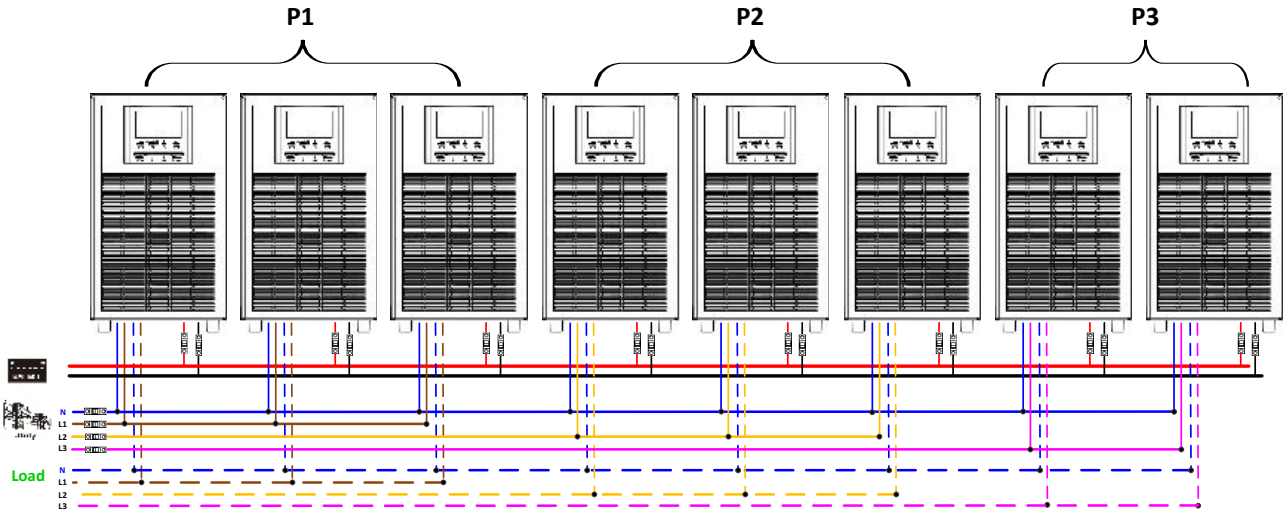


Communication Connection

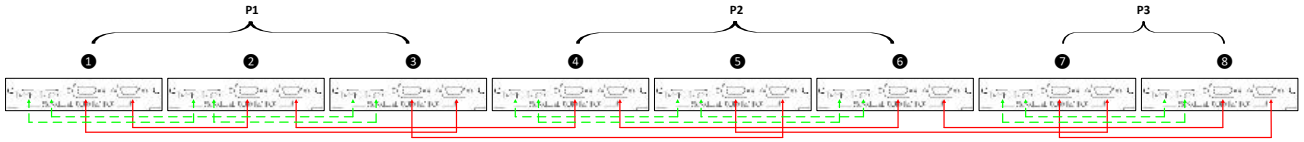


Three UPS in one phase, three UPS in second phase and two UPS for the third phase:

Power Connection

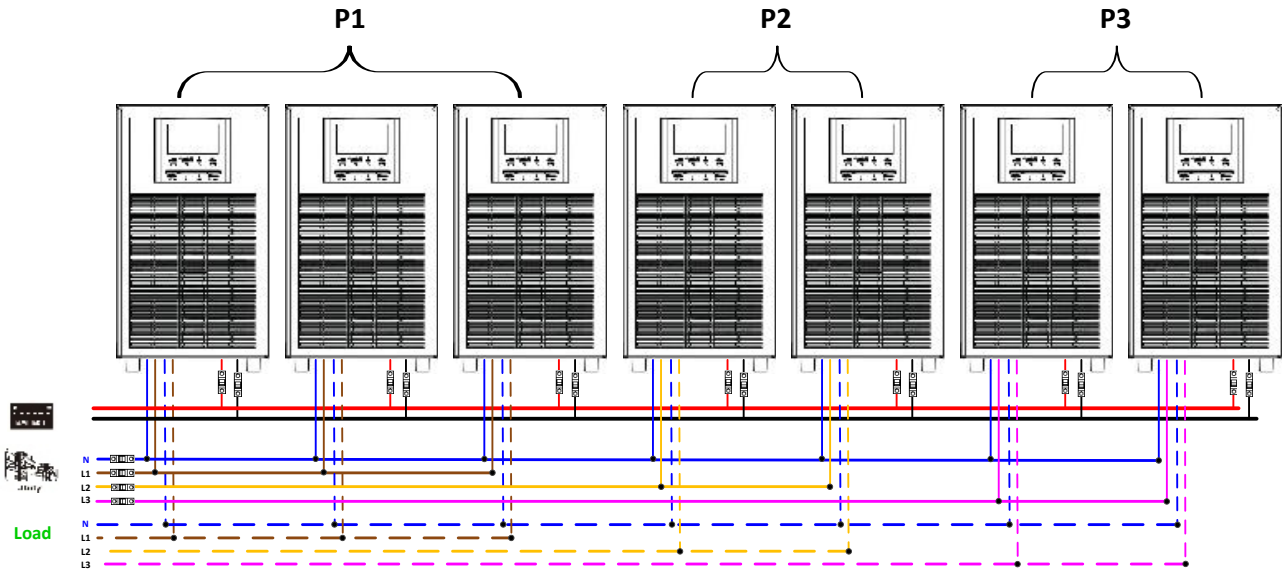


Communication Connection

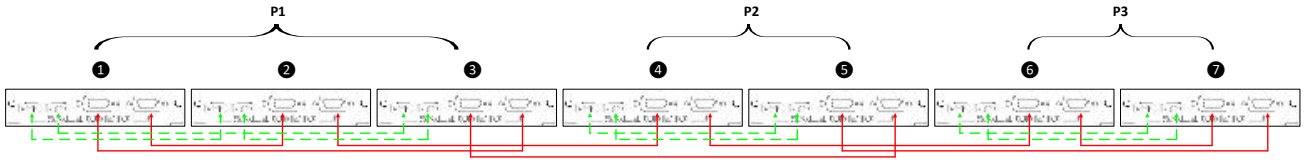


Three UPS in one phase, two UPS in second phase and two UPS for the third phase:

Power Connection

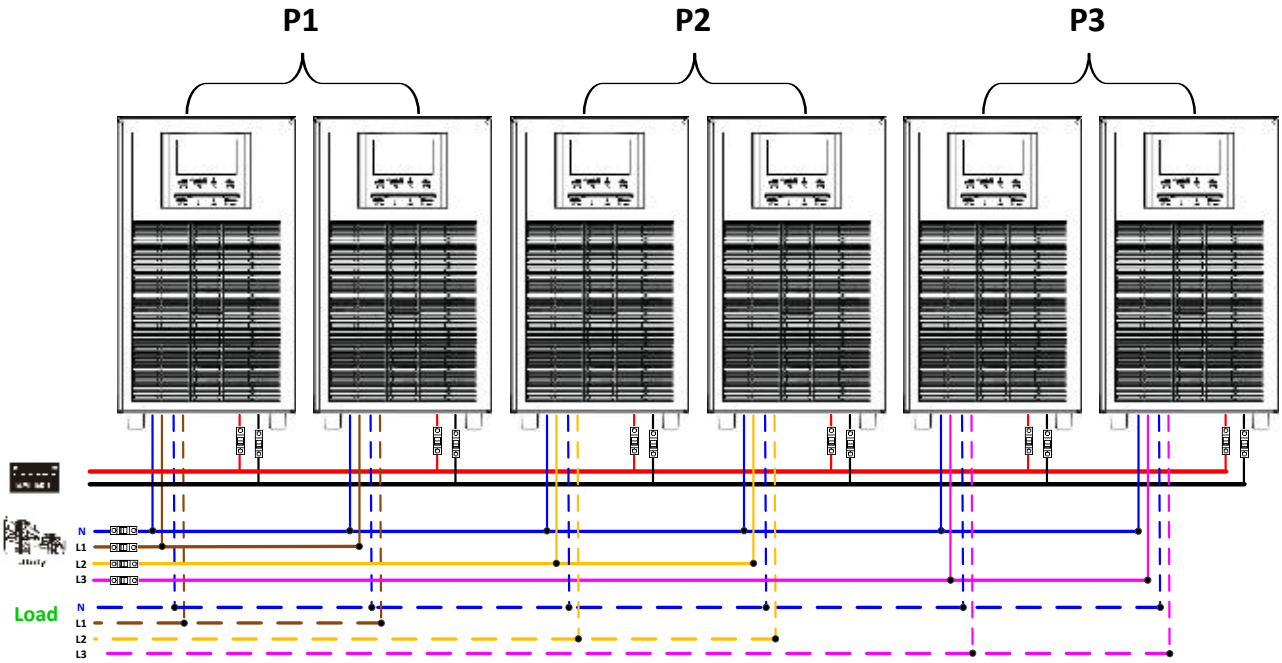


Communication Connection

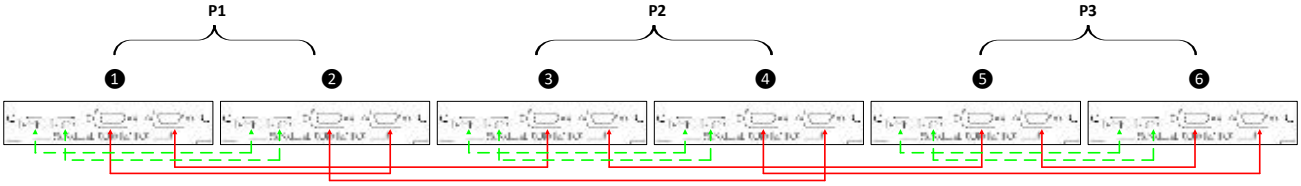


Two UPS in each phase:

Power Connection

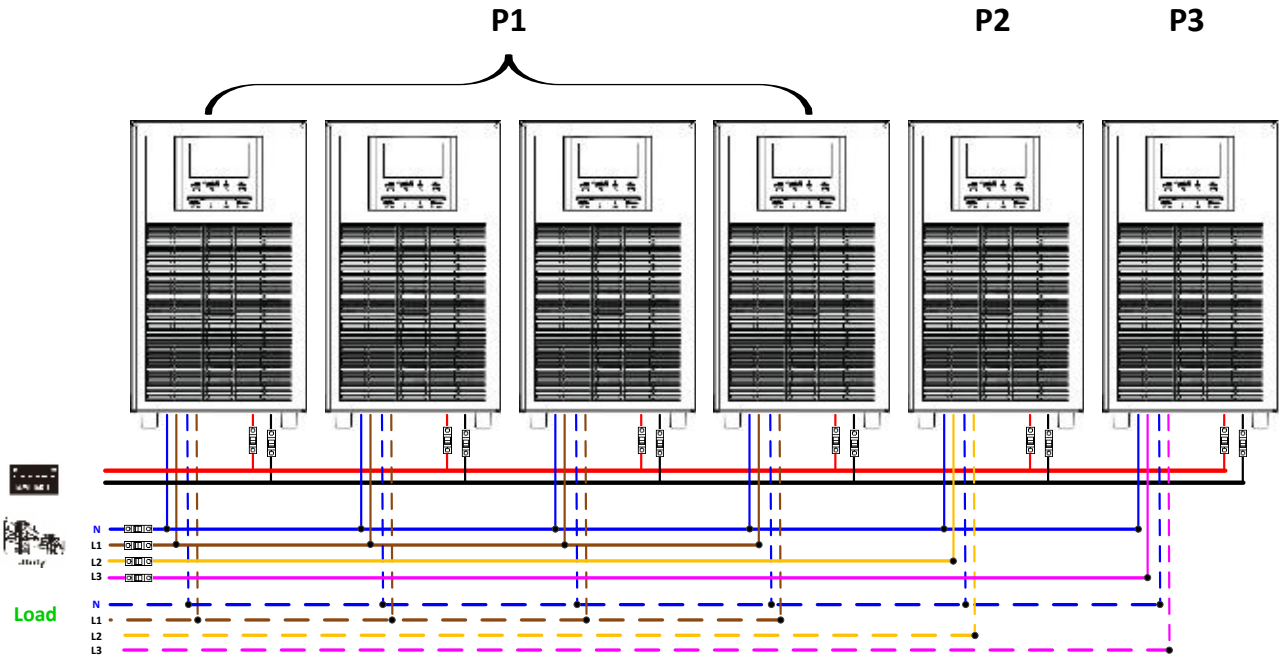


Communication Connection

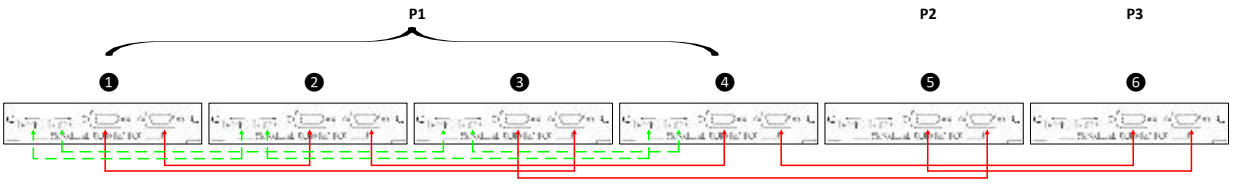


Four UPS in one phase and one UPS for the other two phases:

Power Connection

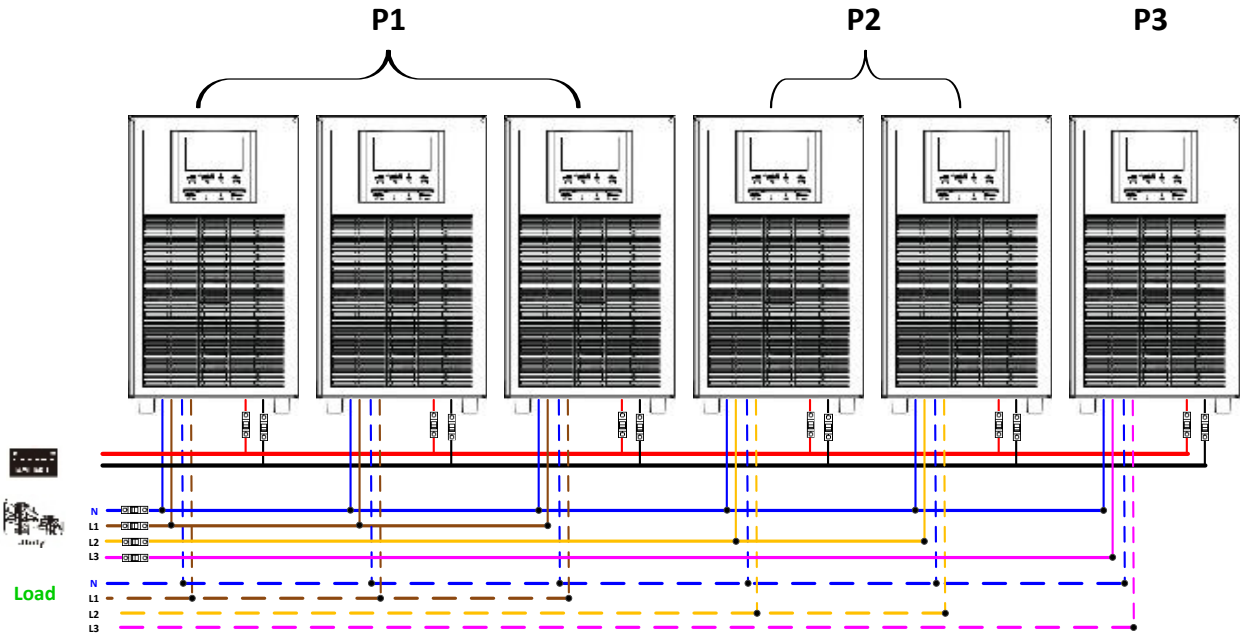


Communication Connection

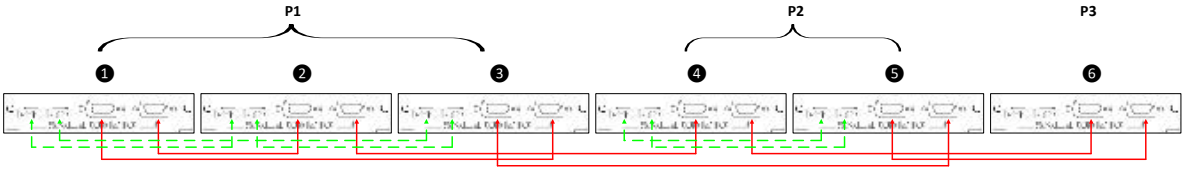


Three UPS in one phase, two UPS in second phase and one UPS for the third phase:

Power Connection

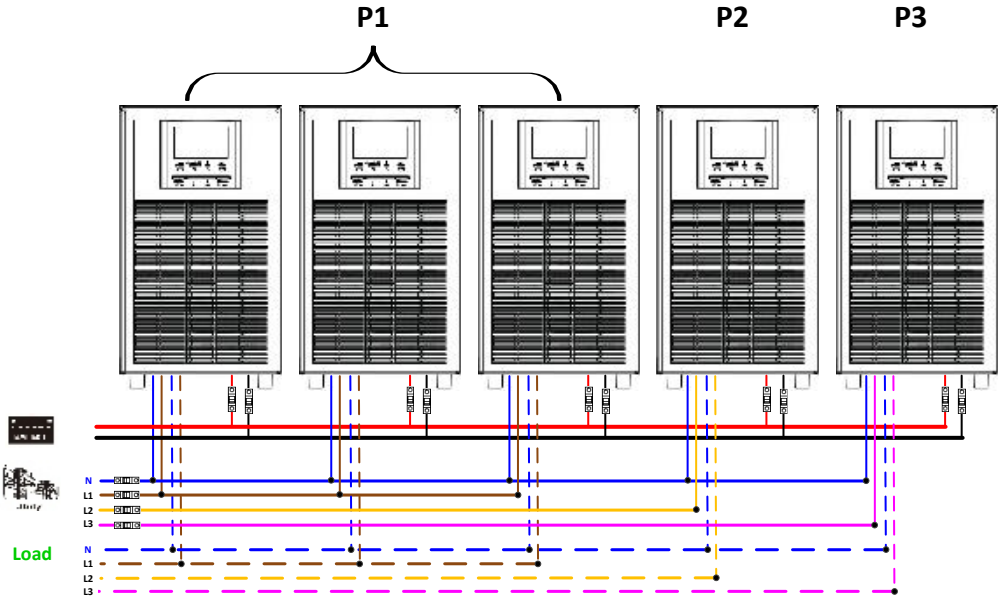


Communication Connection

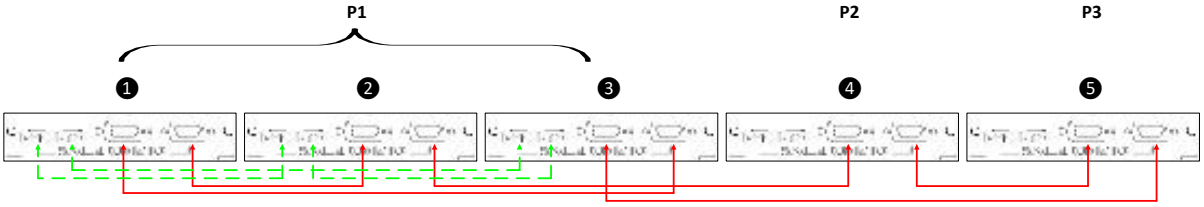


Three UPS in one phase and only one UPS for the remaining two phases:

Power Connection

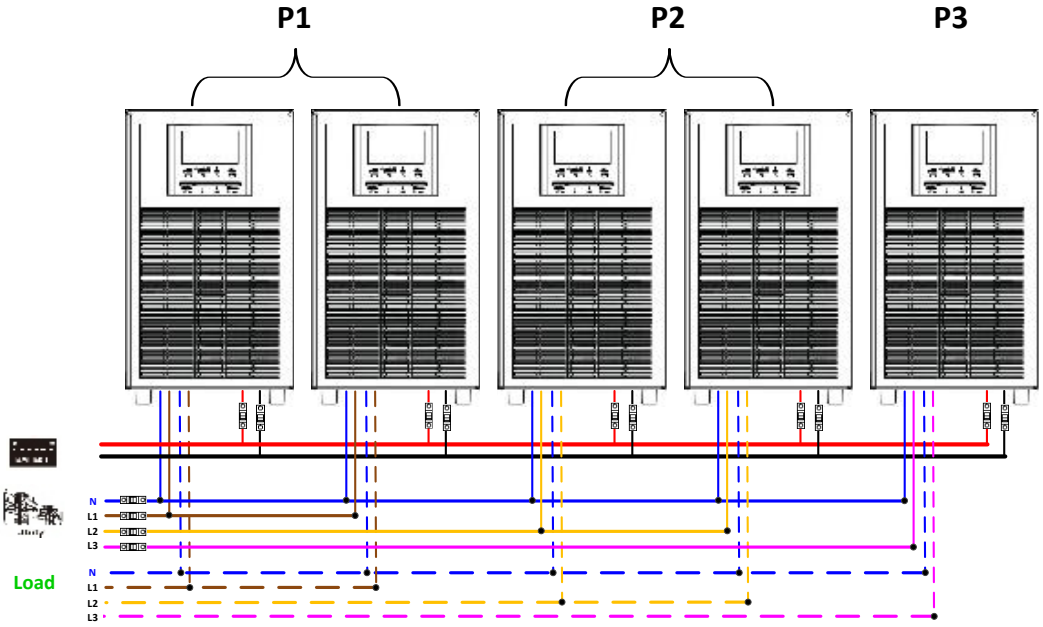


Communication Connection

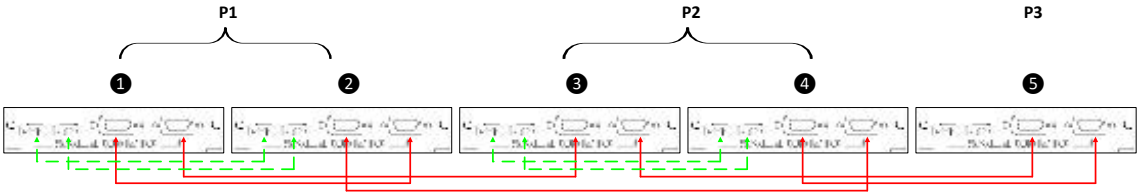


Two UPS in two phases and only one UPS for the remaining phase:

Power Connection

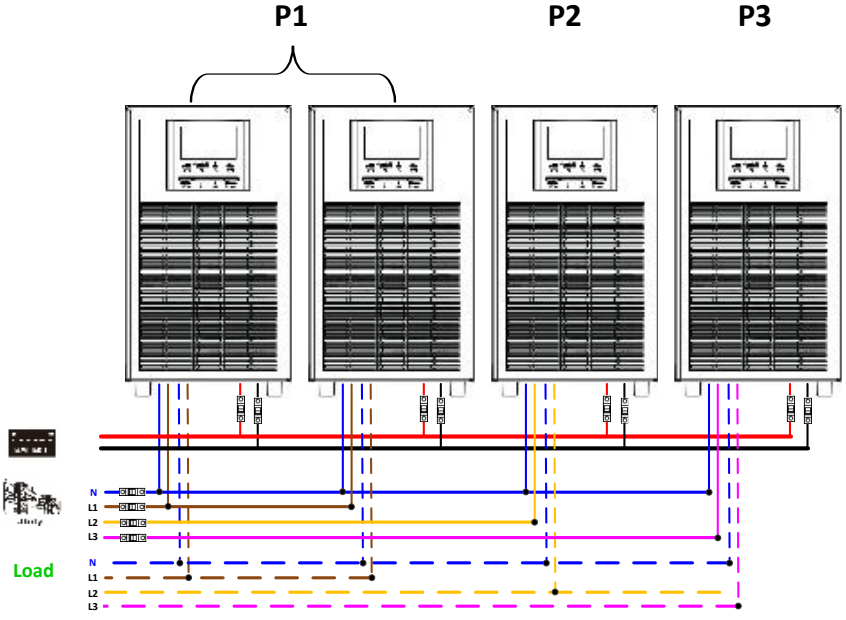


Communication Connection



Two UPS in one phase and only one UPS for the remaining phases:

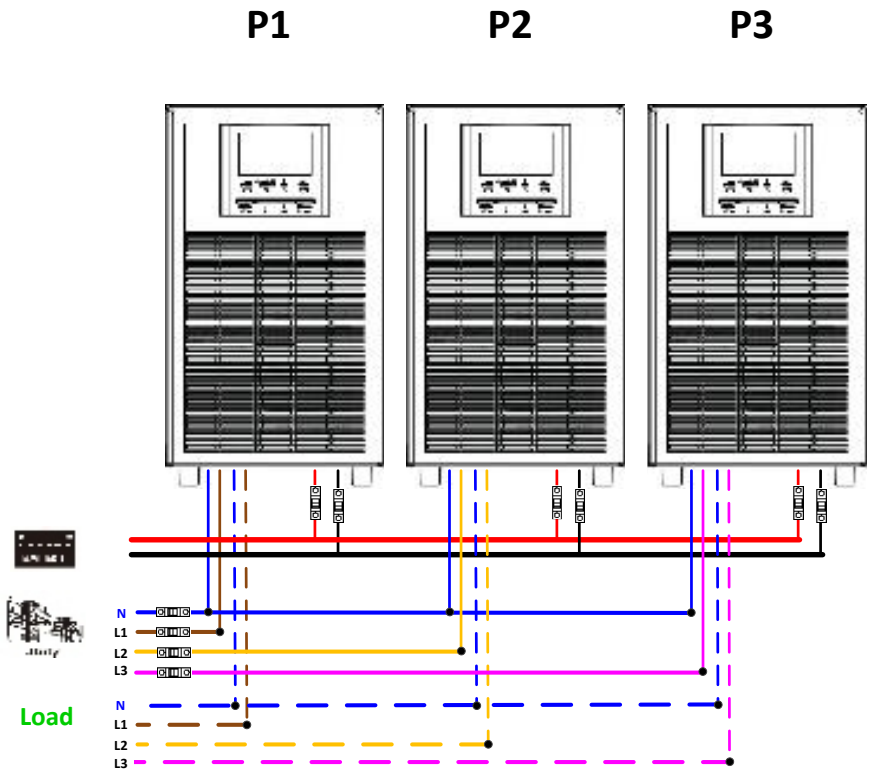
Power Connection



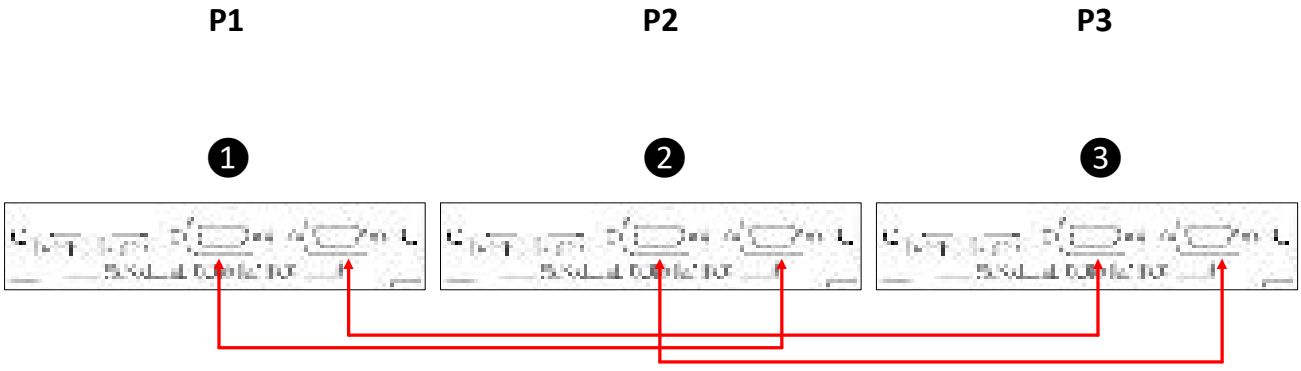
Communication Connection

One UPS in each phase:

Power Connection



Communication Connection



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

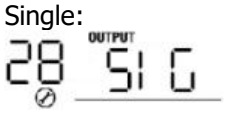
6. PV Connection

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

CAUTION: Each UPS 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="4">28</td><td rowspan="4">AC output mode
*This setting is able to set up only when the UPS is in standby mode. Be sure that AC output is off status. Otherwise, please refer to chapter "Power ON/OFF" to press "ESC" button to turn off AC output.</td><td>Single:
  </td><td rowspan="4">When the units are used in parallel with single phase, please select "PAL" in program 28.

It is required to have at least 3 UPS or maximum 6 UPS to support three-phase equipment. It's required to have at least one UPS in each phase or it's up to four UPS in one phase. Please refers to 5-2 for detailed information.
Please select "3P1" in program 28 for the UPS connected to L1 phase, "3P2" in program 28 for the UPS connected to L2 phase and "3P3" in program 28 for the UPS 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.</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>
</table>

Fault code display:

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

8. Commissioning

Parallel in single phase

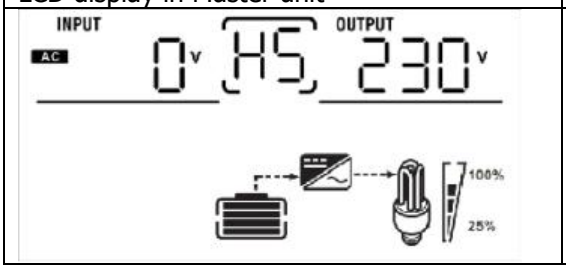
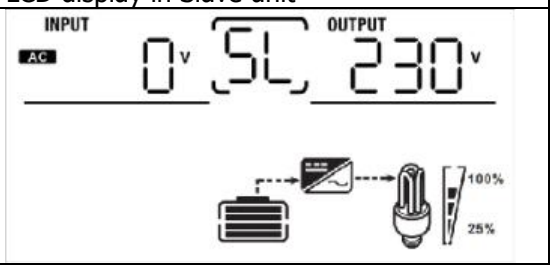
Step 1: Check the following requirements before commissioning:

- 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.

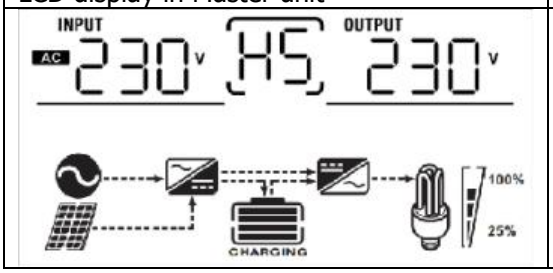
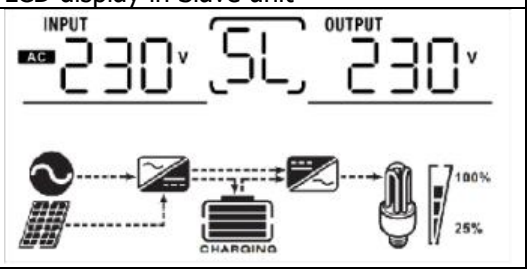
NOET: It's necessary to turn off switch when setting LCD program. Otherwise, the setting can not be programmed.

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 UPS connect to utility at the same time. If not, it will display fault 82 in following-order UPS. However, these UPS 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

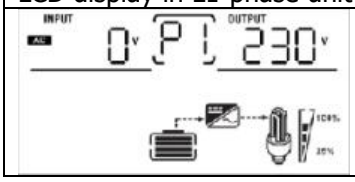
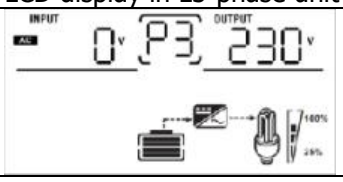
Step 1: Check the following requirements before commissioning:

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

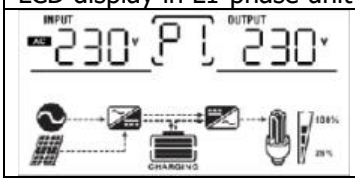
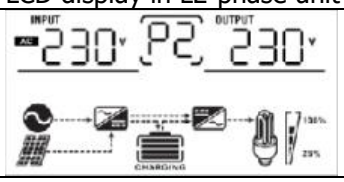
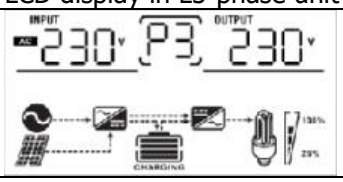
Step 2: Turn on all units and configure LCD program 28 as P1, P2 and P3 sequentially. And then shut down all units.

NOET: It's necessary to turn off switch when setting LCD program. Otherwise, the setting can not 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. Otherwise, the AC icon will flash and they will not work in line mode.

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 UPS is detected.	1. Restart the UPS. 2. Check if L/N cables are not connected reversely in all UPS. 3. For parallel system in single phase, make sure the sharing are connected in all UPS. For supporting three-phase system, make sure the sharing cables are connected in the UPS in the same phase, and disconnected in the UPS in different phases. 4. If the problem remains, please contact your installer.
71	The firmware version of each UPS is not the same.	1. Update all UPS firmware to the same version. 2. Check the version of each UPS 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 UPS is different.	1. Check if sharing cables are connected well and restart the UPS. 2. If the problem remains, please contact your installer.
80	CAN data loss	1. Check if communication cables are connected well and restart the UPS. 2. If the problem remains, please contact your installer.
81	Host data loss	
82	Synchronization data loss	
83	The battery voltage of each UPS is not the same.	1. Make sure all UPS share same groups of batteries together. 2. Remove all loads and disconnect AC input and PV input. Then, check battery voltage of all UPS. If the values from all UPS 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 UPS. 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 UPS. 2. Make sure utility starts up at same time. If there are breakers installed between utility and UPS, 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 UPS. 2. Remove some excessive loads and re-check load information from LCD of UPS. 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 UPS 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 I: Approximate Back-up Time Table

Model	Load (VA)	Backup Time @ 48Vdc 200Ah (min)	Backup Time @ 48Vdc 400Ah (min)
5KW	500	1226	2576
	1000	536	1226
	1500	316	804
	2000	222	542
	2500	180	430
	3000	152	364
	3500	130	282
	4000	100	224
	4500	88	200
	5000	80	180

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.