KODAK Solar Off Grid Inverter

Installation & User Manual

OG-Plus 3.24RM | OG-Plus 3.48RM | OG-Plus 5.48RM

Please read this manual carefully before installing and operating the inverter.
Please keep this manual with you for further reference

version 1.2

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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 protection for the battery supply.
11. GROUNDING INSTRUCTIONS -This inverter/charger should be connected to a permanent grounded wiring system. Be sure to comply with local requirements and regulation to install this inverter.
12. NEVER cause AC output and DC input short circuited. Do NOT connect to the mains when DC input short circuits.
13. **Warning!!** Only qualified service persons are able to service this device. If errors still persist after following troubleshooting table, please send this inverter/charger back to local dealer or service center for maintenance.

INTRODUCTION

This is a multi-function inverter/charger, combining functions of inverter, 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 inverter
- 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 inverter/charger. It also includes following devices to have a complete running system:

- Generator or Utility.
- PV modules

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

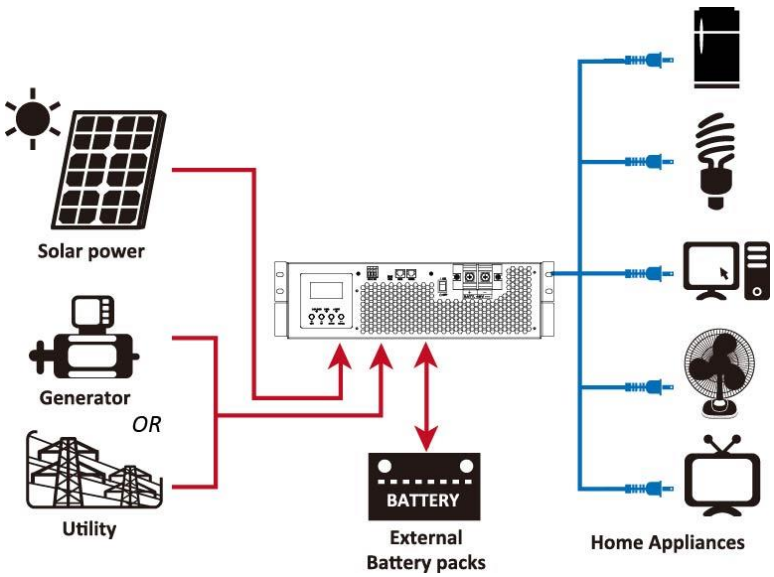
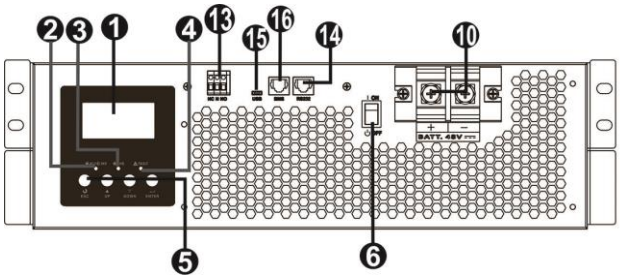
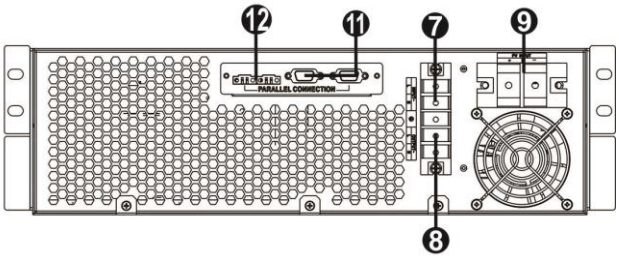


Figure 1 Hybrid Power System

Product Overview



Front



Back

1. LCD display
2. Status indicator
3. Charging indicator
4. Fault indicator
5. Function buttons
6. Power on/off switch
7. AC input
8. AC output
9. PV input
10. Battery input
11. Parallel communication cable (only for parallel model)
12. Current sharing cable (only for parallel model)
13. Dry contact
14. RS-232 communication port
15. USB port
16. BMS communication port: CAN and RS232 or RS485

NOTE: For parallel model installation and operation, please check separate parallel installation guide 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 1
- Software CD x 1
- Parallel cable x 2

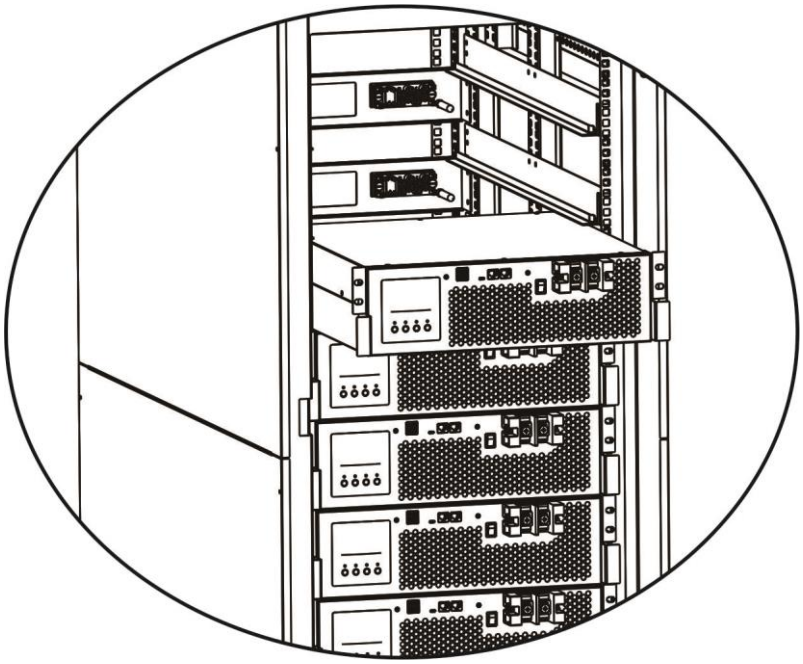
Installation

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

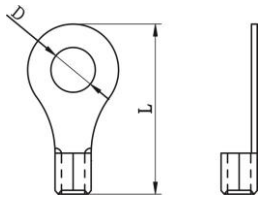
Please follow the diagram below to install the Inverter module in a 19-inch bay at the desired height in the upright cabinet. Secure the device adequately and fix it to the cabinet with six screws.



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 typical amperage in below table as required fuse or breaker size.

Ring terminal:



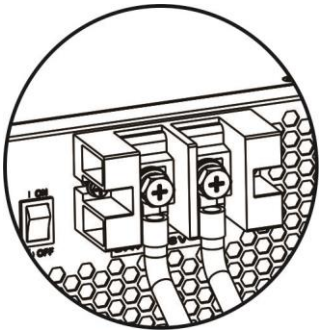
WARNING! All wiring must be performed by a qualified personnel.
WARNING! It's very important for system safety and efficient operation to use appropriate cable for battery connection. To reduce risk of injury, please use the proper recommended cable and terminal size as below.

Recommended battery cable and terminal size:

Model	Typical Amperage	Battery Capacity	Wire Size	Ring Terminal			Torque Value
				Cable mm²	Dimensions		
					D (mm)	L (mm)	
OG-Plus 3.24RM	140A	200AH	1*1/0AWG	60	8.4	49.7	4.5 Nm
			2*4AWG	44	8.4	49.7	
OG-Plus 3.48RM	70A	100A	1*4AWG	22	6.4	33.2	4.5 Nm
OG-Plus 5.48RM	110A	200AH	1*1/0AWG	60	8.4	49.7	4.5 Nm
			2*4AWG	44	8.4	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 100Ah for OG-Plus 3.48RM model and at least 200Ah capacity battery for OG-Plus 3.24RM /OG-Plus 5.48RM model.
3. Insert the ring terminal of battery cable flatly into battery connector of inverter and make sure the bolts are tightened with torque of 2-3 Nm. Make sure polarity at both the battery and the inverter/charge is correctly connected and ring terminals are tightly screwed to the battery terminals.



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

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

AC Input/Output Connection

CAUTION!! Before connecting to AC input power source, please install a **separate** AC breaker between inverter and AC input power source. This will ensure the inverter can be securely disconnected during maintenance and fully protected from over current of AC input. The recommended spec of AC breaker is 30A for 3KW and 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	Typical Amperage	Wire Size	Ring Terminal			Torque Value
			Cable mm^2	Dimensions		
				D (mm)	L (mm)	
OG-Plus 3.24RM OG-Plus 3.48RM	20A	10 AWG	5.5	5.3	19	1.4~1.6 Nm
OG-Plus 5.48RM	40A	8 AWG	8	5.3	19	1.4~1.6 Nm

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

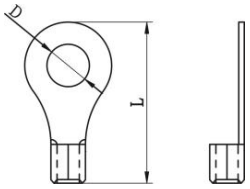
1. Assemble the ring terminal based on the recommended cable and terminal size
2. Insert the ring terminal of the cable flatly into AC input connector of inverter and make sure the bolts are tightened with torque of 2-3 Nm. Make sure the terminals are tightly screwed. Be sure to connect PE protective conductor (⏚**)** first.

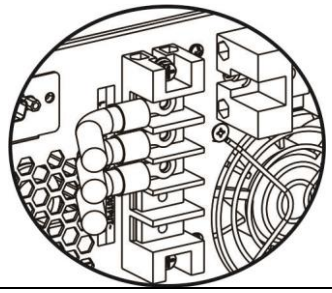
   ⏚**→Ground (yellow-green)**

   L→LINE (brown or black)

   N→Neutral (blue)

Ring terminal:





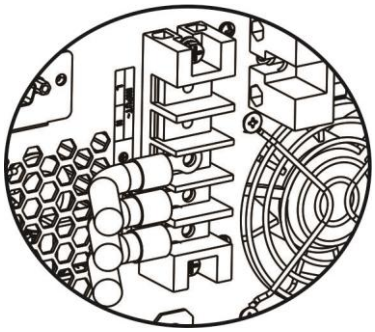
⚠	**WARNING:** Be sure that AC power source is disconnected before attempting to hardwire it to the unit.

3. Then, Insert the ring terminal of the cable flatly into AC output connector of inverter and make sure the bolts are tightened with torque of 2-3 Nm. Make sure the terminals are tightly screwed. Be sure to connect PE protective conductor (⏚) first.

   ⏚**→Ground (yellow-green)**

   L→LINE (brown or black)

   N→Neutral (blue)



4. 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 inverters 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 inverter/charger will trig overload fault and cut off output to protect your appliance but sometimes it still causes internal damage to the air conditioner.

CAUTION: Important

When input source is the generator, it's suggested to choose the generator by following parameters:

- The recommend generator rating should be at least 2X of inverter capacity.
- Generator output: Pure Sine Wave
- Generator output voltage rms range: 180 ~ 270Vac
- Generator output frequency range: 45Hz ~ 63Hz

It's recommended to test the generator with the inverter before the installation. Few generators complied above parameters may still not be accepted by the inverter as the input source.

PV Connection

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

WARNING! All wiring must be performed by a qualified personnel.
WARNING! It'' 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	Wire Size	Ring Terminal			Torque Value
			Cable mm^2	Dimensions		
				D (mm)	L (mm)	
OG-Plus 3.24RM	60A	8 AWG	8	6.4	29.8	2~3 Nm
OG-Plus 3.48RM OG-Plus 5.48RM	80A	6 AWG	14	6.4	29.8	2~3 Nm

PV Module Selection:

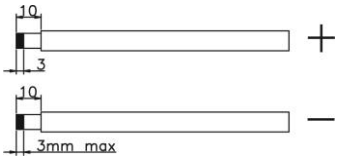
When selecting proper PV modules, please be sure to consider below parameters:

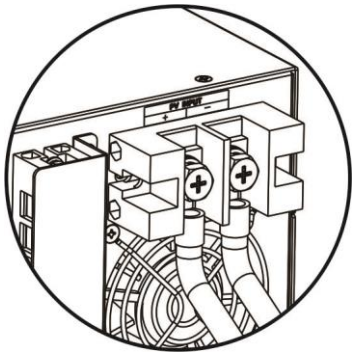
1. Open circuit Voltage (Voc) of PV modules not exceeds max. PV array open circuit voltage of inverter.
2. Open circuit Voltage (Voc) of PV modules should be higher than min. battery voltage.

Solar Charging Mode			
INVERTER MODEL	**OG-Plus 3.24RM**	**OG-Plus 3.48RM**	**OG-Plus 5.48RM**
Max. PV Array Open Circuit Voltage	145Vdc		
PV Array MPPT Voltage Range	30~115Vdc	60~115Vdc	

Please follow below steps to implement PV module connection:

1. Assemble the ring terminal based on the recommended cable and terminal size.
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.

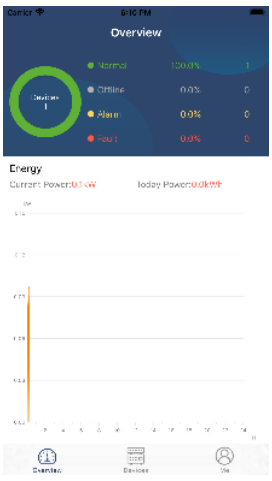
Communication Connection

Serial Connection

Please use supplied communication cable to connect to inverter and PC. Insert bundled CD into a computer and follow on-screen instruction to install the monitoring software. For the detailed software operation, please check user manual of software inside of CD.

Wi-Fi Connection

This unit is equipped with a Wi-Fi transmitter. Wi-Fi transmitter can enable wireless communication between off-grid inverters and monitoring platform. Users can access and control the monitored inverter with downloaded APP. You may find "WatchPower" app from the Apple® Store or "WatchPower Wi-Fi" in Google® Play Store. All data loggers and parameters are saved in iCloud. For quick installation and operation, please check Appendix III.



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.

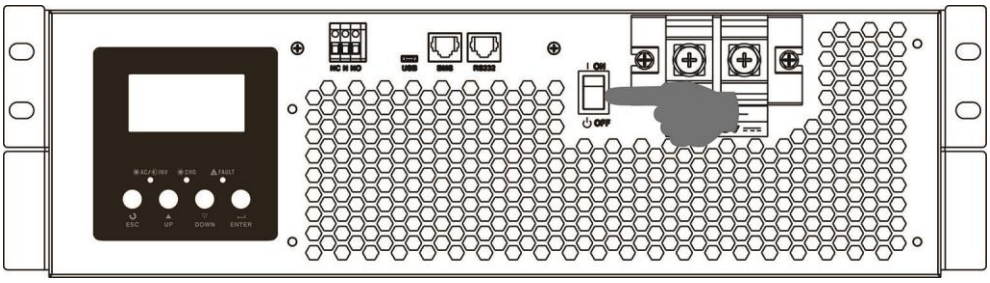
Unit Status	Condition			Dry contact port: 	
				NC & C	NO & C
Power Off	Unit is off and no output is powered.			Close	Open
Power On	Output is powered from Utility.			Close	Open
	Output is powered from Battery power or Solar energy.	Program 01 set as USB (utility first)	Battery voltage < Low DC warning 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

BMS Communication

If connecting to lithium battery, it's requested to buy a special communication cable. For the detailed BMS communication and installation, please check Appendix B – BMS Communication Installation.

OPERATION

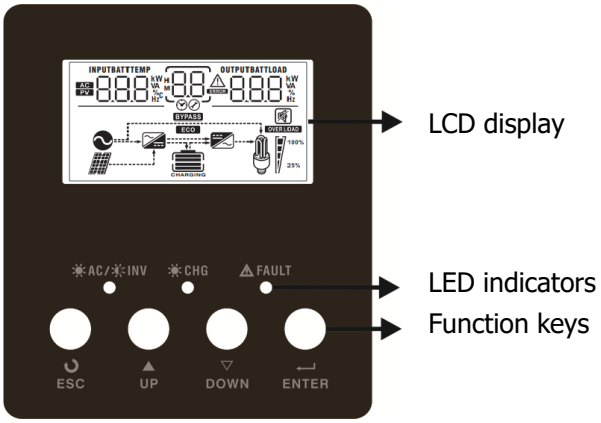
Power ON/OFF



Once the unit has been properly installed and the batteries are connected well, simply press On/Off switch (located on the button of the case) 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, four function keys and a LCD display, indicating the operating status and input/output power information.



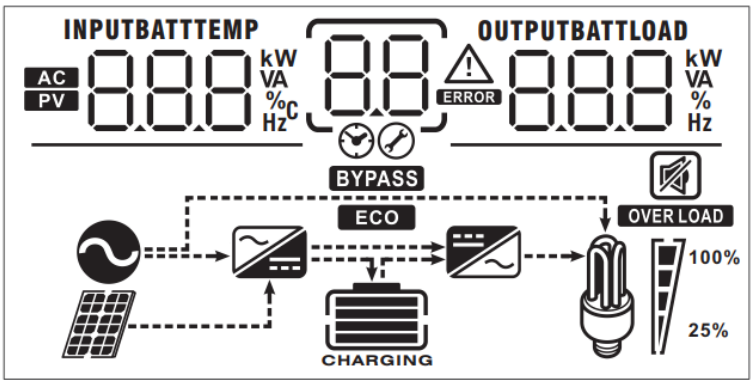
LED Indicator

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

Function Keys

Function Key	Description
ESC	To exit setting mode
UP	To go to previous selection
DOWN	To go to next selection
ENTER	To confirm the selection in setting mode or enter setting mode

LCD Display Icons



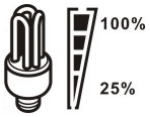
Icon	Function description
Input Source Information	
AC	Indicates the AC input.
PV	Indicates the PV input
INPUTBATT kW VA % °C Hz	Indicate input voltage, input frequency, PV voltage, battery voltage and charger current.
Configuration Program and Fault Information	
	Indicates the setting programs.
ERROR	Indicates the warning and fault codes. Warning: flashing with warning code. Fault: ERROR lighting with fault code
Output Information	
OUTPUTBATTLOAD 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%	< 1.717V/cell	
	1.717V/cell ~ 1.8V/cell	
	1.8 ~ 1.883V/cell	
	> 1.883 V/cell	
50%> Load > 20%	< 1.817V/cell	
	1.817V/cell ~ 1.9V/cell	
	1.9 ~ 1.983V/cell	
	> 1.983	
Load < 20%	< 1.867V/cell	
	1.867V/cell ~ 1.95V/cell	
	1.95 ~ 2.033V/cell	
	> 2.033	

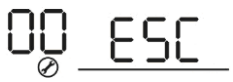
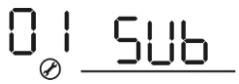
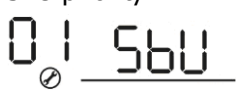
Load Information				
OVER LOAD	Indicates overload.			
	Indicates the load level by 0-24%, 25-49%, 50-74% and 75-100%.			
	0%~24%	25%~49%	50%~74%	75%~100%
				

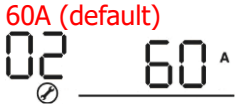
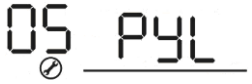
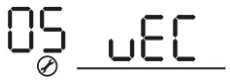
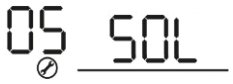
Mode Operation Information	
	Indicates unit connects to the mains.
	Indicates unit connects to the PV panel.
BYPASS	Indicates inverter will work in Bypass mode
ECO	Indicates inverter will work in ECO mode
	Indicates the utility charger circuit is working.
	Indicates the DC/AC inverter circuit is working.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

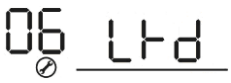
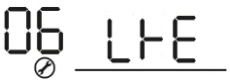
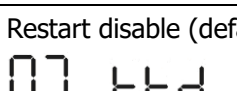
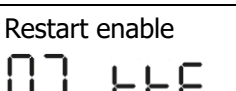
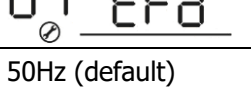
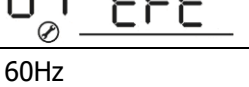
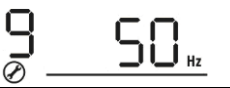
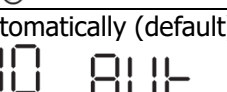
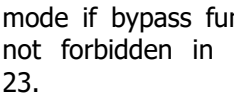
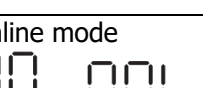
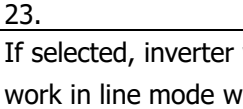
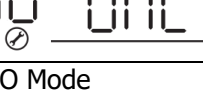
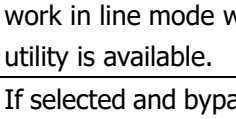
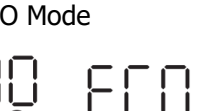
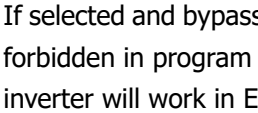
LCD Setting

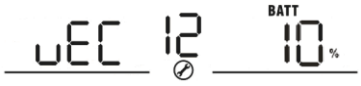
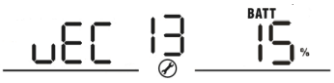
After pressing and holding ENTER button for 3 seconds, the unit will enter setting mode. Press "UP" or "DOWN" button to select setting programs. And then, press "ENTER" button to confirm the selection or ESC button to exit.

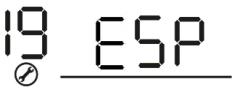
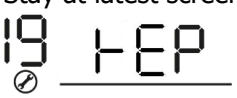
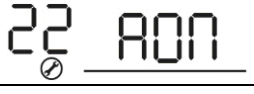
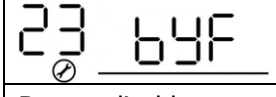
Setting Programs:

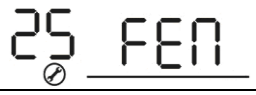
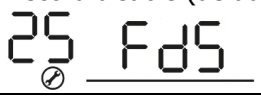
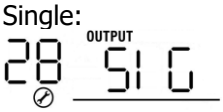
Program	Description	Selectable option	
00	Exit setting mode	Escape 	
01	Output source priority: To configure load power source priority	USB : Utility first (default) 	Utility will provide power to the loads as first priority. If Utility energy is unavailable, solar energy and battery provides power the 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 120A for OG-Plus 3.24RM model and 10A to 140A for OG-Plus 3.48RM model. The setting range is from 10A to 160A for OG-Plus 5.48RM model. 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.
		Pylontech battery 	If selected, programs of 02, 26, 27 and 29 will be automatically set up. No need for further setting.
		WECO battery (only for OG-Plus 5.48RM model) 	If selected, programs of 02, 12, 26, 27 and 29 will be auto-configured per battery supplier recommended. No need for further adjustment. Setting parameters in Programs 12 and 13 parameters change to SOC (State of charge) of battery.
		Soltaro battery (only for OG-Plus 5.48RM model) 	If selected, programs of 02, 26, 27 and 29 will be automatically set up. No need for further setting.
		LIb-protocol compatible battery 	Select " LIb" if using Lithium battery compatible to Lib protocol. If selected, programs of 02, 26, 27 and 29 will be automatically set up. No need for further setting.
		3rd party Lithium battery 	If selected, programs of 02, 26, 27 and 29 will be automatically set up. No need for further setting. Please contact the battery supplier for installation procedure.

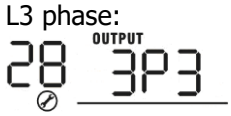
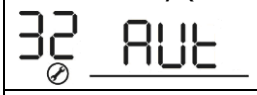
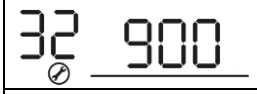
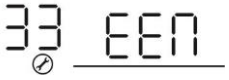
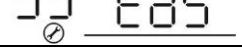
06	Auto restart when overload occurs	Restart disable (default) 	Restart enable 
07	Auto restart when over temperature occurs	Restart disable (default) 	Restart enable 
09	Output frequency	50Hz (default) 	60Hz 
10	Operation Logic	Automatically (default) 	If selected and utility is available, inverter will work in line mode. Once utility frequency is unstable, inverter will work in bypass mode if bypass function is not forbidden in program 23.
10	Operation Logic	Online mode 	If selected, inverter will work in line mode when utility is available.
		ECO Mode 	If selected and bypass is not forbidden in program 23, inverter will work in ECO mode when utility is available.
11	Maximum utility charging current	2A 	10A 
		20A 	30A (default) 
		40A 	50A 
		60A 	70A (only for OG-Plus 5.48RM) 
		80A (only for OG-Plus 5.48RM) 	
12	Setting voltage point back to utility source when selecting "SBU" (SBU priority) or "SUB" (Solar first) in program 01	Available options for 24V:	
		Default setting: 23.0V 	The setting range is from 22.0V to 28.5V and increment of each click is 1.0V.
		Available options for 48V:	

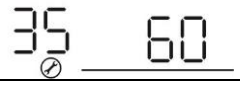
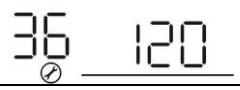
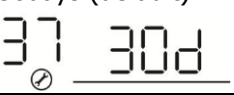
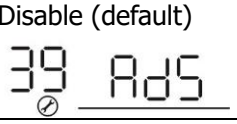
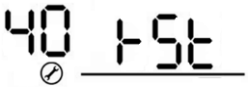
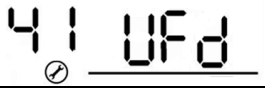
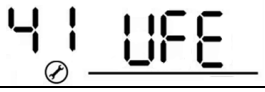
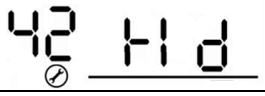
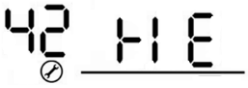
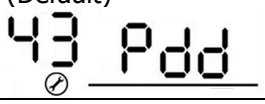
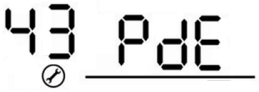
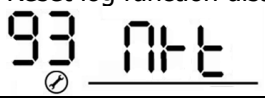
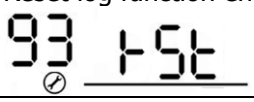
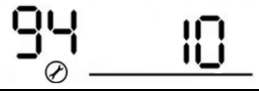
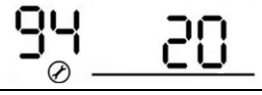
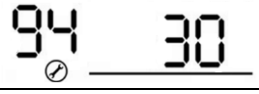
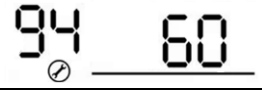
		Default setting: 46.0V 	The setting range is from 44.0V to 57.0V and increment of each click is 1.0V.
		If "WECO battery" is selected in program 05	
		Default setting: 10% 	The parameter will be fixed at 10% SOC of battery.
13	Setting voltage point back to battery mode when selecting "SBU" (SBU priority) or "SUB" (Solar first) in program 01	Available options for 24V:	
		Battery fully charged 	The setting range is from 24.0V to 32.0V and increment of each click is 1.0V.
		27V (default) 	
	Setting voltage point back to battery mode when selecting "SBU" (SBU priority) or "SUB" (Solar first) in program 01	Available options for 48V:	
		Battery fully charged 	The setting range is from 48.0V to 64.0V and increment of each click is 1.0V.
		54.0V (default) 	
		If "WECO battery" is selected in program 5	
		15% 	This parameter will refer to the SOC of battery and adjustable from 15 to 100%. Increment of each click is 5%. 15% is default setting.
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, inverter won't work in bypass/ECO modes.
		Bypass disable 	If selected and power ON button is pressed on, inverter can work in bypass/ECO mode only if utility is available.

<table>
<tr><td></td><td></td><td>Bypass enable (default)
  </td><td>If selected and no matter power ON button is pressed on or not, inverter can work in bypass mode if utility is available.</td></tr>
<tr><td>25</td><td>Record Fault code</td><td>Record enable
  </td><td>Record disable (default)
  </td></tr>
<tr><td rowspan="3">26</td><td rowspan="3">Bulk charging voltage
(C.V voltage)</td><td colspan="2">24V default setting: 28.2V
  </td></tr>
<tr><td colspan="2">Default setting: 56.4V
  </td></tr>
<tr><td colspan="2">If self-defined is selected in program 5, this program can be set up. Setting range is 24.0V to 32V for 24V and 48.0V to 64.0V for 48V. Increment of each click is 0.1V.</td></tr>
<tr><td rowspan="2">27</td><td>Floating charging voltage</td><td colspan="2">24V default to 27.0V
  </td></tr>
<tr><td>Floating charging voltage</td><td colspan="2">48V default setting: 54.0V
 
If self-defined is selected in program 5, this program can be set up. Setting range is 24.0V to 32V for 24Vl and 48.0V to 64.0V for 48V. Increment of each click is 0.1V.</td></tr>
<tr><td>28</td><td>AC output mode
*This setting is able to set up only when the inverter is in standby mode. Be sure that on/off switch is in “OFF” status</td><td>Single:
 
Parallel:
 
L1 phase:
 
L2 phase:
  </td><td>When the units are used in parallel with single phase, please select “PAL” in program 28.

It is required to have at least 3 inverters or maximum 9 inverters to support three-phase equipment. It’s required to have at least one inverter in each phase or it’s up to four inverters in one phase. Please refers to 5-2 for detailed information. Please select “3P1” in program 28 for the inverters connected to L1 phase, “3P2” in program 28 for the inverters connected to L2 phase and “3P3” in program</td></tr>
</table>

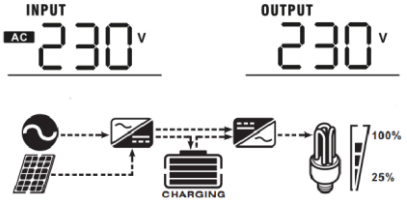
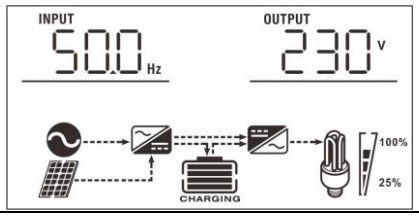
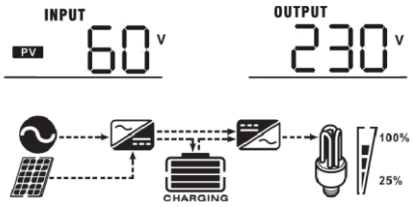
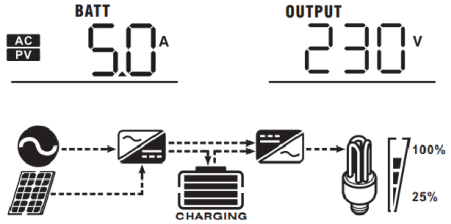
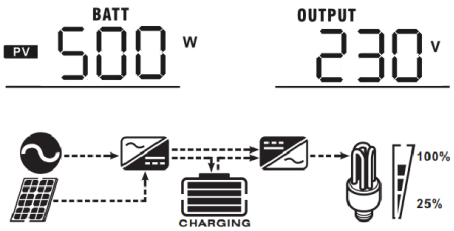
		L3 phase: 	28 for the inverters connected to L3 phase. Be sure to connect share current cable to units which are on the same phase. Do NOT connect share current cable between units on different phases.
29	Low DC cut-off voltage	24V default setting: 21.0V 	
		48V default setting: 42.0V 	
		If self-defined is selected in program 5, this program can be set up. Setting range is from 20.0V to 27.0V for 24V and 40.0V to 54.0V for 48V. 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 (C.V stage)	Automatically (Default): 	If selected, inverter will judge this charging time automatically.
		5 min 	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.
		900 min 	
		If "USE" is selected in program 05, this program can be set up.	
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	24V default setting: 29.2V 	
		48V default setting: 58.4V 	
		Setting range is 24.0V to 32V for 24V and 48.0V to 64.0V for 48V. Increment of each click is 0.1V.	

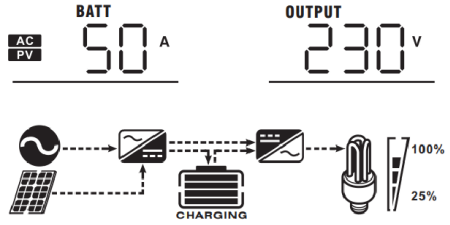
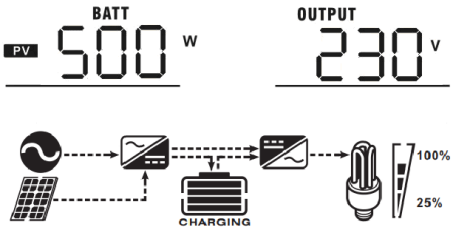
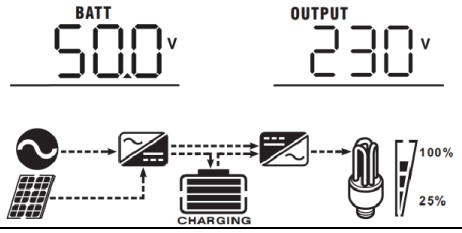
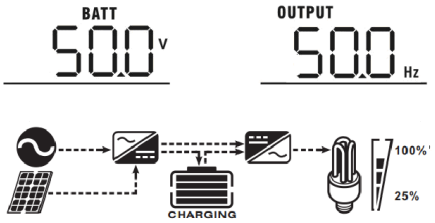
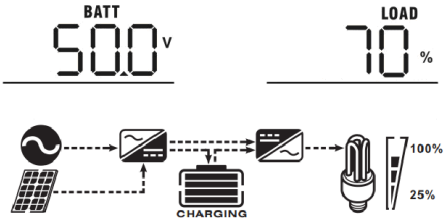
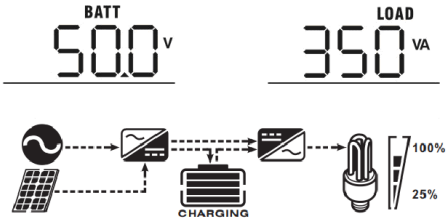
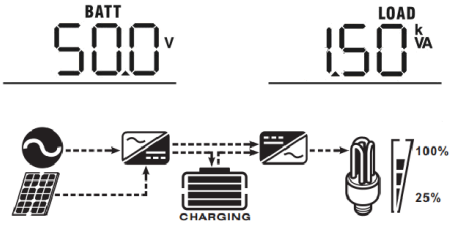
35	Battery equalized time	60min (default) 	Setting range is from 5min to 900min. Increment of each click is 5min.
36	Battery equalized timeout	120min (default) 	Setting range is from 5min to 900 min. Increment of each click is 5 min.
37	Equalization interval	30days (default) 	Setting range is from 0 to 90 days. Increment of each click is 1 day
39	Equalization activated immediately	Enable 	Disable (default) 
		If equalization function is enabled in program 33, this program can be set up. If "Enable" is selected in this program, it's to activate battery equalization immediately and LCD main page will shows "". If "Disable" is selected, it will cancel equalization function until next activated equalization time arrives based on program 37 setting. At this time, "  " will not be shown in LCD main page.	
40	Reset all stored data for PV generated power and output load energy	Not reset(Default) 	Reset 
41	Firmware upgrade for USB On-the-Go function	Upgrade disable (Default) 	Upgrade enable 
42	Re-write USB internal parameter	Re-write function disable (Default) 	RE-write function enable 
43	Export data log function	Export log function disable (Default) 	Export log function enable 
93	Erase all data log	Reset log function disable 	Reset log function enable 
94	Data log recorded interval *The maximum data log number is 1440. If it's over 1440, it will overwrite as first log.	3 minutes 	5 minutes 
		10 minutes(default) 	20 minutes 
		30 minutes 	60 minutes 
95	Time setting – Minute		For minute setting, the range is from 00 to 59.

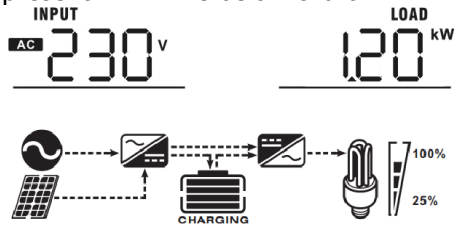
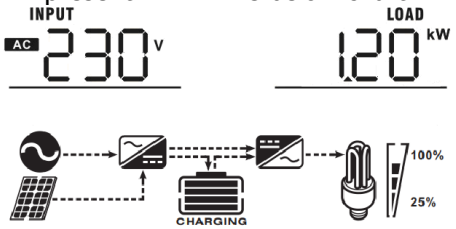
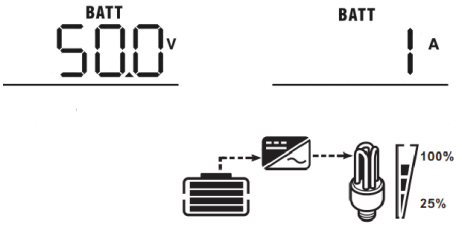
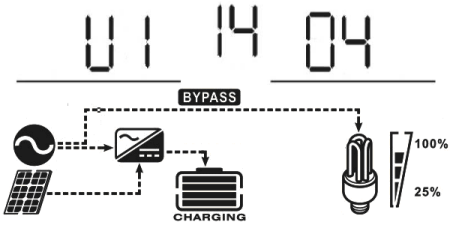
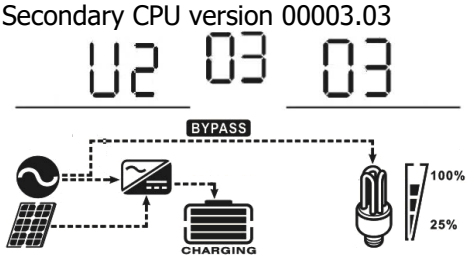
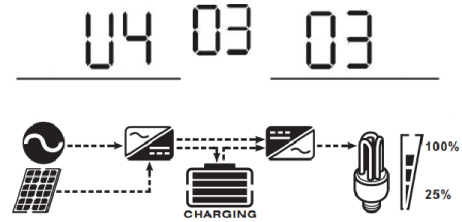
96	Time setting – Hour		For hour setting, the range is from 00 to 23.
97	Time setting– Day		For day setting, the range is from 00 to 31.
98	Time setting– Month		For month setting, the range is from 01 to 12.
99	Time setting – Year		For year setting, the range is from 18to 99.

Display Setting

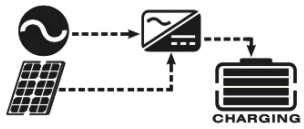
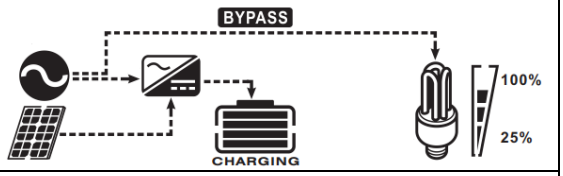
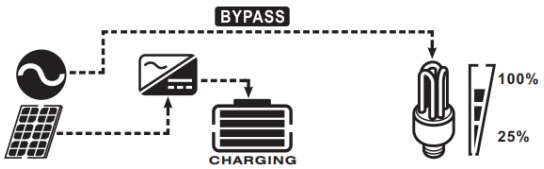
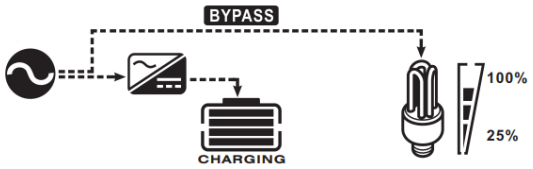
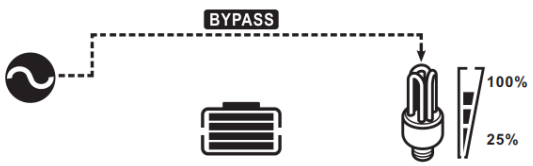
The LCD display information will be switched in turns by pressing "UP" or "DOWN" key. The selectable information is switched as below order: input voltage, input frequency, PV voltage, MPPT charging current, MPPT charging power, battery voltage, output voltage, output frequency, load percentage, load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

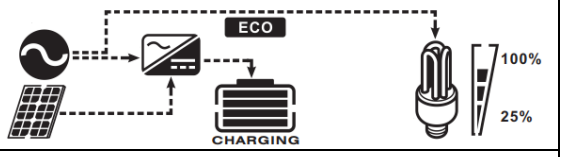
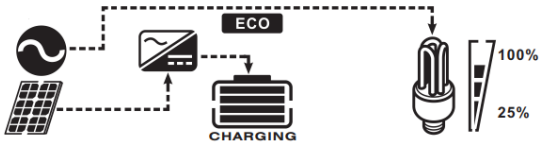
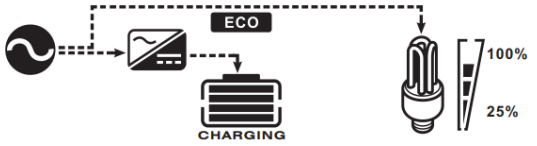
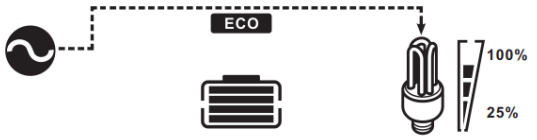
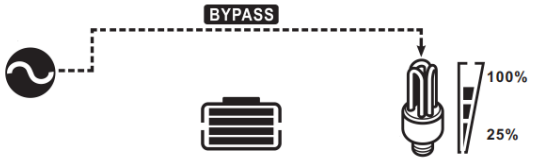
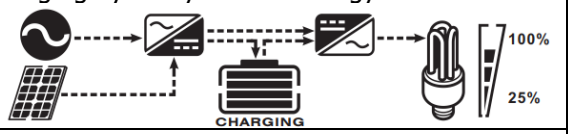
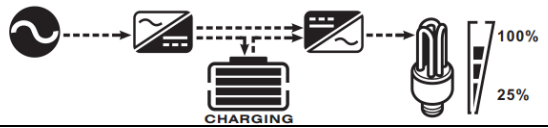
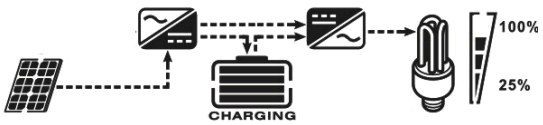
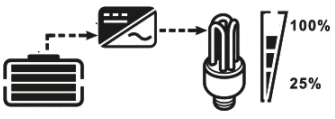
Selectable information	LCD display
Input voltage/Output voltage (Default Display Screen)	Input Voltage=230V, output voltage=230V 
Input frequency	Input frequency=50Hz 
PV voltage	PV voltage=60V 
PV current	PV current=5.0A 
PV power	PV power =500W 

Charging current	charging current=50A 
PV power	PV power = 500W 
Battery voltage and output voltage	Battery voltage=50V, 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. 

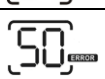
Load in Watt	When load is lower than 1kW, load in W will present xxxW like below chart.  When load is larger than 1kW (≧1KW), load in W will present x.xkW like below chart. 
Battery voltage/DC discharging current	Battery voltage=50V, discharging current=1A 
Main CPU version checking	Main CPU version 00014.04 
Secondary CPU version checking	Secondary CPU version 00003.03 
SCC version checking	SCC version 00003.03. 

Operating Mode Description

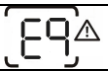
Operation mode	Description	LCD display
Standby mode **Note:** *Standby mode: The inverter is not turned on yet but at this time, the inverter can charge battery without AC output.	No output is supplied by the unit but it still can charge batteries.	Charging by utility and PV energy. 
		Charging by utility.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

	power from the utility. PV energy and utility can charge batteries.	 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 abnormal. (For 1K/2K/3K model) Output voltage is too high. (For 4K/5K model)	
07	Overload time out	
08	Bus voltage is too high	
09	Bus soft start failed	
50	PFC over current	
51	Over current or surge	
52	Bus voltage is too low	
53	Inverter soft start failed	
55	Over DC voltage in AC output	
56	Battery connection is open	
57	Current sensor failed	
58	Output voltage is too low	

Warning Indicator

Warning Code	Warning Event	Audible Alarm	Icon flashing
01	Fan is locked when inverter 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	
72	No USB disk is detected.	None	
73	USB disk is protected from copying.	None	
74	Document inside the USB disk contains the wrong format.	None	
E9	Battery equalization	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.

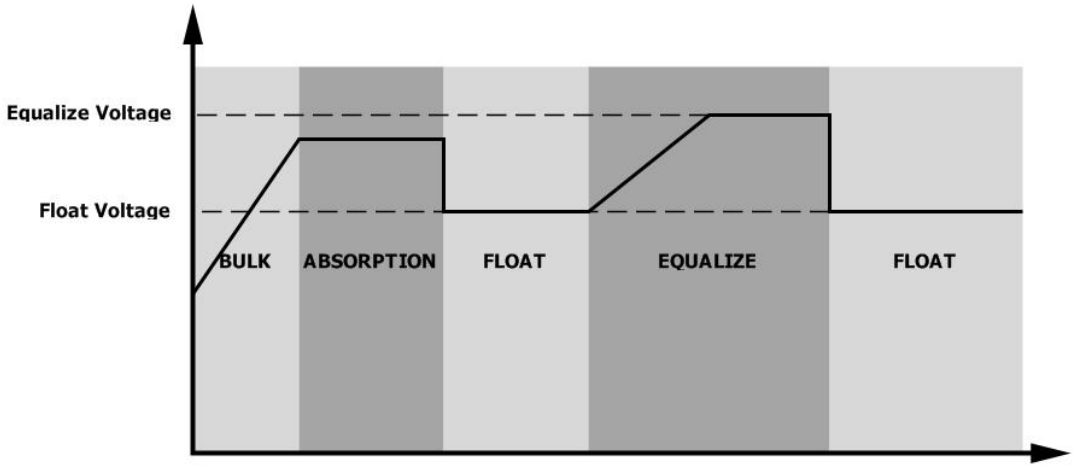
- **How to Apply Equalization Function**

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.

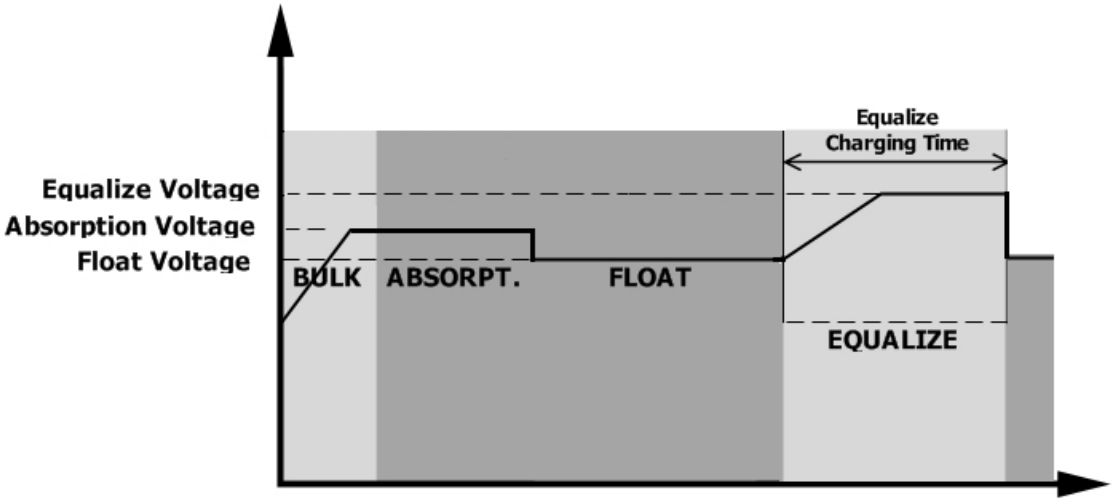
- **When to Equalize**

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.

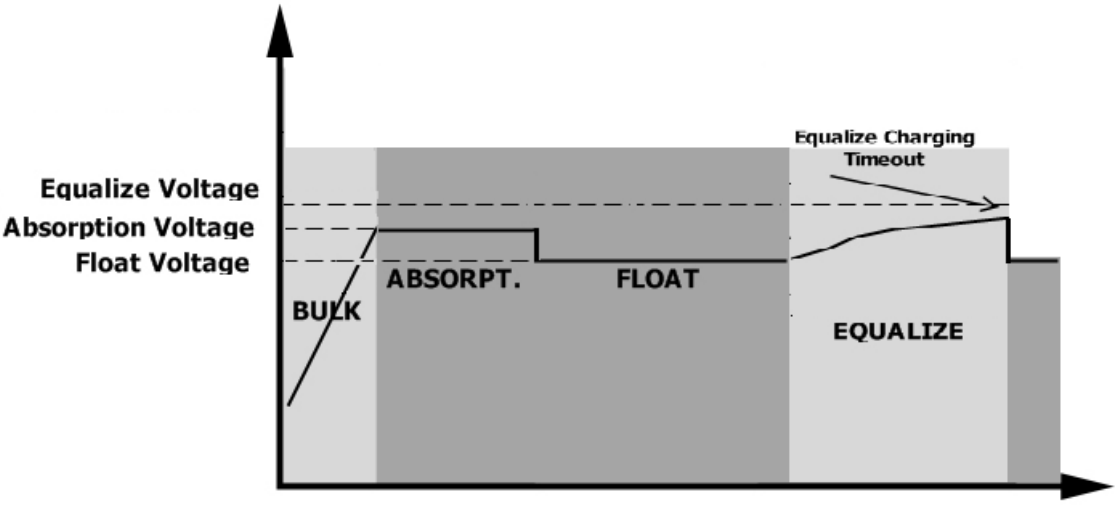


- **Equalize charging time and timeout**

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

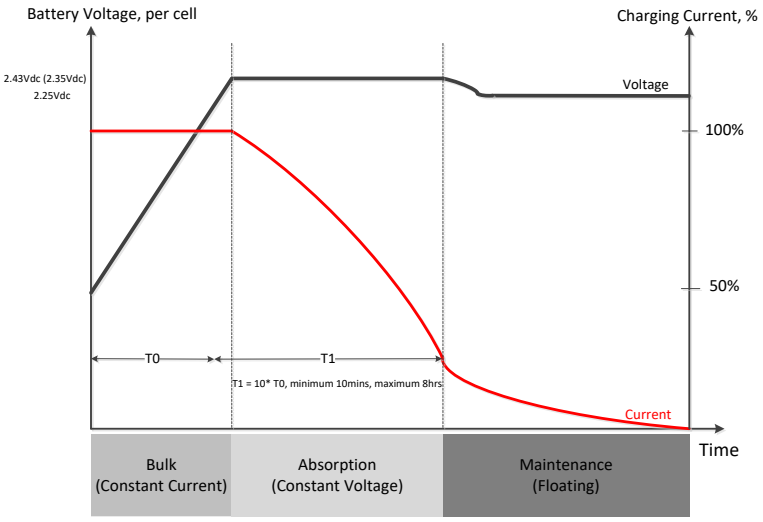
Table 1 Line Mode Specifications

INVERTER MODEL	OG-Plus 3.24RM	OG-Plus 3.48RM	OG-Plus 5.48RM
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 Inverter←→Bypass 4ms		

Table 2 Battery Mode Specifications

INVERTER MODEL	OG-Plus 3.24RM	OG-Plus 3.48RM	OG-Plus 5.48RM
Rated Output Power	3KVA/3KW	3KVA/3KW	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	24Vdc	48Vdc	
Operating Range	20Vdc -34Vdc	40Vdc -66Vdc	
Cold Start Voltage	23Vdc	46Vdc	
Low DC Warning Voltage @ load < 50% @ load ≥ 50%	 22.5Vdc 22.0Vdc	 45.0Vdc 44.0Vdc	
Low DC Warning Return Voltage @ load < 50% @ load ≥ 50%	 23.5Vdc 23.0Vdc	 47.0Vdc 46.0Vdc	
Low DC Cut-off Voltage @ load < 50% @ load ≥ 50%	 21.5Vdc 21.0Vdc	 43.0Vdc 42.0Vdc	
High DC Recovery Voltage	32Vdc	64Vdc	
High DC Cut-off Voltage	34Vdc	66Vdc	
No Load Power Consumption	<75W	<75W	

Table 3 Charge Mode Specifications

Utility Charging Mode				
INVERTER MODEL		**OG-Plus 3.24RM**	**OG-Plus 3.48RM**	**OG-Plus 5.48RM**
Charging Current @ Nominal Input Voltage		Default: 30A, max: 60A		Default: 30A, max: 80A
Bulk Charging Voltage	**Flooded Battery**	29.2Vdc	58.4Vdc	
	AGM / Gel Battery	28.2Vdc	56.4Vdc	
Floating Charging Voltage		27Vdc	54Vdc	
Overcharge Protection		34Vdc	66Vdc	
Charging Algorithm		3-Step		
Charging Curve				

Solar Charging Mode (MPPT type)			
INVERTER MODEL	**OG-Plus 3.24RM**	**OG-Plus 3.48RM**	**OG-Plus 5.48RM**
Rated Power	1500W	4000W	4000W
Maximum charging current	60A	80A	80A
Efficiency	98.0% max.		
Max. PV Array Open Circuit Voltage	145Vdc		
PV Array MPPT Voltage Range	30~115Vdc	60~115Vdc	60~115Vdc
Battery Voltage Accuracy	+/-0.3%		
PV Voltage Accuracy	+/-2V		
Charging Algorithm	3-Step		
Joint Utility and Solar Charging			
Max Charging Current	120A	140A	160A
Default Charging Current	60A		

Table 4 ECO/Bypass Mode Specifications

Bypass Mode			
INVERTER MODEL	**OG-Plus 3.24RM**	**OG-Plus 3.48RM**	**OG-Plus 5.48RM**
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

INVERTER MODEL	**OG-Plus 3.24RM**	**OG-Plus 3.48RM**	**OG-Plus 5.48RM**
SCC type	**MPPT**		
Parallel-able	YES		
Communication	RS232 and WiFi		
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	466.3 x 438 x 130.8		
Net Weight, kg	14.5		15

TROUBLE SHOOTING

Problem	LCD/LED/Buzzer	Explanation / Possible cause	What to do
Unit shuts down automatically during startup process.	LCD/LEDs and buzzer will be active for 3 seconds and then complete off.	The battery voltage is too low (<1.91V/Cell)	1. Re-charge battery. 2. Replace battery.
No response after power on.	No indication.	1. The battery voltage is far too low. (<1.4V/Cell) 2. Battery polarity is connected reversed.	1. Check if batteries and the wiring are connected well. 2. Re-charge battery. 3. Replace battery.
Mains exist but the unit works in battery mode.	Input voltage is displayed as 0 on the LCD and green LED is flashing.	Input protector is tripped	Check if AC breaker is tripped and AC wiring is connected well.
	Green LED is flashing.	Insufficient quality of AC power. (Shore or Generator)	1. Check if AC wires are too thin and/or too long. 2. Check if generator (if applied) is working well or if input voltage range setting is correct. (UPS→Appliance)
	Green LED is flashing.	Set "Solar First" as the priority of output source.	Change output source priority to Utility first.
When the unit is turned on, internal relay is switched on and off repeatedly.	LCD display and LEDs are flashing	Battery is disconnected.	Check if battery wires are connected well.
Buzzer beeps continuously and red LED is on.	Fault code 07	Overload error. The inverter is overload 110% and time is up.	Reduce the connected load by switching off some equipment.
	Fault code 05	Output short circuited.	Check if wiring is connected well and remove abnormal load.
	Fault code 02	Internal temperature of inverter 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

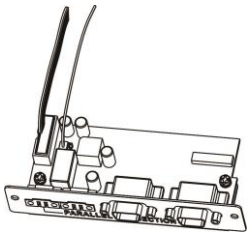
This inverter can be used in parallel for two applications.

1. Parallel operation in single phase with up to 8 units. The supported maximum output power is 24KW/24KVA for OGPlus3.24/RM OG-Plus 3.48RM model and 40KW/40KVA for OG-Plus 5.48RM model.
2. Maximum 8 units work together to support three-phase equipment. Six units support one phase maximum. For OGPlus3.24/RM OG-Plus 3.48RM model, the supported maximum output power is 24KW/24KVA and one phase can be up to 18KW/18KVA. For OG-Plus 5.48RM model, the supported maximum output power is 40KW/40KVA and one phase can be up to 30KW/30KVA.

NOTE: If this unit is bundled with share current cable and parallel cable, this inverter 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:



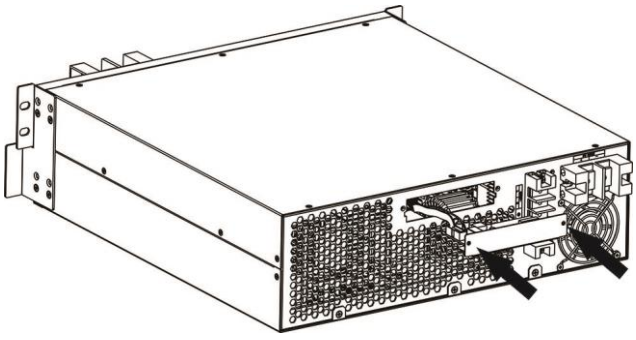
Parallel board

Parallel communication cable

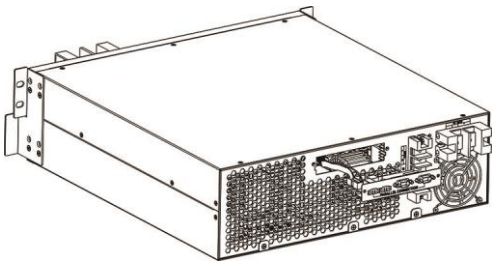
Current sharing cable

3. Parallel board installation

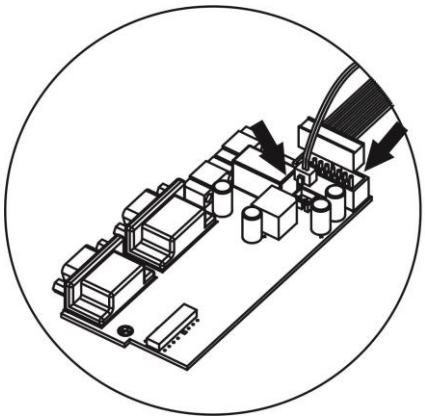
Step 1: Take out parallel cover by removing two screws as below chart and remove 2-pin and 14-pin cables.



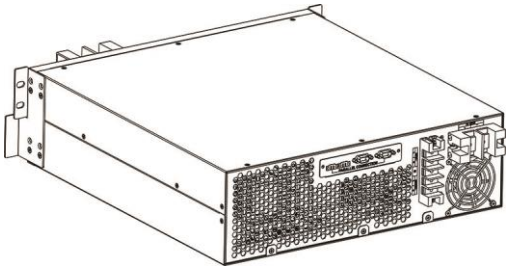
Step 2: Replace it with parallel board.



Step 3: Re-connect 2-pin and 14-pin to original position on parallel board as shown below chart.



Step 4: Put parallel cover back to the unit. Now the inverter is providing parallel operation function.



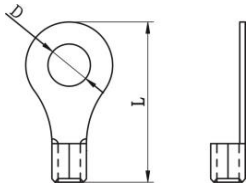
4. Wiring Connection

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 mm²	Dimensions		
			D (mm)	L (mm)	
OG-Plus 3.24RM	1*1/0AWG	60	8.4	49.7	4.5 Nm
	2*4AWG	44	8.4	49.7	
OG-Plus 3.48RM	1*4AWG	22	6.4	33.2	
OG-Plus 5.48RM	1*1/0AWG	60	8.4	49.7	
	2 * 4AWG	44	8.4	49.7	

Ring terminal:



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

Recommended AC input and output cable size for each inverter:

Model	AWG no.	Torque
OG-Plus 3.24RM /OG-Plus 3.48RM	10 AWG	1.4~1.6Nm
OG-Plus 5.48RM	8 AWG	1.4~1.6Nm

CAUTION!! Please make sure the output neutral of each unit is connected together. Otherwise, it may cause the inverter fail.

You need to connect the cables of each inverter together. Take the battery cables for example: You need to use a connector or bus-bar as a joint to connect the battery cables together, and then connect to the battery terminal. The cable size used from joint to battery should be X times cable size in the tables above. "X" indicates the number of inverters connected in parallel.

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

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

Recommended breaker specification of battery for each inverter:

Model	1 unit*
OG-Plus 3.24RM	150A/60VDC
OG-Plus 3.48RM	80A/80VDC
OG-Plus 5.48RM	125A/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 inverters connected in parallel.

Recommended breaker specification of AC input:

Model	2 units	3 units	4 units	5 units	6 units	7 units	8 units
OG-Plus 3.24RM /OG-Plus 3.48RM	80A	120A	160A	200A	240A	280A	320A
OG-Plus 5.48RM	100A	150A	200A	250A	300A	350A	400A

Note1: Also, you can use 40A breaker for OG-Plus 3.24RM/OG-Plus 3.48RM model and 50A for OG-Plus 5.48RM for only 1 unit and install one breaker at its AC input in each inverter.

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

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

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

PV Connection

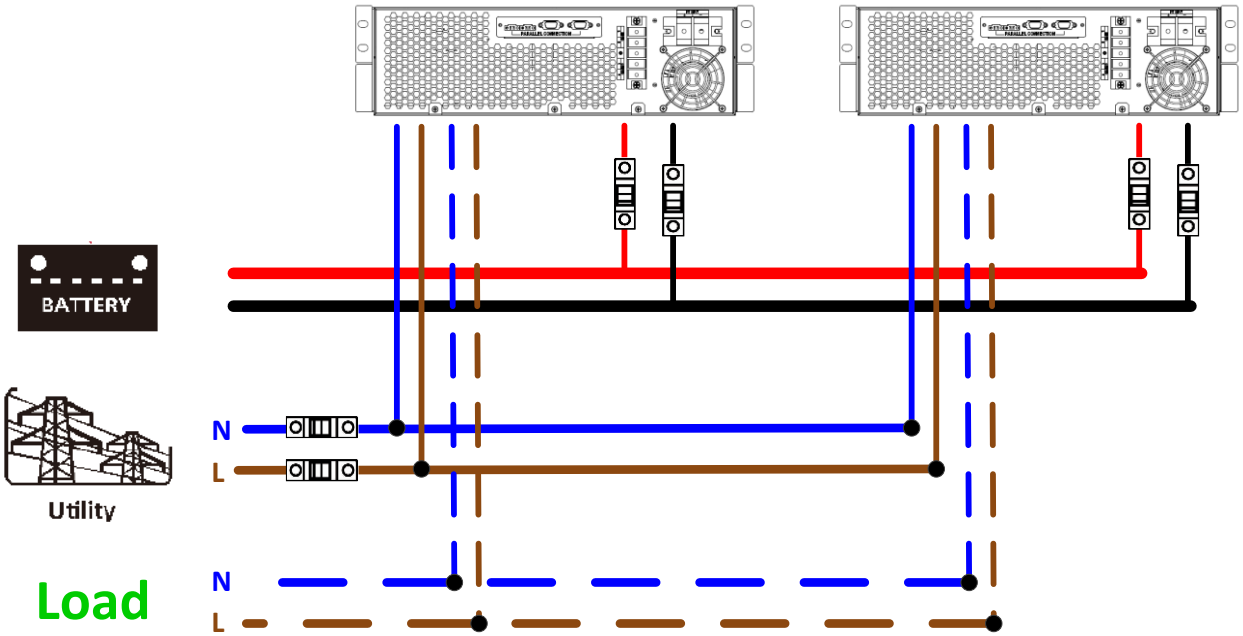
Please refer to user manual of single unit for PV Connection.

CAUTION: Each inverter should connect to PV modules separately.

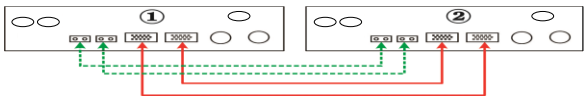
4-1. Parallel Operation in Single phase

Two inverters in parallel:

Power Connection

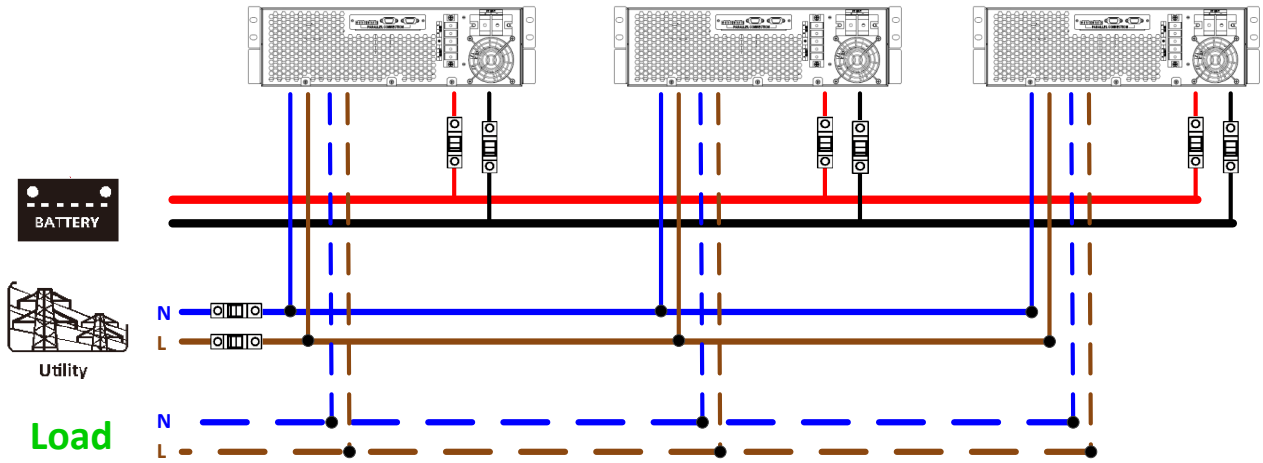


Communication Connection

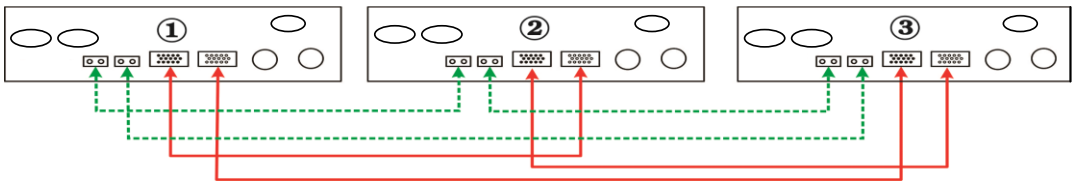


Three inverters in parallel:

Power Connection

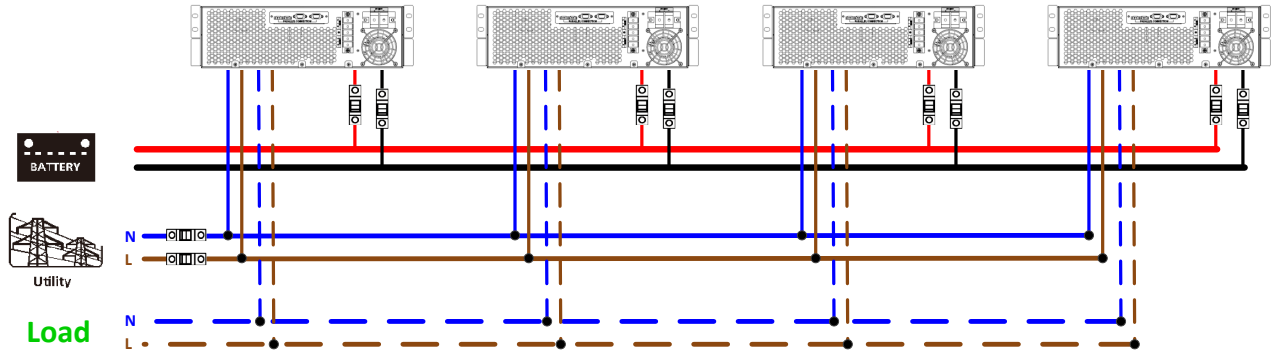


Communication Connection

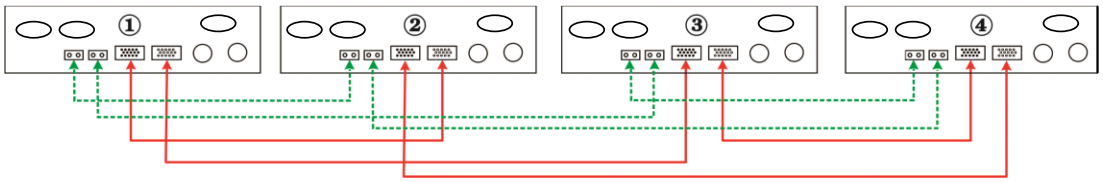


Four inverters in parallel:

Power Connection

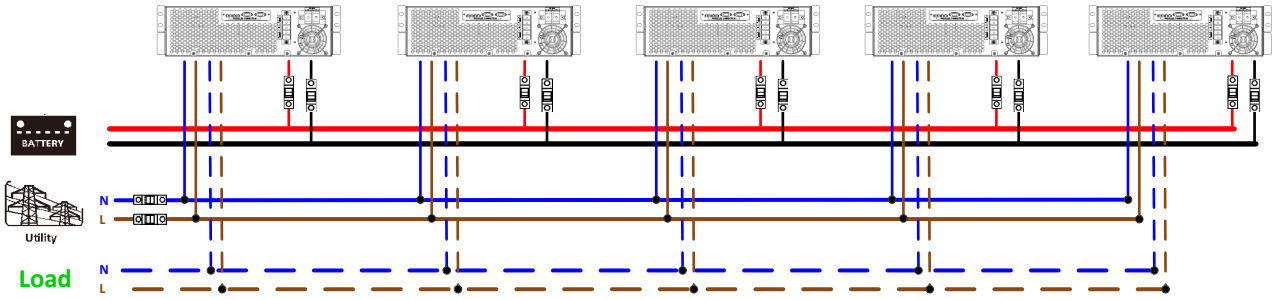


Communication Connection

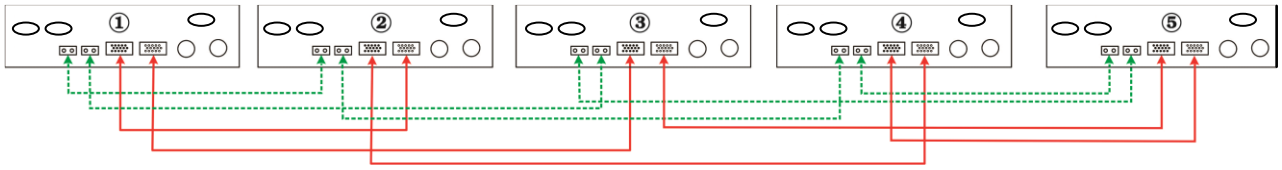


Five inverters in parallel:

Power Connection

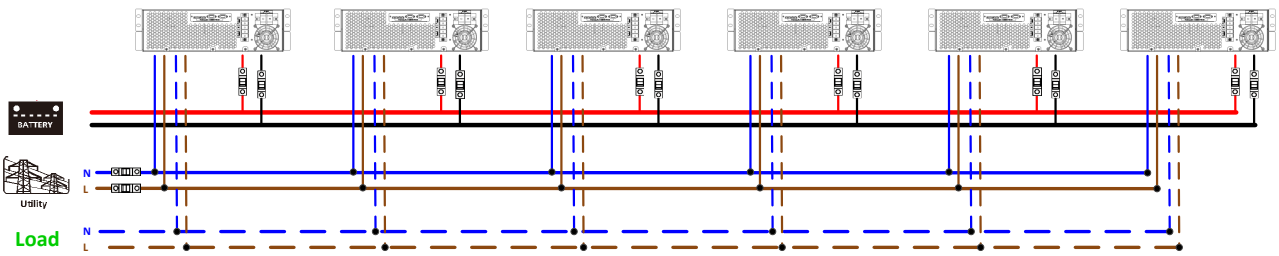


Communication Connection



Six inverters in parallel:

Power Connection



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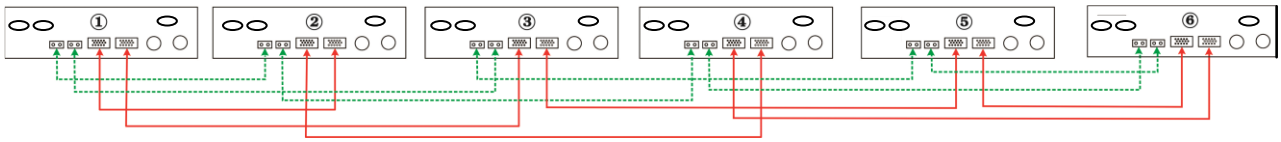
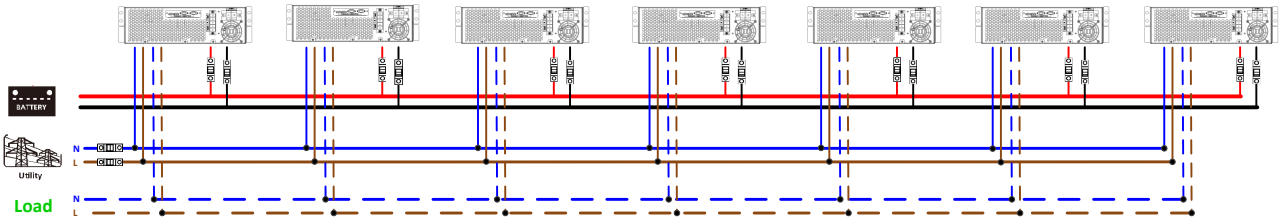


Seven inverters in parallel:

Power Connection



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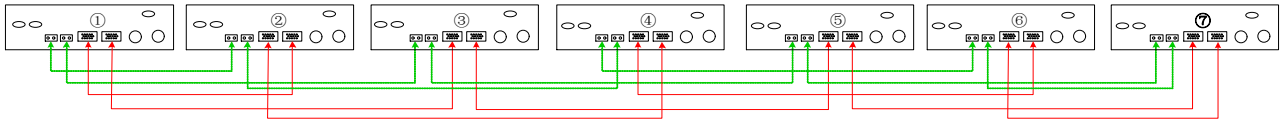
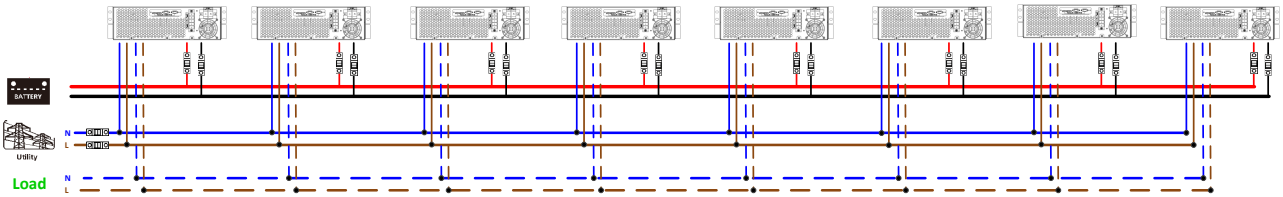


Eight inverters in parallel:

Power Connection



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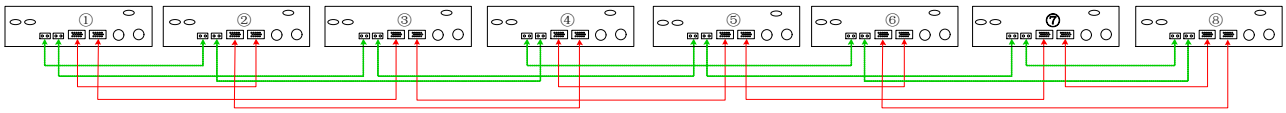
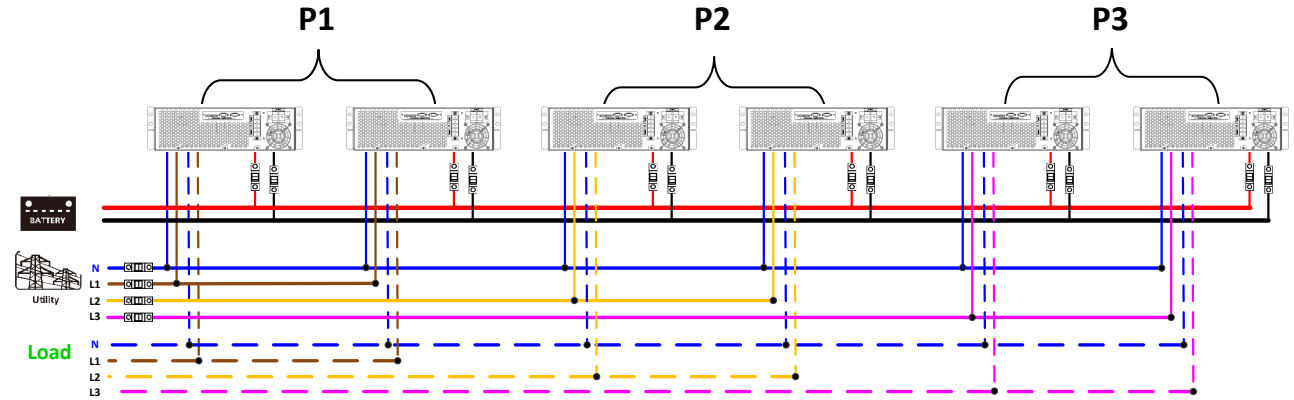


4-2. Support 3-phase equipment

Two inverters in each phase:

Power Connection



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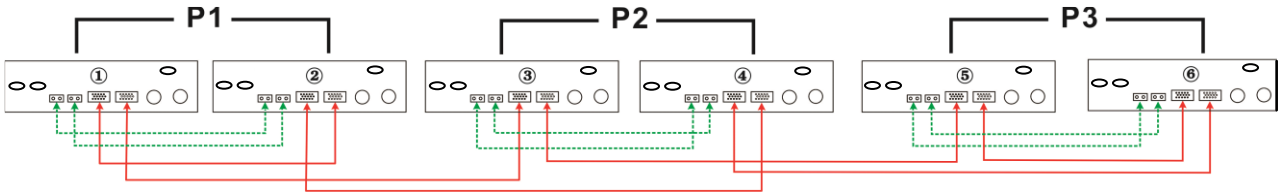
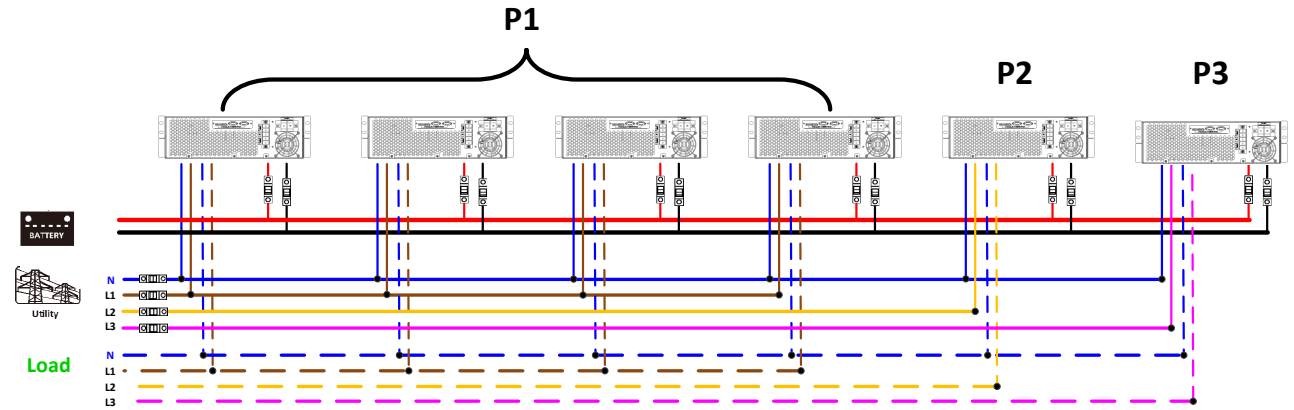


Four inverters in one phase and one inverter for the other two phases:

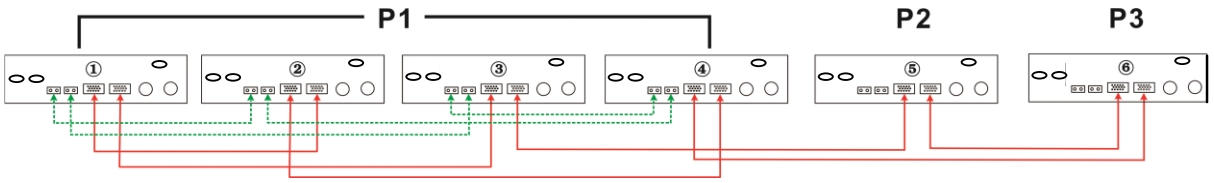
Power Connection



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

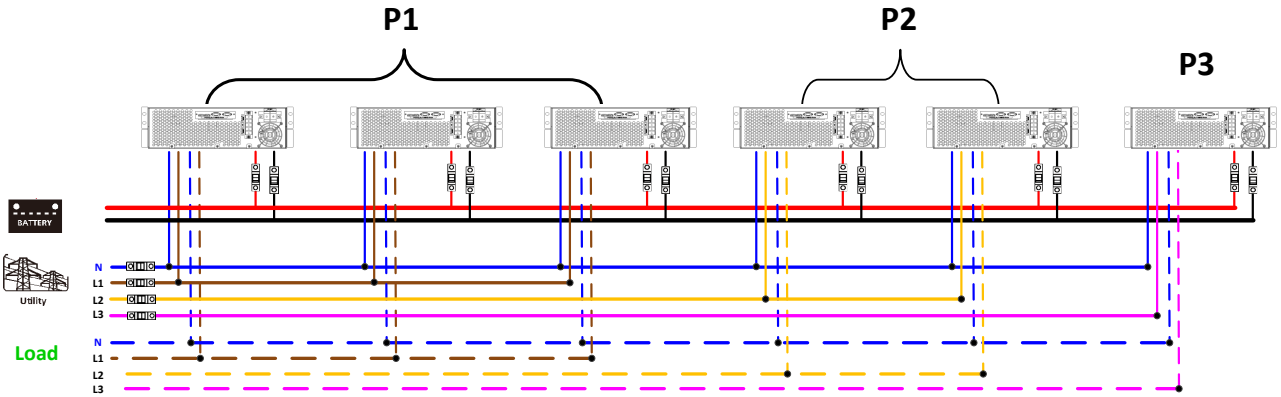
P1: L1-phase, P2: L2-phase, P3: L3-phase.

Communication Connection

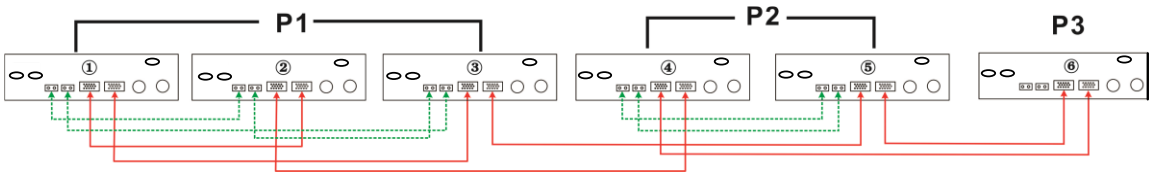


Three inverters in one phase, two inverters in second phase and one inverter for the third phase:

Power Connection

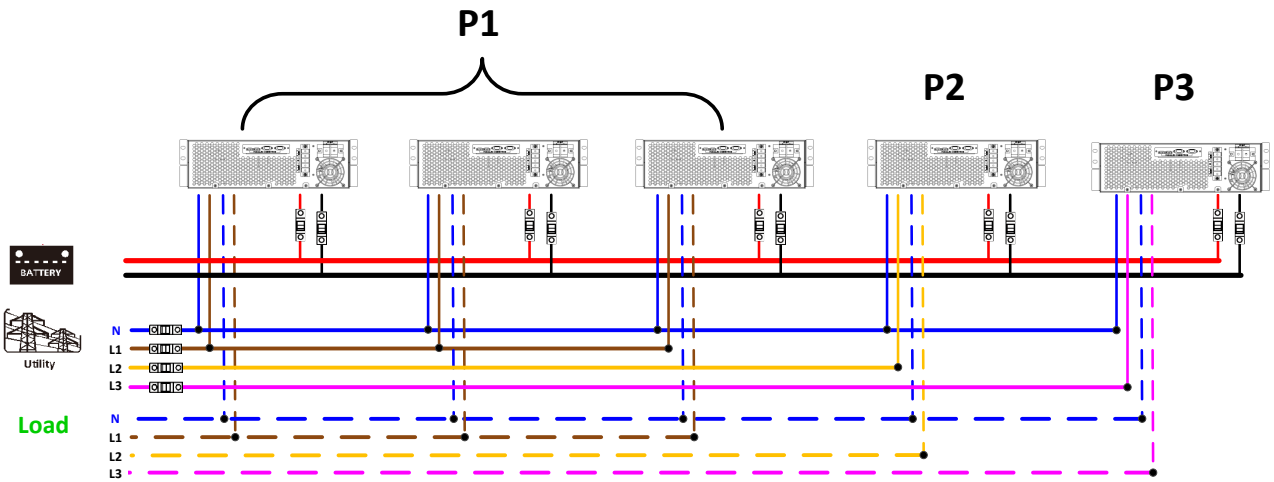


Communication Connection



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

Power Connection



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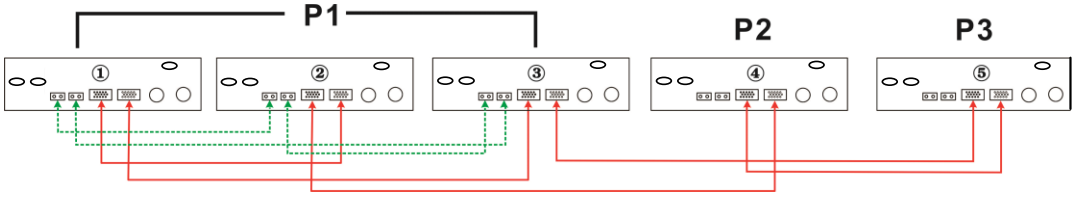
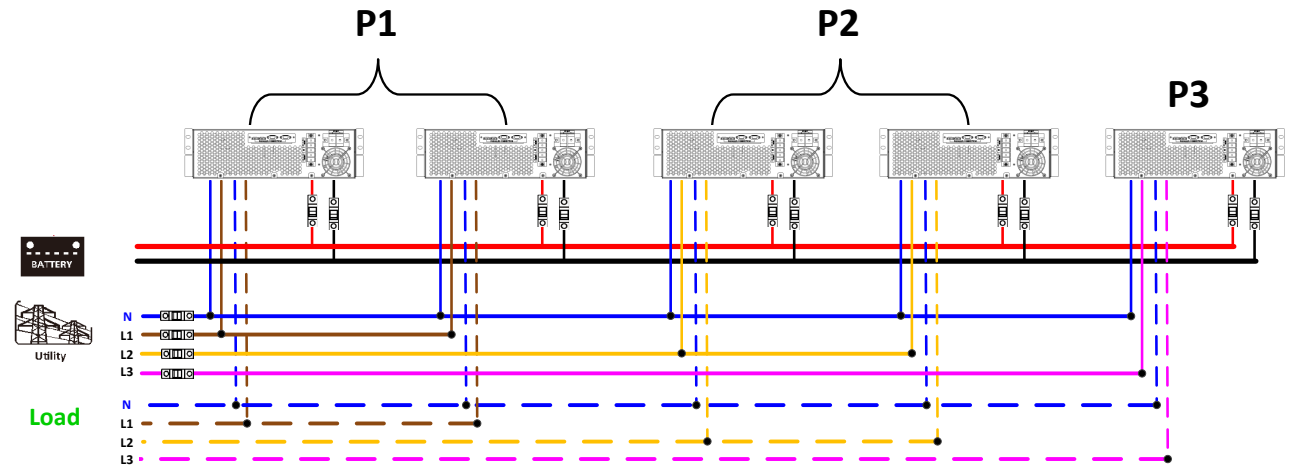
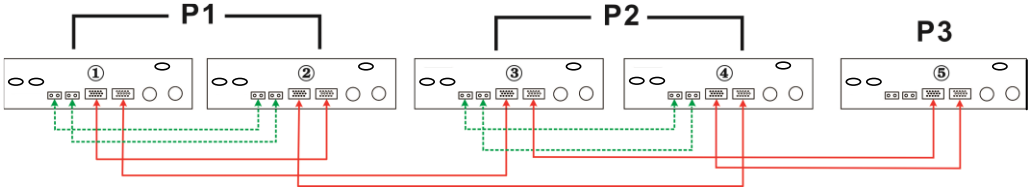


Two inverters in two phases and only one inverter for the remaining phase:

Power Connection

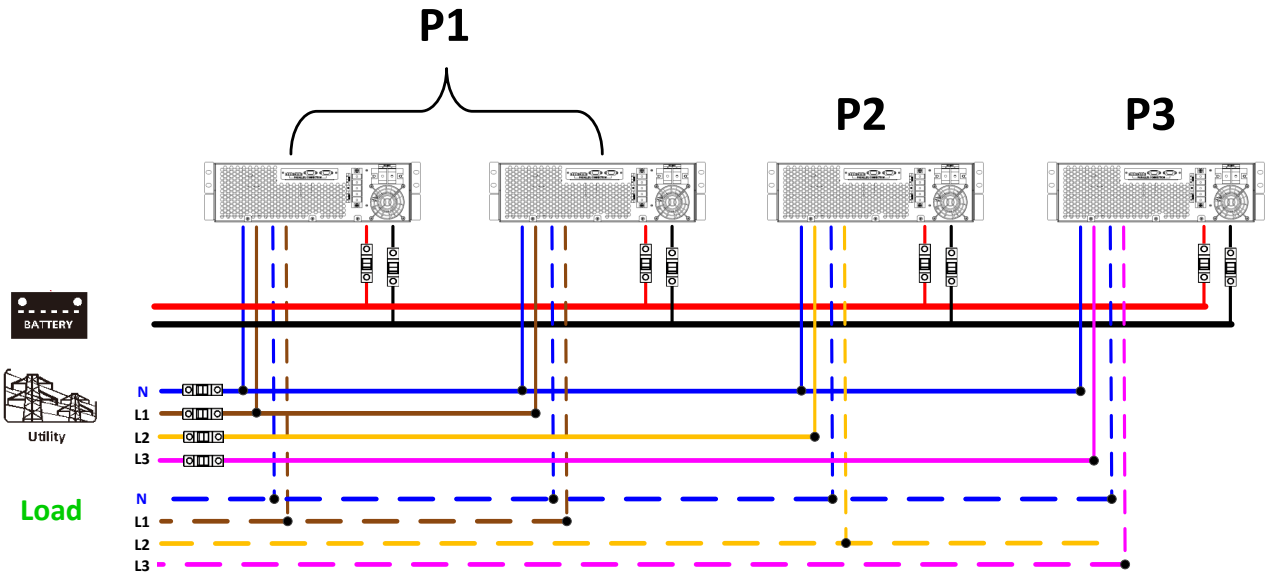


Communication Connection

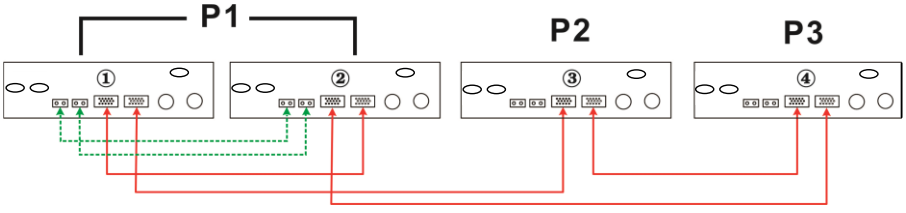


Two inverters in one phase and only one inverter for the remaining phases:

Power Connection

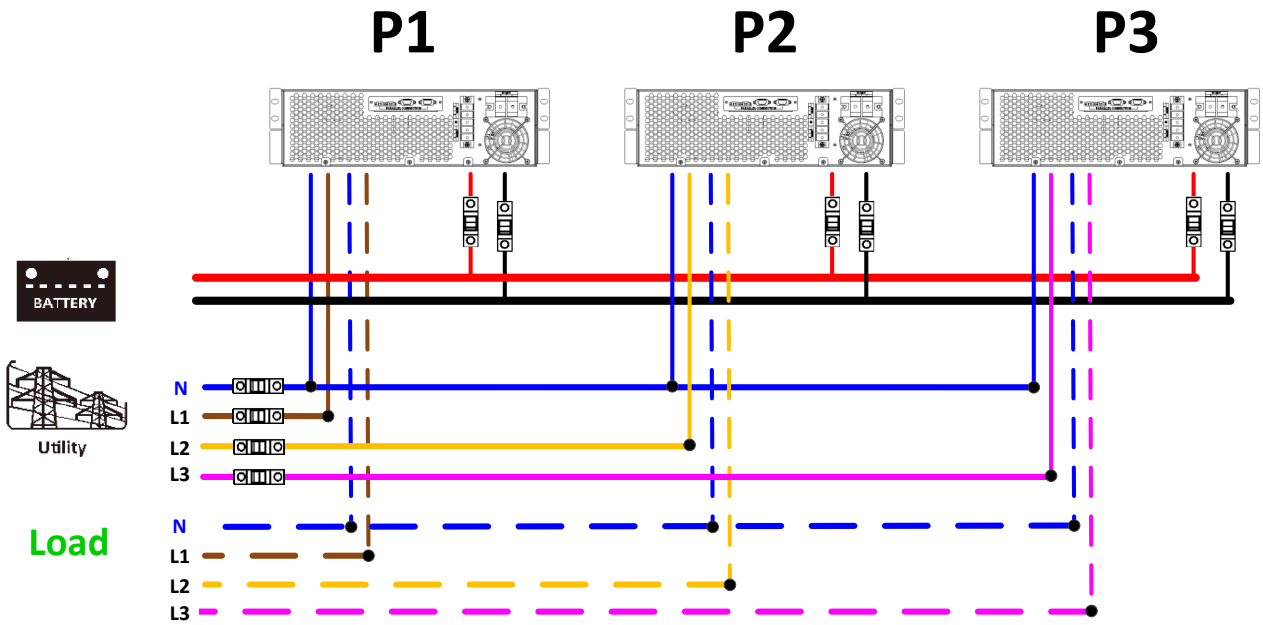


Communication Connection

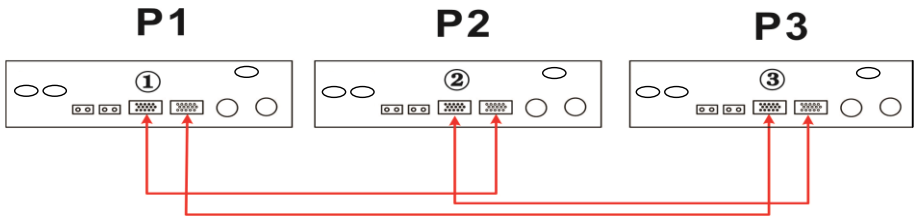


One inverter in each phase:

Power Connection



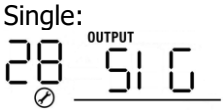
Communication Connection



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

5. LCD Setting and Display

Setting Program:

Program	Description	Selectable option	
28	AC output mode *This setting is able to set up only when the inverter is in standby mode. Be sure that on/off switch is in "OFF" status.	Single: 	When the unit is operated alone, please select "SIG" in program 28.
		Parallel: 	When the units are used in parallel for single phase application, please select "PAL" in program 28. Please refer to 5-1 for detailed information.

		L1 phase: 	When the units are operated in 3-phase application, please choose "3PX" to define each inverter. It is required to have at least 3 inverters or maximum 8 inverters to support three-phase equipment. It's required to have at least one inverter in each phase or it's up to six inverters in one phase. Please refers to 5-2 for detailed information. Please select "3P1" in program 28 for the inverters connected to L1 phase, "3P2" in program 28 for the inverters connected to L2 phase and "3P3" in program 28 for the inverters connected to L3 phase. Be sure to connect share current cable to units which are on the same phase. Do NOT connect share current cable between units on different phases.
		L2 phase: 	
		L3 phase: 	

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	

6. Commissioning

Parallel in single phase

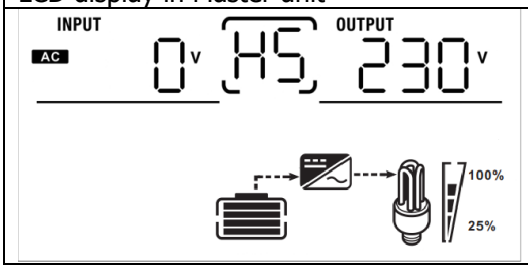
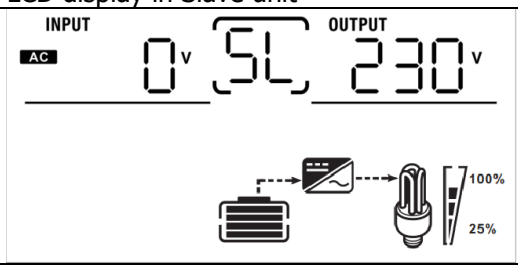
Step 1: Check the following requirements before commissioning:

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

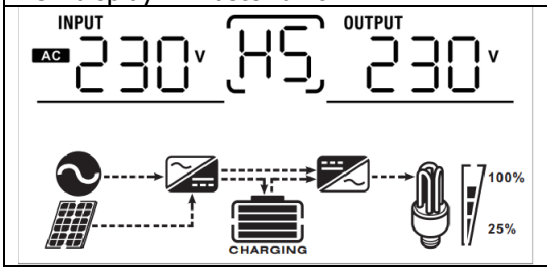
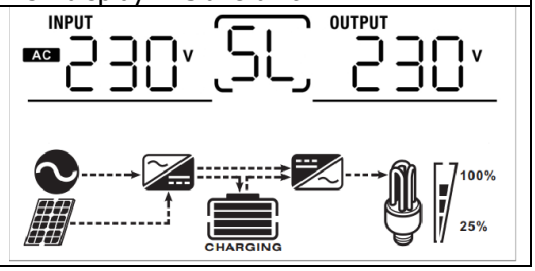
NOET: It's necessary to turn off switch when setting LCD program. Otherwise, the setting can not be programmed.

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 inverters connect to utility at the same time. 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

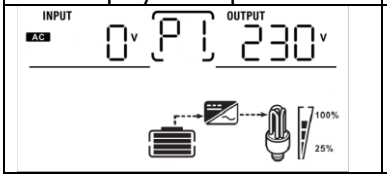
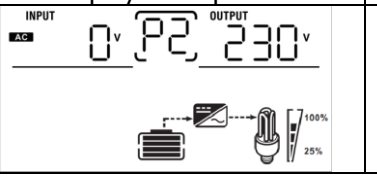
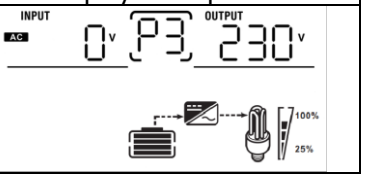
Step 1: Check the following requirements before commissioning:

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

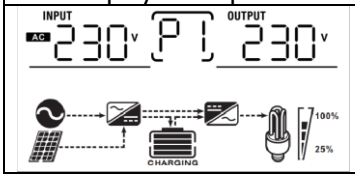
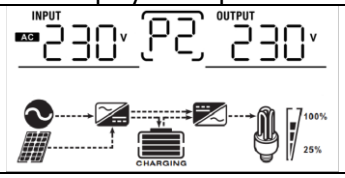
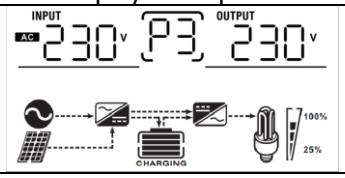
Step 2: Turn on all units and configure LCD program 28 as P1, P2 and P3 sequentially. And then shut down all units.

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.

7. Trouble shooting

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

Appendix A: Approximate Back-up Time Table

Model	Load (VA)	Backup Time @24Vdc 200Ah (min)	Backup Time @24Vdc 400Ah (min)
OG-Plus 3.24RM	300	898	2200
	600	444	1050
	900	249	606
	1200	190	454
	1500	136	328
	1800	112	252
	2100	96	216
	2400	70	188
	2700	62	148
	3000	56	134

Model	Load (VA)	Backup Time @ 48Vdc 200Ah (min)	Backup Time @ 48Vdc 400Ah (min)
OG-Plus 3.48RM OG-Plus 5.48RM	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.

Appendix B: BMS Communication Installation

1. Introduction

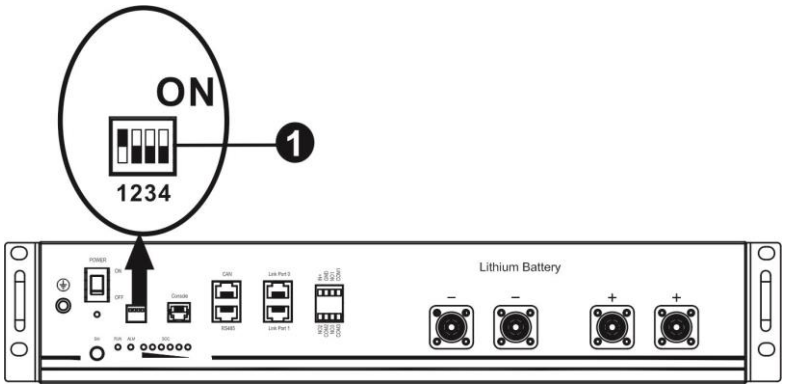
If connecting to lithium battery, it is recommended to purchase a custom-made RJ45 communication cable. Please check with your dealer or integrator for details.

This custom-made RJ45 communication cable delivers information and signal between lithium battery and the inverter. These information are listed below:

- Re-configure charging voltage, charging current and battery discharge cut-off voltage according to the lithium battery parameters.
- Have the inverter start or stop charging according to the status of lithium battery.

2. Lithium Battery Communication Configuration

PYLONTECH



Dip Switch: There are 4 Dip Switches that sets different baud rate and battery group address. If switch position is turned to the "OFF" position, it means "0". If switch position is turned to the "ON" position, it means "1".

Dip 1 is "ON" to represent the baud rate 9600.
Dip 2, 3 and 4 are to set up battery group address.
Dip switch 2, 3 and 4 on master battery (first battery) are to set up or change the group address.

NOTE: "1" is upper position and "0" is bottom position.

Dip 1	Dip 2	Dip 3	Dip 4	Group address
1: RS485 baud rate=9600 **Restart to take effect**	0	0	0	Single group only. It's necessary to set up master battery with this setting and slave batteries are unrestricted.
	1	0	0	Multiple group condition. It's necessary to set up master battery on the first group with this setting and slave batteries are unrestricted.
	0	1	0	Multiple group condition. It's necessary to set up master battery on the second group with this setting and slave batteries are unrestricted.
	1	1	0	Multiple group condition. It's necessary to set up master battery on the third group with this setting and slave batteries are unrestricted.
	0	0	1	Multiple group condition. It's necessary to set up master battery on the fourth group with this setting and slave batteries are unrestricted.
	1	0	1	Multiple group condition. It's necessary to set up master battery on the fifth group with this setting and slave batteries are unrestricted.

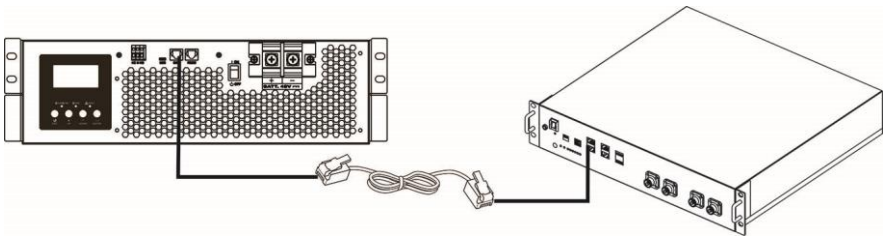
NOTE: The maximum groups of lithium battery is 5 and for maximum number for each group, please check with battery manufacturer.

3. Installation and Operation

PYLONTECH

After configuration, please install LCD panel with inverter and Lithium battery with the following steps.

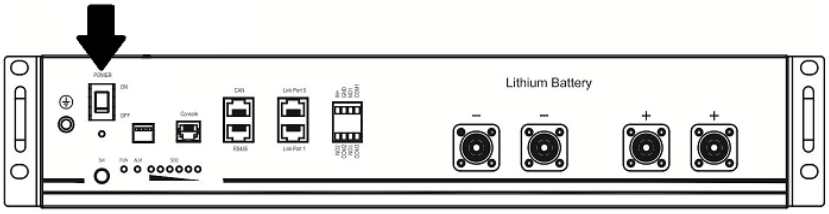
Step 1. Use custom-made RJ45 cable to connect inverter and Lithium battery.



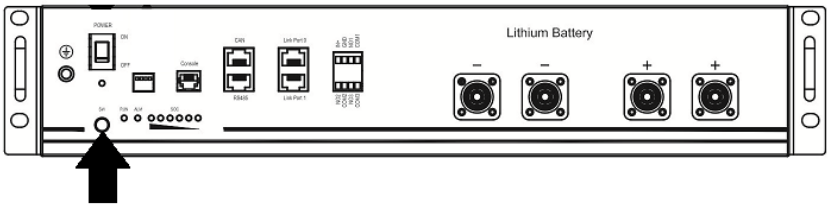
Note for parallel system:

1. Only support common battery installation.
2. Use custom-made RJ45 cable to connect any inverter (no need to connect to a specific inverter) and Lithium battery. Simply set this inverter battery type to "PYL" in LCD program 5. Others should be "USE".

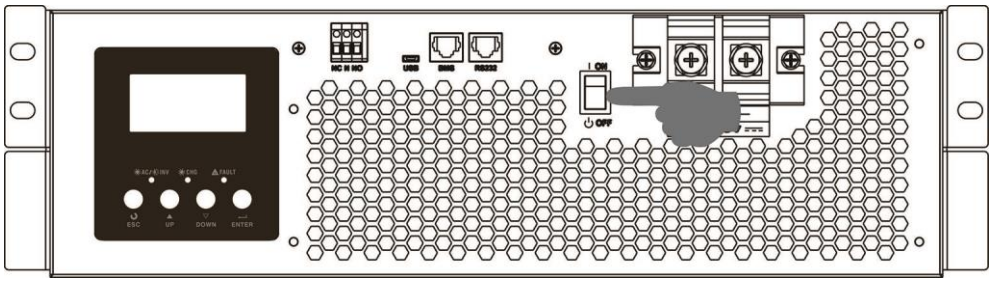
Step 2. Switch on Lithium battery.



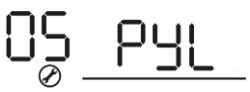
Step 3. Press more than three seconds to start Lithium battery, power output ready.



Step 4. Turn on the inverter.

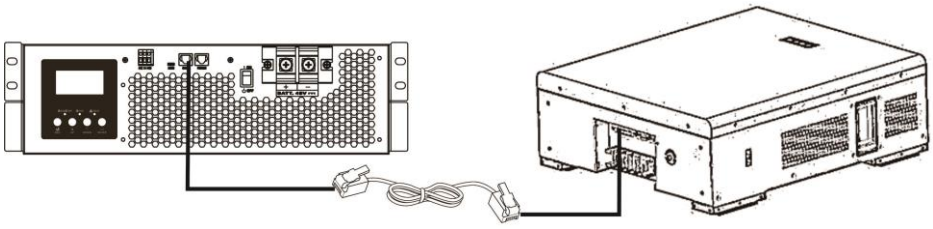


Step 5. Be sure to select battery type as "PYL" in LCD program 5.



WECO

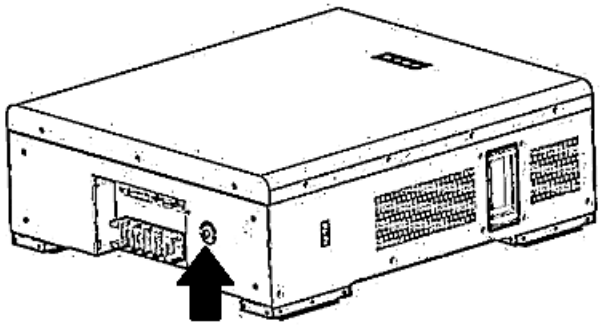
Step 1. Use custom-made RJ45 cable to connect inverter and Lithium battery.



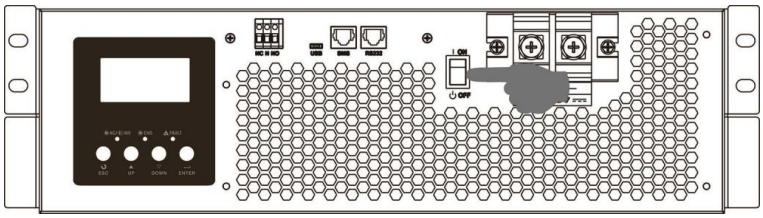
Note for parallel system:

1. Only support common battery installation.
2. Use custom-made RJ45 cable to connect any inverter (no need to connect to a specific inverter) and Lithium battery. Simply set this inverter battery type to "WEC" in LCD program 5. Others should be "USE".

Step 2. Switch on Lithium battery.



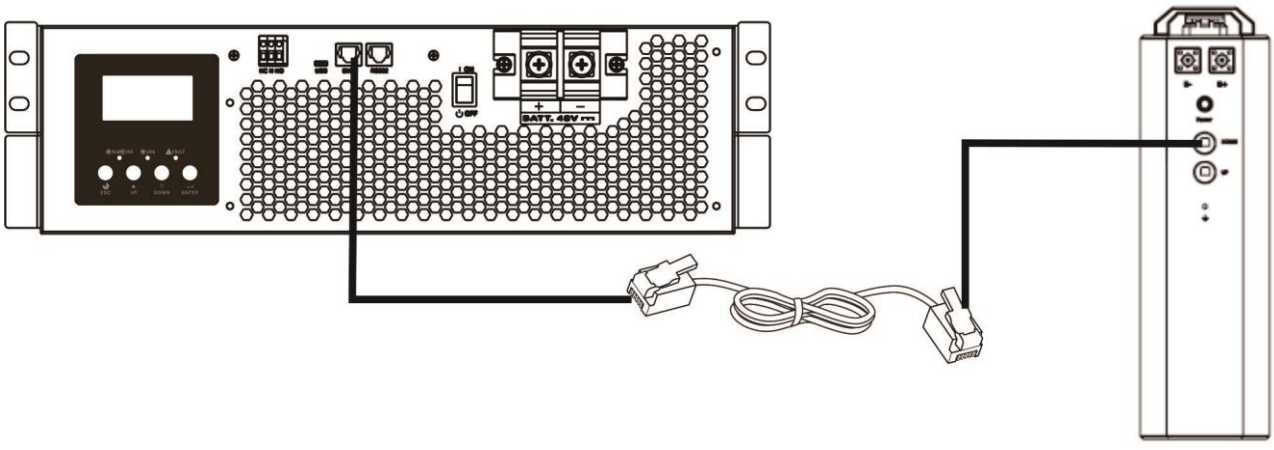
Step 3. Turn on the inverter.



Step 4. Be sure to select battery type as "WEC" in LCD program 5.

SOLTARO

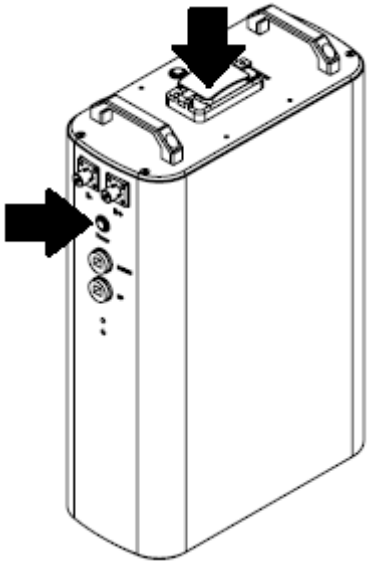
Step 1. Use custom-made RJ45 cable to connect inverter and Lithium battery.



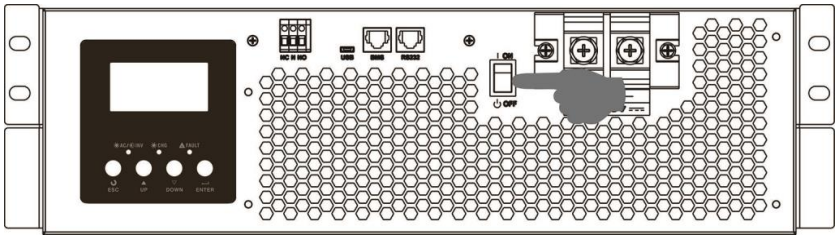
Note for parallel system:

1. Only support common battery installation.
2. Use custom-made RJ45 cable to connect any inverter (no need to connect to a specific inverter) and Lithium battery. Simply set this inverter battery type to "SOL" in LCD program 5. Others should be "USE".

Step 2. Open DC isolator and switch on Lithium battery.



Step 3. Turn on the inverter.



Step 4. Be sure to select battery type as "SOL" in LCD program 5.

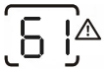
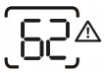
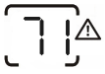
4. LCD Display Information

Press "UP" or "DOWN" key to switch LCD display information. It will show battery pack and battery group number before "Main CPU version checking" as below screen.

Selectable information	LCD display
Battery pack numbers & Battery group numbers	Battery pack numbers = 3, battery group numbers = 1 

5. Code Reference

Related information code will be displayed on LCD screen. Please check inverter LCD screen for the operation.

Code	Description	Action
	If battery status is not allowed to charge and discharge after the communication between the inverter and battery is successful, it will show code 60 to stop charging and discharging battery.	
	Communication lost (only available when the battery type is setting as "Pylontech Battery" or "WECO Battery" or "Soltaro Battery" or "BAK Battery".) ● After battery is connected, communication signal is not detected for 3 minutes, buzzer will beep. After 10 minutes, inverter will stop charging and discharging to lithium battery. ● Communication lost occurs after the inverter and battery is connected successfully, buzzer beeps immediately.	
	Battery number is changed. It probably is because of communication lost between battery packs.	Press "UP" or "DOWN" key to switch LCD display until below screen shows. It will have battery number re-checked and 62 warning code will be clear. 
	If battery status is not allowed to charge after the communication between the inverter and battery is successful, it will show code 69 to stop charging battery.	
	If battery status must to charge after the communication between the inverter and battery is successful, it will show code 70 to charge battery.	
	If battery status is not allowed to discharge after the communication between the inverter and battery is successful, it will show code 71 to stop charging battery.	

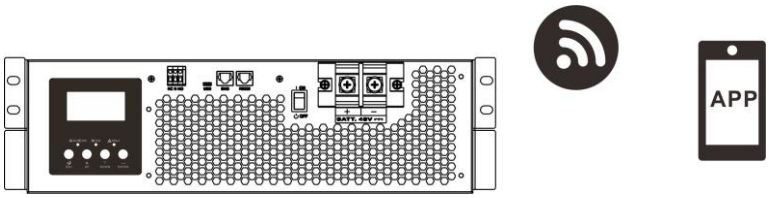
Appendix C: The Wi-Fi Operation Guide in Remote Panel

1. Introduction

Wi-Fi module can enable wireless communication between off-grid inverters and monitoring platform. Users have complete and remote monitoring and controlling experience for inverters when combining Wi-Fi module with WatchPower APP, available for both iOS and Android based device. All data loggers and parameters are saved in iCloud.

The major functions of this APP:

- Delivers device status during normal operation.
- Allows to configure device setting after installation.
- Notifies users when a warning or alarm occurs.
- Allows users to query inverter history data.



2. WatchPower App

2-1. Download and install APP

Operating system requirement for your smart phone:
iOS system supports iOS 9.0 and above
Android system supports Android 5.0 and above

Please scan the following QR code with your smart phone and download WatchPower App.

Android system

iOS system

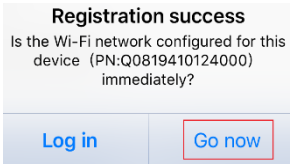
Or you may find "WatchPower" app from the Apple® Store or "WatchPower Wi-Fi" in Google® Play Store.

2-2. Initial Setup

Step 1: Registration at first time

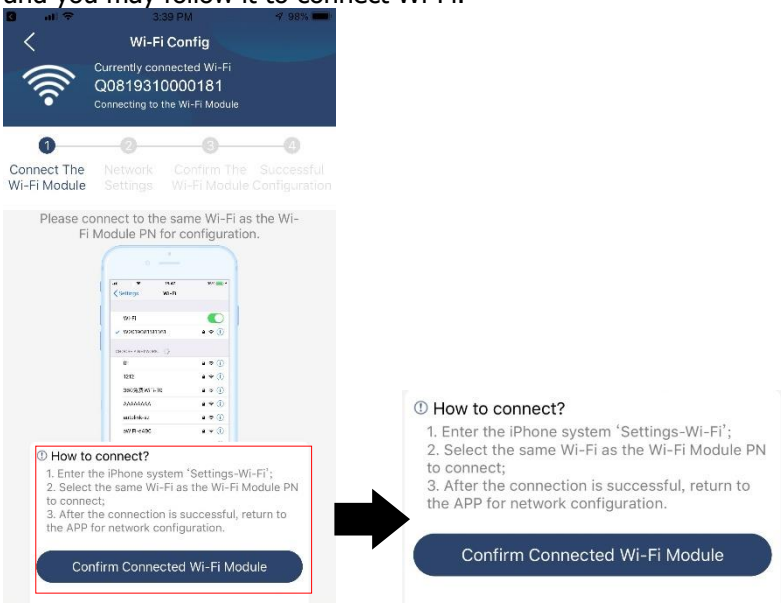
After the installation, please tap the shortcut icon to access this APP on your mobile screen. In the screen, tap "Register" to access "User Registration" page. Fill in all required information and scan the remote box PN by tapping icon. Or you can simply enter PN directly. Then, tap "Register" button.

Then, a "Registration success" window will pop up. Tap "Go now" to continue setting local Wi-Fi network connection.

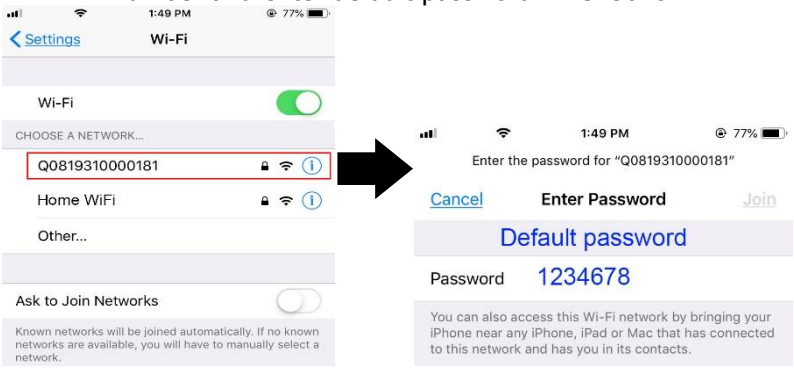


Step 2: Local Wi-Fi Module Configuration

Now, you are in "Wi-Fi Config" page. There are detailed setup procedure listed in "How to connect?" section and you may follow it to connect Wi-Fi.



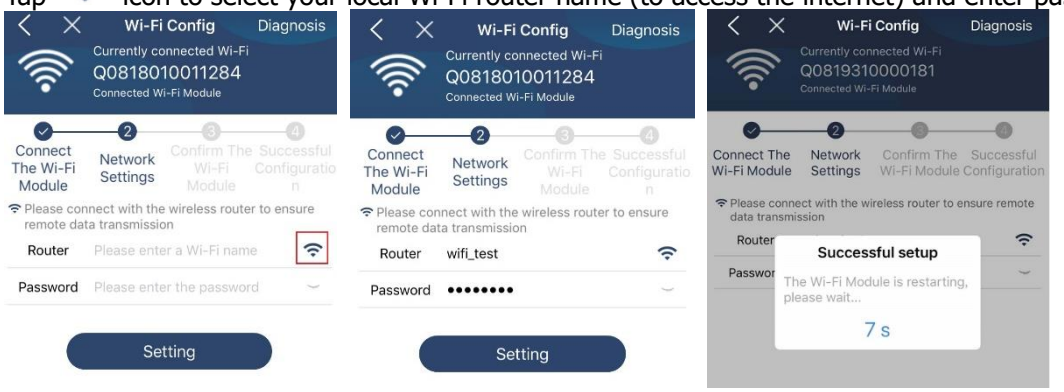
Enter the "Settings→Wi-Fi" and select connected Wi-Fi name. The connected Wi-Fi name is the same to your Wi-Fi PN number and enter default password "12345678".



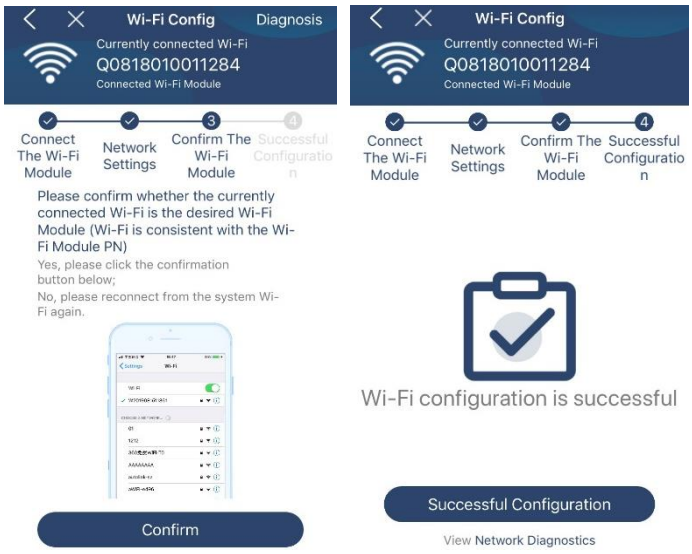
Then, return to WatchPower APP and tap " Confirm Connected Wi-Fi Module " button when Wi-Fi module is connected successfully.

Step 3: Wi-Fi Network settings

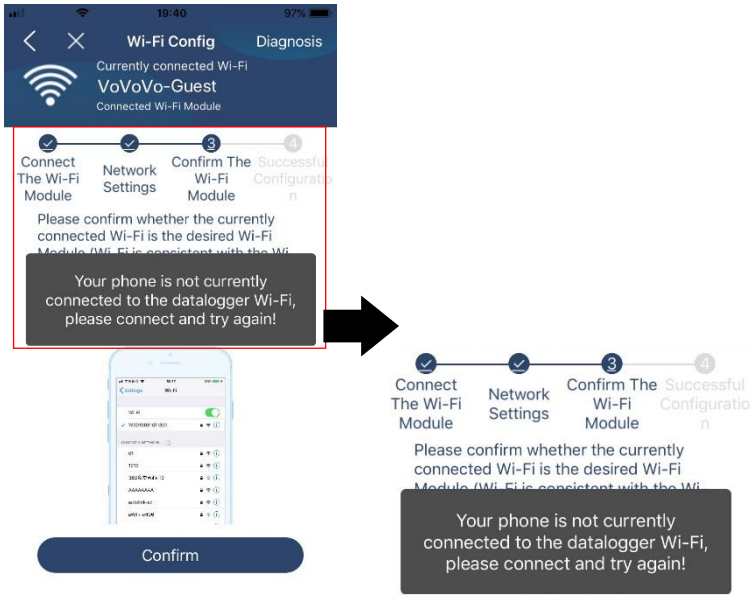
Tap icon to select your local Wi-Fi router name (to access the internet) and enter password.



Step 4: Tap "Confirm" to complete the Wi-Fi configuration between the Wi-Fi module and the Internet.

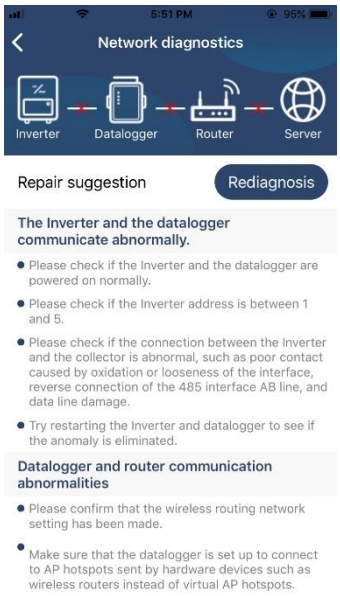


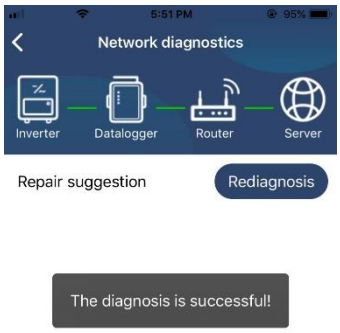
If the connection fails, please repeat Step 2 and 3.



Diagnose Function

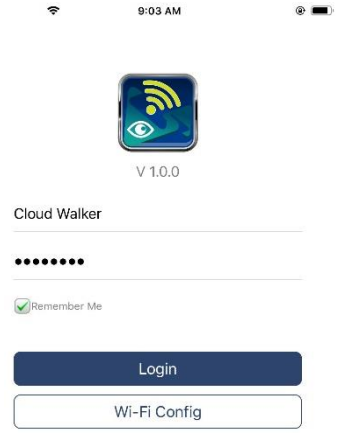
If the module is not monitoring properly, please tap " Diagnosis " on the top right corner of the screen for further details. It will show repair suggestion. Please follow it to fix the problem. Then, repeat the steps in the chapter 4.2 to re-set network setting. After all setting, tap "Rediagnosis" to re-connect again.





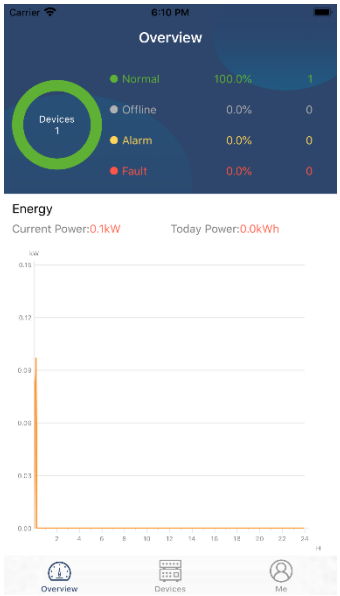
2-3. Login and APP Main Function

After finishing the registration and local Wi-Fi configuration, enter registered name and password to login. Note: Tick "Remember Me" for your login convenience afterwards.



Overview

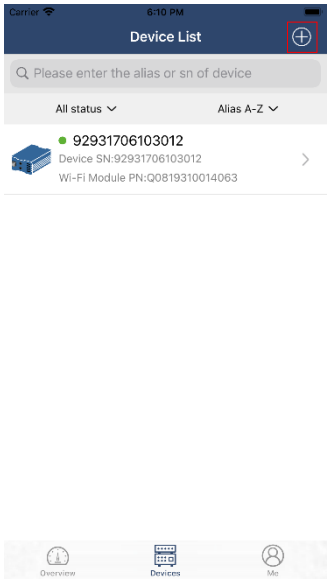
After login is successfully, you can access "Overview" page to have overview of your monitoring devices, including overall operation situation and Energy information for Current power and Today power as below diagram.

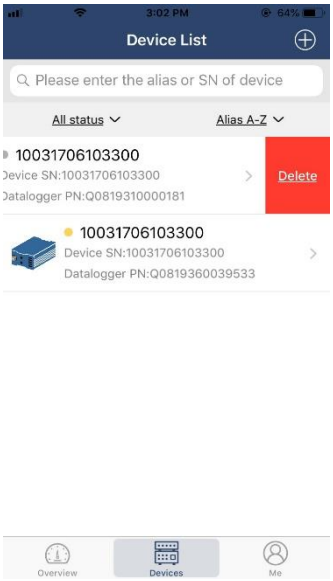


Devices

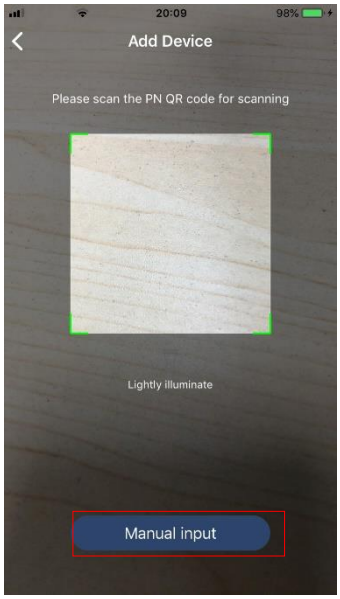
Tap the Devices icon (located on the bottom) to enter Device List page. You can review all devices here by adding or deleting Wi-Fi Module in this page.

Add device **Delete device**





Tap icon on the top right corner and enter part number by scanning bar code to add Wi-Fi module. This part number is pasted on the front panel and manually enter it. Tap "Confirm" to add Wi-Fi module in the Device list.

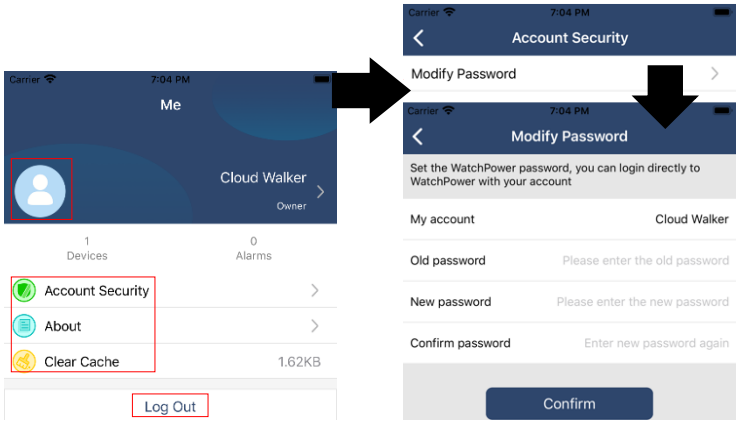


Part number label is pasted on front panel.

For more information about Device List, please refer to the section 2.4.

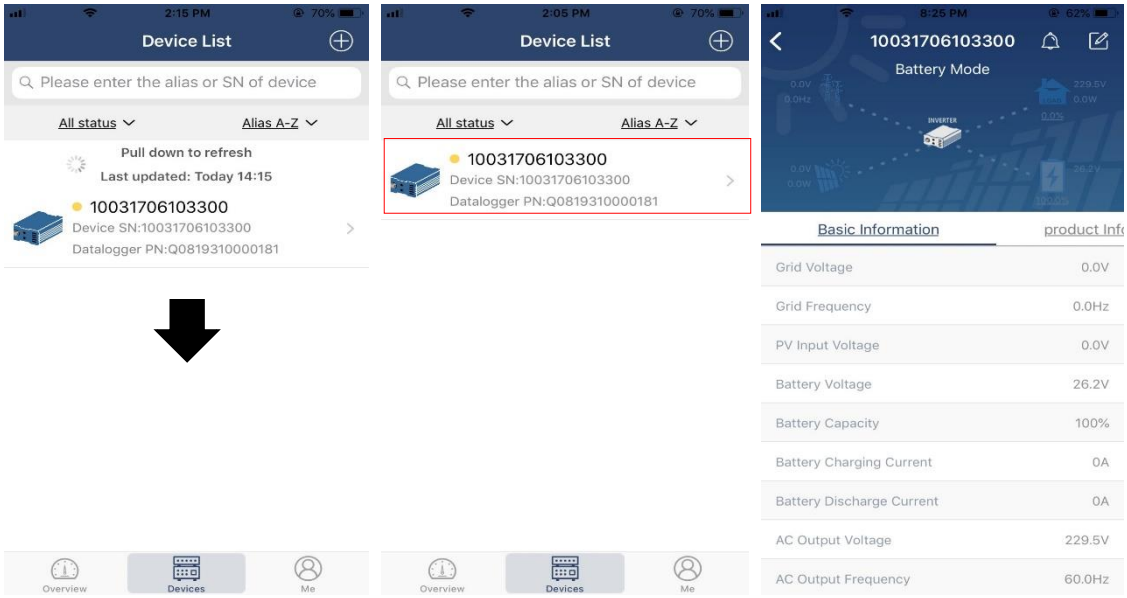
ME

In ME page, users can modify "My information", including【User's Photo】,【Account security】, 【Modify password】,【Clear cache】,and【Log-out】, shown as below diagrams.



2-4. Device List

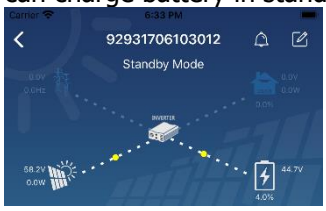
In Device List page, you can pull down to refresh the device information and then tap any device you want to check up for its real-time status and related information as well as to change parameter settings. Please refer to the parameter setting list.



Device Mode

On the top of screen, there is a dynamic power flow chart to show live operation. It contains five icons to present PV power, inverter, load, utility and battery. Based on your inverter model status, there will be 【Standby Mode】, 【Line Mode】, 【Battery Mode】.

【Standby Mode】 Inverter will not power the load until "ON" switch is pressed. Qualified utility or PV source can charge battery in standby mode.

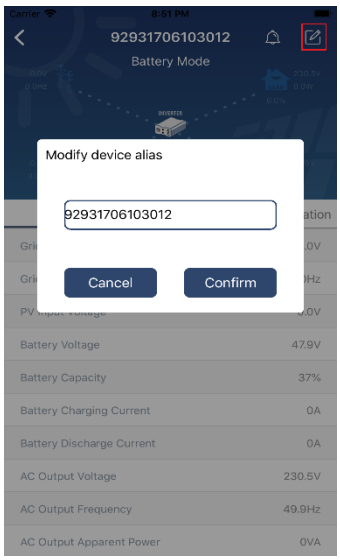


【Line Mode】 Inverter will power the load from the utility with or without PV charging. Qualified utility or PV source can charge battery.

【**Battery Mode**】Inverter will power the load from the batter with or without PV charging. Only PV source can charge battery.

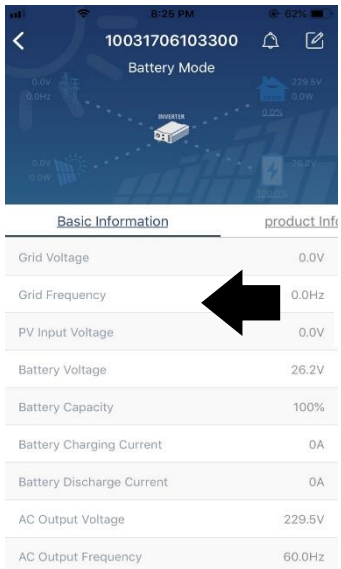
Device Alarm and Name Modification

In this page, tap the  icon on the top right corner to enter the device alarm page. Then, you can review alarm history and detailed information. Tap the  icon on the top right corner, a blank input box will pop out. Then, you can edit the name for your device and tap "Confirm" to complete name modification.



Device Information Data

Users can check up 【Basic Information】,【Product Information】,【Rated information】,【History】, and 【Wi-Fi Module Information】by swiping left.



Swipe left

【**Basic Information**】displays basic information of the inverter, including AC voltage, AC frequency, PV input voltage, Battery voltage, Battery capacity, Charging current, Output voltage, Output frequency, Output apparent power, Output active power and Load percent. Please slide up to see more basic information.

【**Production Information**】displays Model type (Inverter type), Main CPU version and secondary CPU version.

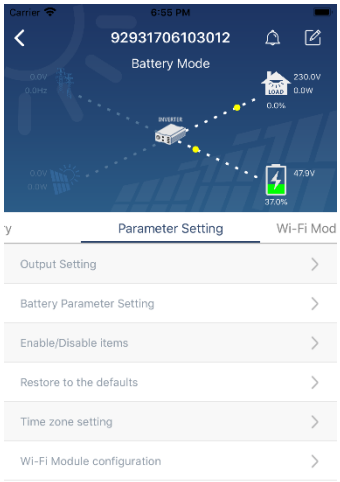
【**Rated Information**】displays information of Nominal AC voltage, Nominal AC current, Rated battery voltage, Nominal output voltage, Nominal output frequency, Nominal output current, Nominal output apparent power and Nominal output active power. Please slide up to see more rated information.

【**History**】displays the record of unit information and setting timely.

【**Wi-Fi Module Information**】displays of Wi-Fi Module PN, status and firmware version.

Parameter Setting

This page is to activate some features and set up parameters for inverters. Please be noted that the listing in "Parameter Setting" page in below diagram may differ from the models of monitored inverter. Here will briefly highlight some of it,【Output Setting】,【Battery Parameter Setting】,【Enable/ Disable items】,【Restore to the defaults】to illustrate.



There are three ways to modify setting and they vary according to each parameter.

a) Listing options to change values by tapping one of it.

b) Activate/Shut down functions by clicking "Enable" or "Disable" button.

c) Changing values by clicking arrows or entering the numbers directly in the column.

Each function setting is saved by clicking "Set" button.

Please refer to below parameter setting list for an overall description and be noted that the available parameters may vary depending on different models. Please always see the original product manual for detailed setting instructions.

Parameter setting list:

Item		Description
Output setting	Output source priority	To configure load power source priority.
	AC input range	When selecting "UPS", it's allowed to connect personal computer. Please check product manual for details.
		When selecting "Appliance", it's allowed to connect home appliances.
	Output voltage	To set output voltage.
	Output frequency	To set output frequency.
Battery parameter setting	Battery type:	To set connected battery type.
	Battery cut-off voltage	To set the battery stop discharging voltage. Please see product manual for the recommended voltage range based

		on connected battery type.
	Back to grid voltage	When "SBU" or "SOL" is set as output source priority and battery voltage is lower than this setting voltage, unit will transfer to line mode and the grid will provide power to load.
	Back to discharge voltage	When "SBU" or "SOL" is set as output source priority and battery voltage is higher than this setting voltage, battery will be allowed to discharge.
	Charger source priority:	To configure charger source priority.
	Max. charging current	It's to set up battery charging parameters. The selectable values in different inverter model may vary. Please see product manual for the details.
	Max. AC charging current:	
	Float charging voltage	
	Bulk charging voltage	It's to set up battery charging parameters. The selectable values in different inverter model may vary. Please see product manual for the details.
	Battery equalization	Enable or disable battery equalization function.
	Real-time Activate Battery Equalization	It's real-time action to activate battery equalization.
	Equalized Time Out	To set up the duration time for battery equalization.
	Equalized Time	To set up the extended time to continue battery equalization.
	Equalization Period	To set up the frequency for battery equalization.
	Equalization Voltage	To set up the battery equalization voltage.
Enable/Disable Functions	LCD Auto-return to Main screen	If enable, LCD screen will return to its main screen after one minute automatically.
	Fault Code Record	If enabled, fault code will be recorded in the inverter when any fault happens.
	Backlight	If disabled, LCD backlight will be off when panel button is not operated for 1 minute.
	Bypass Function	If enabled, unit will transfer to line mode when overload happened in battery mode.
	Beeps while primary source interrupt	If enabled, buzzer will alarm when primary source is abnormal.
	Over Temperature Auto Restart	If disabled, the unit won't be restarted after over-temperature fault is solved.
	Overload Auto Restart	If disabled, the unit won't be restarted after overload occurs.
	Buzzer	If disabled, buzzer won't be on when alarm/fault occurred.
RGB LED Setting	Enable/disable	Turn on or off RGB LEDs

	Brightness	Adjust the lighting brightness
	Speed	Adjust the lighting speed
	Effects	Change the light effects
	Color selection	Adjust color combination to show energy source an battery status
Restore to the default	This function is to restore all settings back to default settings.	

For further information visit www.bluemountainpv.com

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