



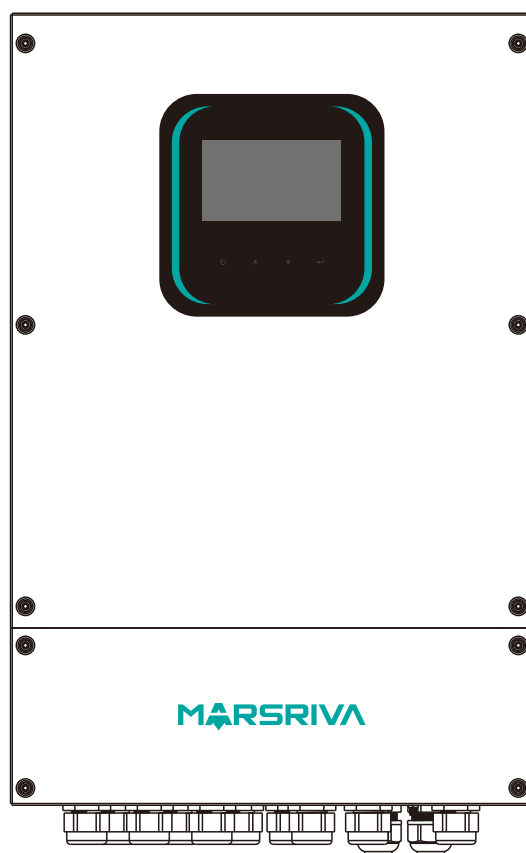
User Manual

Hybrid Solar Inverter

MR-SPH6.6K-LP1-TL65E

MR-SPH8.6K-LP1-TL65E

MR-SPH10.6K-LP1-TL65E



www.marsriva.com

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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 hybrid PV inverter can provide power to connected loads by utilizing PV power, utility power and battery power.

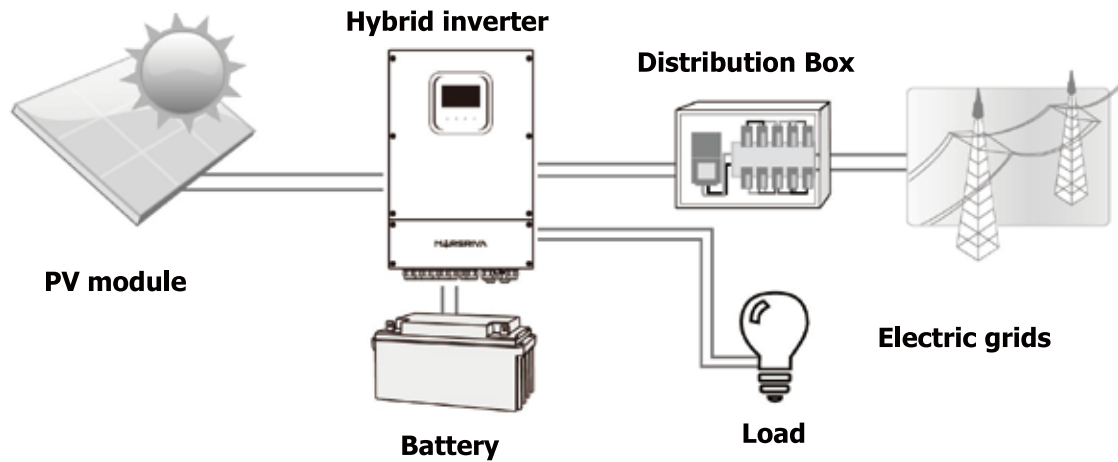
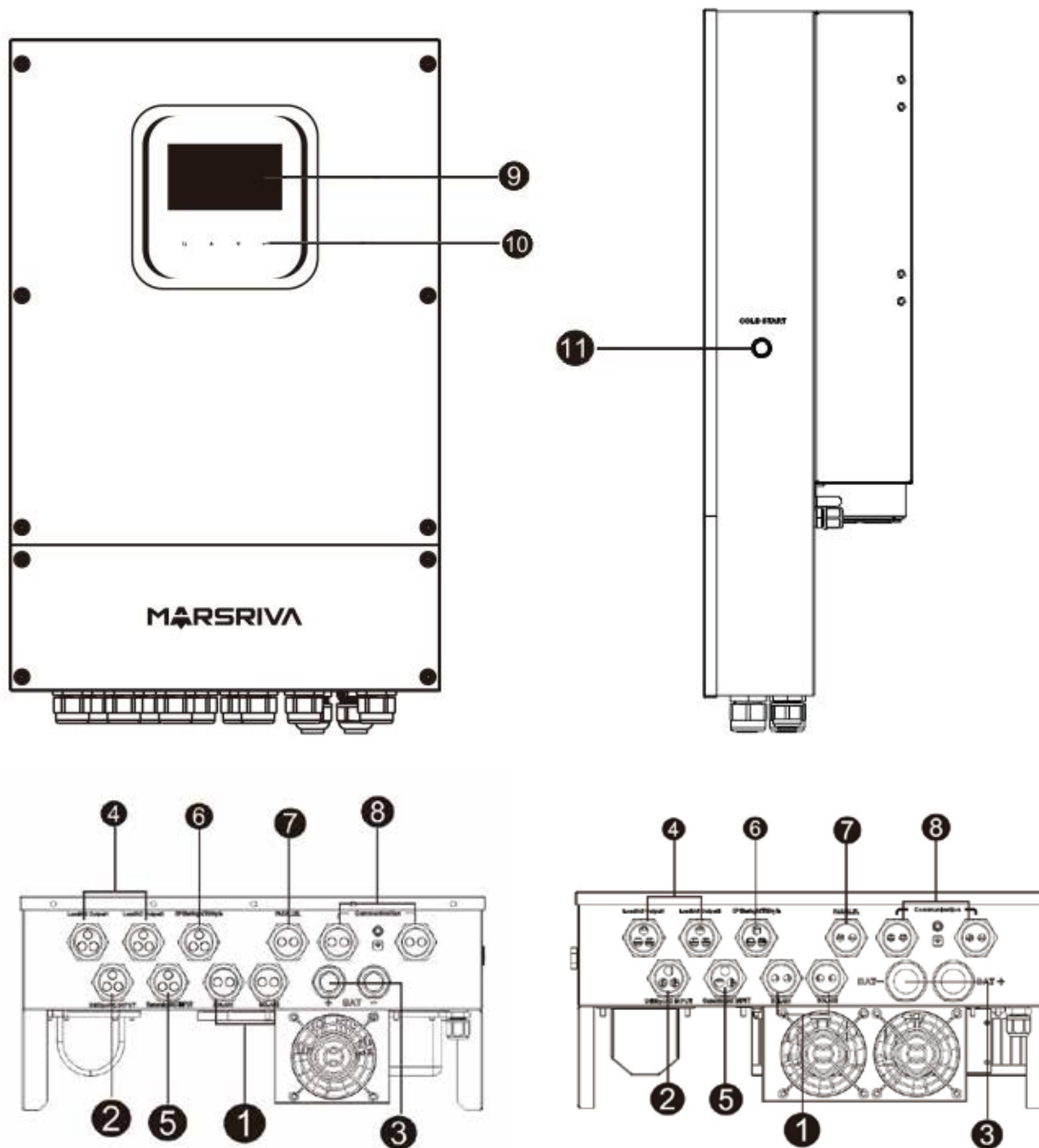


Figure 1 Basic hybrid PV System Overview

Depending on different power situations, this hybrid inverter is designed to generate continuous power from PV solar modules (solar panels), battery, and the utility. When MPP input voltage of PV modules is within acceptable range (see specification for the details), this inverter is able to generate power to feed the grid (utility) and charge battery. **Never connect the positive and negative terminals of the solar panel to the ground.** See Figure 1 for a simple diagram of a typical solar system with this hybrid inverter.

Product Overview



6.6KW

8.6KW/10.6KW

NOTE: For parallel model installation and operation, please check separate parallel installation guide for the details.

1. PV connectors
2. AC Grid connectors
3. Battery connectors
4. AC output connectors
5. AC Generator connectors
6. Sharing current ports & external sensor ports
7. Parallel communication ports
8. Dry contact/USB/RS-232/BMS communication ports
9. LCD display panel (Please check section 10 for detailed LCD operation)
10. Operation buttons
11. Cold start button

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:



Inverter unit



Software CD



Manual



RS-232 cable



Parallel communication cable



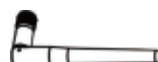
Current sharing cable



Mounting screws



Mounting plate



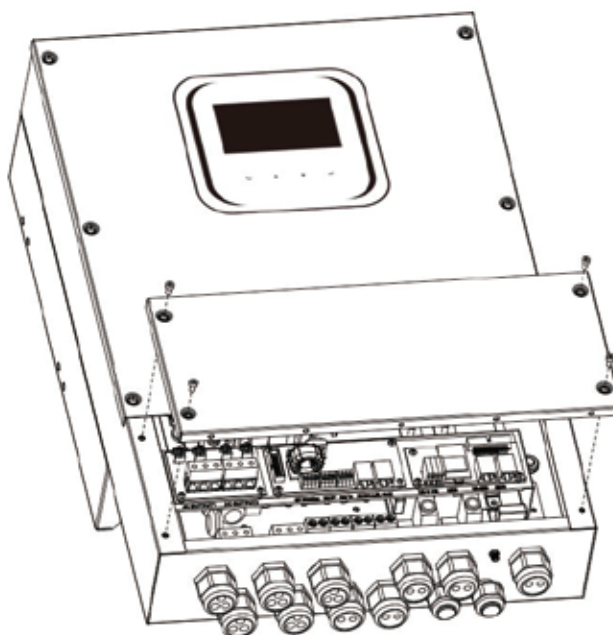
WiFi antenna



DC terminals
(Only for 8.6KW, 10.6KW)

Preparation

Before connecting all wirings, please take off bottom cover by removing four screws as shown below.



Installing the Unit

Preparation

This hybrid inverter is designed for indoor or outdoor use (IP66), please make sure the installation site meets below conditions:

- Not in direct sunlight
- Not in areas where highly flammable materials are stored.
- Not in potential explosive areas.
- Not in the cool air directly.
- Not near the television Antenna or antenna cable.
- Not higher than altitude of about 2000 meters above sea level.

Please AVOID direct sunlight, rain exposure, snow laying up during installation and operation.

Select the Mounting Place

- Please select a vertical wall with load-bearing capacity for installation, appropriate for installation on concrete or other non-flammable surfaces.
- The ambient temperature should be between $-25\sim 50^{\circ}\text{C}$ to ensure optimal operation.
- Be sure to keep other objects and surfaces as shown in the diagram to guarantee sufficient heat dissipation and have enough space for removing wires.
- For proper air ventilation to dissipate heat, allow a clearance of approx. 50cm to the side and approx. 50cm above and below the unit. And 100cm toward 50cm above and below the unit. And 100cm toward the front of the unit.

Mounting the Unit

WARNING!! Remember that this inverter is heavy! Please be careful when lifting out from the package.

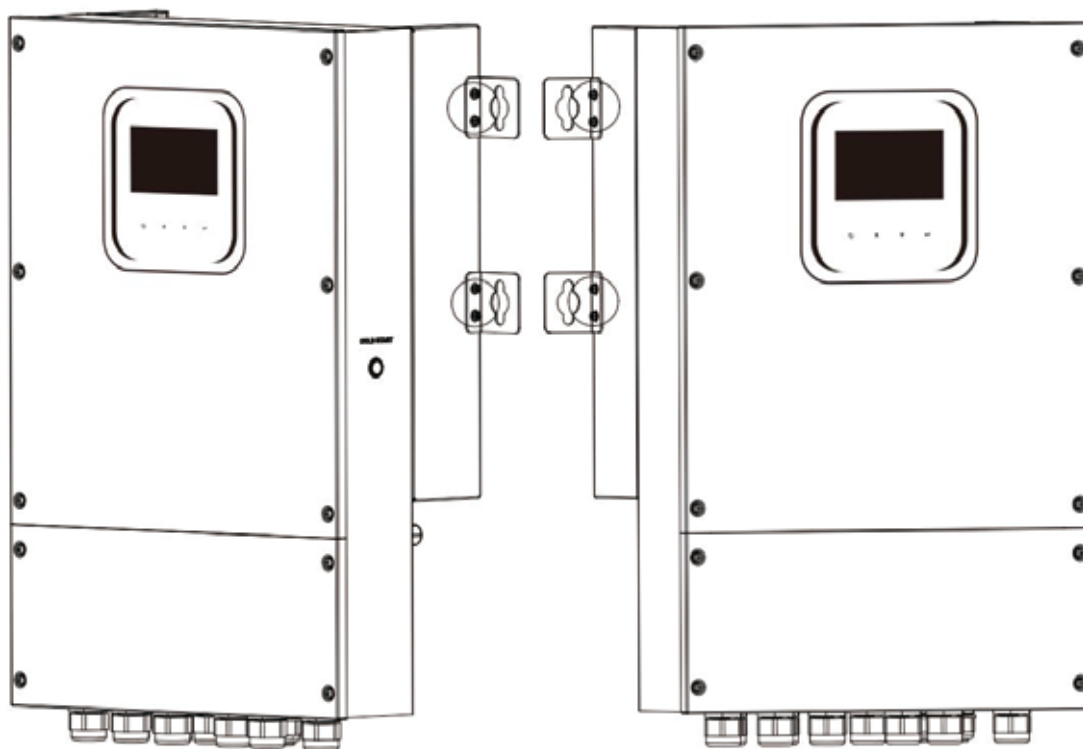
Installation to the wall should be implemented with the proper screws. After that, the device should be bolted on securely.

The inverter only can be used in a CLOSED ELECTRICAL OPERATING AREA. Only service person can enter this area.

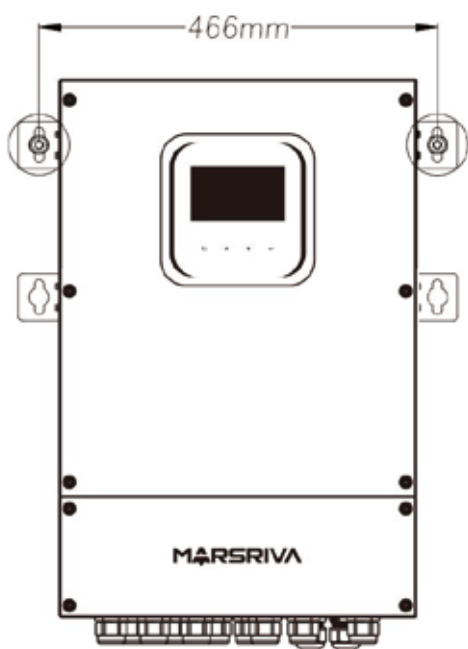
WARNING!! FIRE HAZARD.

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

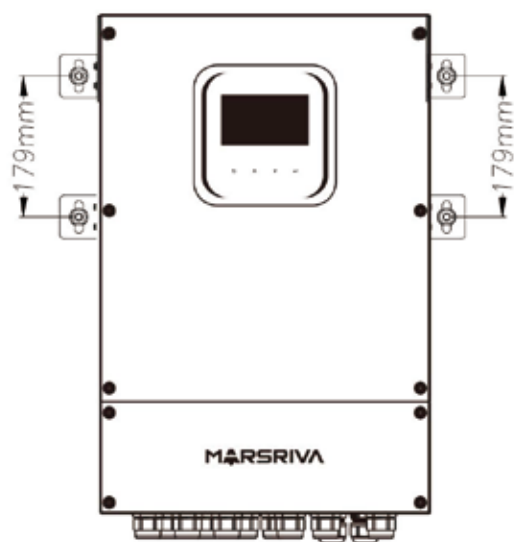
Step 1: Fix two brackets on the two sides of the inverter with 8 screws.



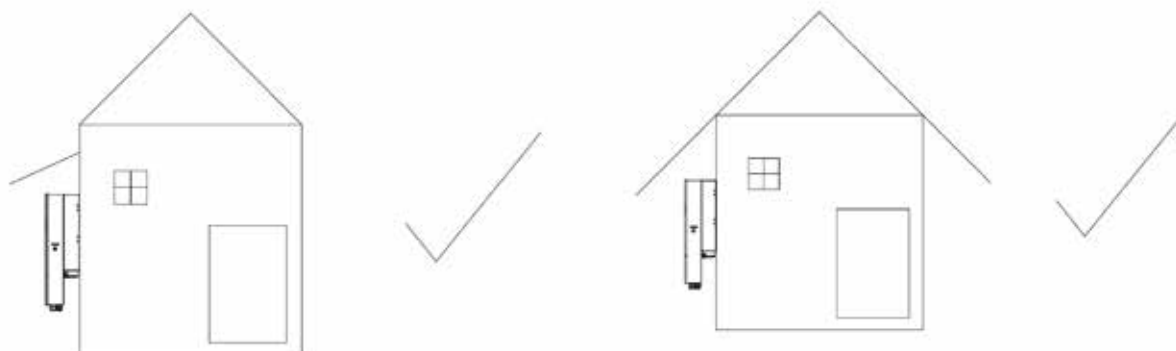
Step 2: Install the inverter by screwing two screws on the top first.



Step 3: Then, fix the remaining two mounting holes with screws.



Step 4: The inverter should be installed in a shaded, rain proof or protected location.



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.

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.

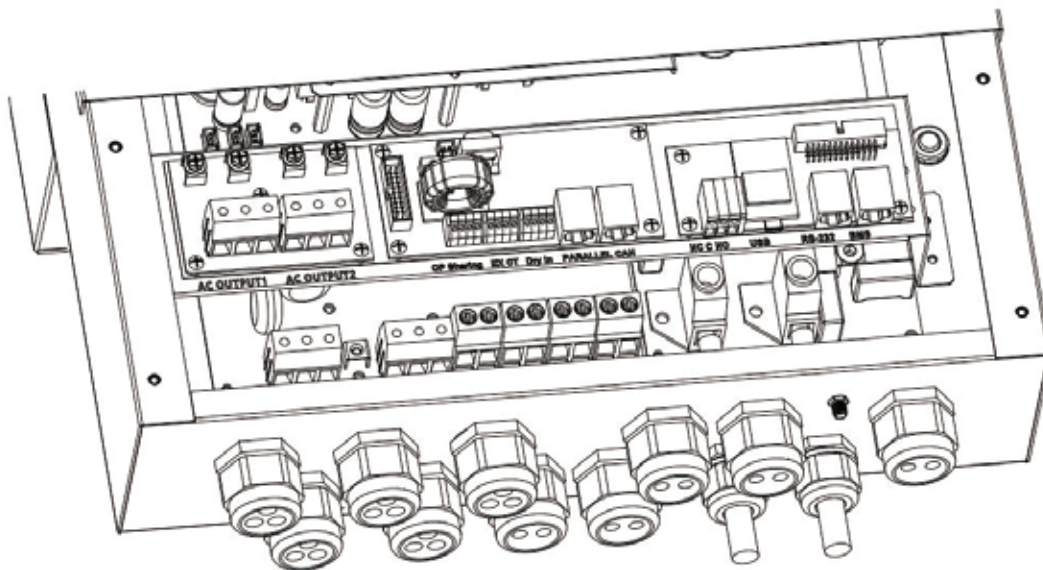
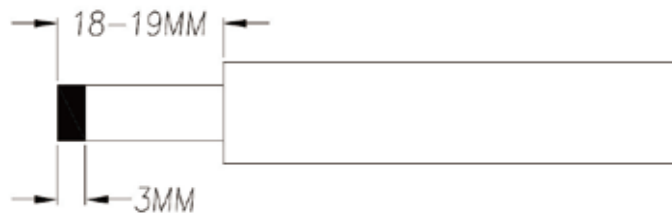
Recommended battery cable and terminal size:

MODEL	Typical Amperage	Wire Size	Torque Value
6.6KW	125A	1*2AWG	1.98 Nm
8.6KW	190A	1*1/0 AWG	5 Nm
10.6KW	210A	1*1/0 AWG	5 Nm

For 6.6KW model:

Please follow the below steps to implement battery connection:

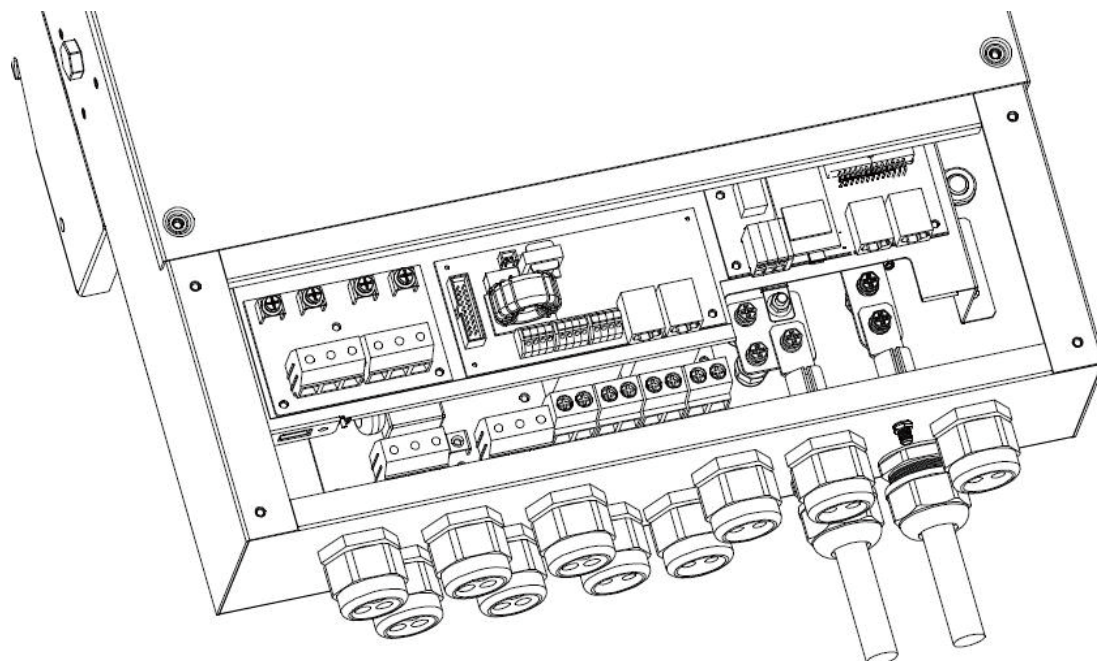
1. Remove insulation sleeve 18~19mm for two conductors.
2. Insert battery wires according to polarities indicated on the terminal block and tighten the terminal screws.
Make sure polarity at both the battery and the inverter/charge is correctly connected.



For 8.6KW and 10.6KW models:

Please follow the below steps to implement battery connection:

1. Assemble battery ring terminal based on recommended battery cable.
2. Fix two cable glands into positive and negative terminals.
3. Insert the ring terminal of battery cable flatly into battery connector of inverter and make sure the screws are tightened with torque of 5Nm. Make sure polarity at both the battery and the inverter/charge is correctly connected and ring terminals are tightly screwed to the battery terminals.

Ring terminal:

8.6KW & 10.6KW

**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. The recommended spec of AC breaker is 50A. This will ensure the inverter can be securely disconnected during maintenance and fully protected from over current of AC input.

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

WARNING! All wiring must be performed by a qualified personnel.

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

Suggested cable requirement for AC wires

MODEL	Gauge	Torque Value
6.6KW	10 AWG	1.2~ 1.6 Nm
8.6KW/10.6KW	8 AWG	1.2~ 1.6 Nm



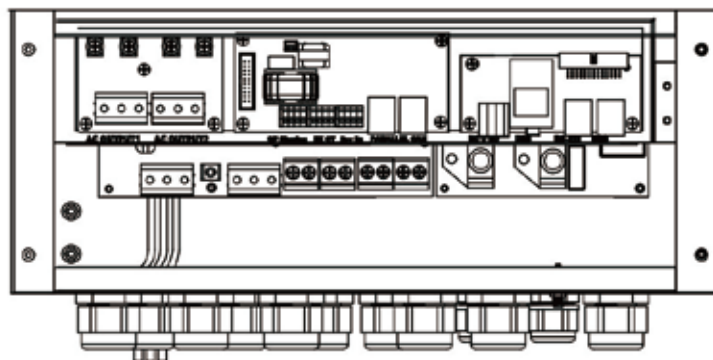
Please follow below steps to implement AC input/output connection:

1. Before making AC input/output connection, be sure to open DC protector or disconnect first.
2. Remove insulation sleeve 10-11mm.
3. Insert AC input wires according to polarities indicated on terminal block and tighten the terminal screws. Be sure to connect PE protective conductor () first.

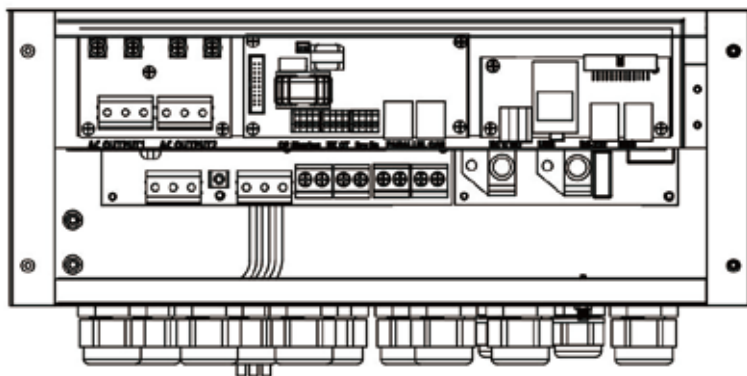
 → **Ground (yellow-green)**

L→LINE (brown or black)

N→Neutral (blue)



Utility AC INPUT



Generator AC INPUT



WARNING:

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

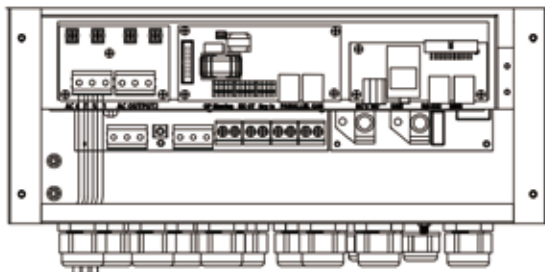
4. This inverter is equipped with dual-output. There are two outputs: AC output 1 and AC output 2. It's set up through LCD program or monitoring software to turn on and off the second output. Refer to "LCD setting" section for the details.

Insert AC output wires according to polarities indicated on terminal block and tighten terminal screws. Be sure to connect PE protective conductor (⏏) first.

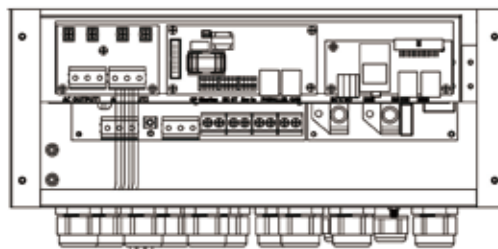
⏏→**Ground (yellow-green)**

L→LINE (brown or black)

N→Neutral (blue)



AC Output 1



AC Output 2

5. Make sure the wires are securely connected.

CAUTION: Important

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

The working logic of the generator

The generator is mainly used to substitute the Utility power to ensure the normal operation of the inverter. There are two operation situations:

- (1) Connect to the generator and Utility when the Utility is normal:

The inverter will close the Grid relay, and at this time, the utility will provide power to load, charge battery or feed the grid. In this case, the generator relay will be open.

- (2) Connect to the generator when the Utility is abnormal or lost:

The inverter will close the generator relay, and at this time, the generator will provide power to load. The generator does not charge the battery by default, and if it needs to be charged, it needs to enable the LCD setting #65. In this case, the grid relay will be open.

NOTE 1: After the generator is connected, the inverter will automatically turn off the grid-connected function to protect the generator.

NOTE 2: Only when the inverter is set to single-machine mode, the generator will be connected.

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: Please switch off the inverter before you connect PV modules. Otherwise, it will damage the inverter.

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

MODEL	Typical Amperage	Cable Size	Torque
6.6KW	21A	14AWG	2.0~2.4Nm
8.6KW/10.6KW	27A	12AWG	2.0~2.4Nm

PV Module Selection:

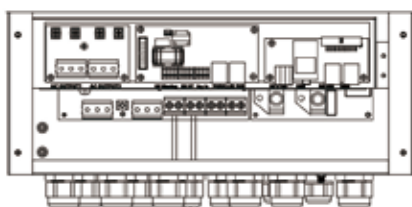
When selecting proper PV modules, please be sure to consider below parameters:

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.

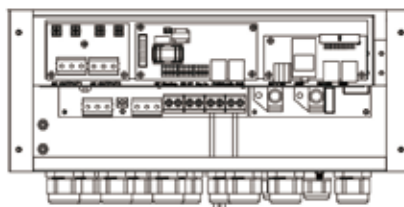
Solar Charging Mode	
Max. PV Array Open Circuit Voltage	500 Vdc
PV Array MPPT Voltage Range	120~450Vdc
MPP Number	2

Please follow below steps to implement PV module connection:

1. Remove insulation sleeve 10-11 mm for positive and negative conductors.
2. Check correct polarity of connection cable from PV modules and PV input connectors. Then, connect positive pole (+) of connection cable to positive pole (+) of PV input connector. Connect negative pole (-) of connection cable to negative pole (-) of PV input connector.



PV input 1



PV input 2

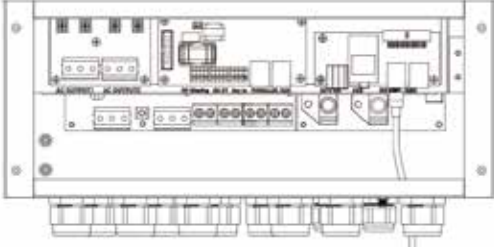
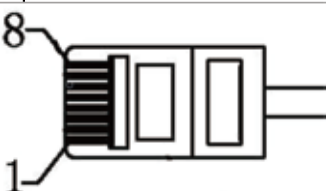
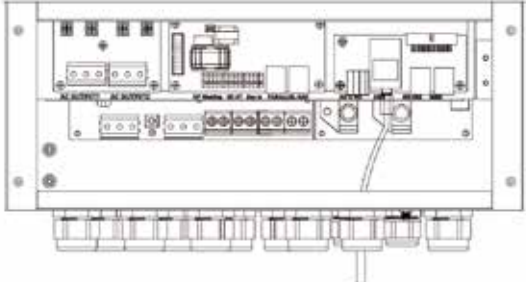
Recommended PV Module Configuration

Solar Panel Spec				
Nominal Max. power (Pmax)(W)	450	454	615	620
Opt. Operating Voltage (Vmp) (V)	41.4	41.6	44.6	44.8
Opt. Operating Current (Imp) (A)	10.87	10.91	13.79	13.84
Open Circuit Voltage (Voc) (V)	48.9	49	52.4	52.6
Short Circuit Current (Isc) (A)	11.68	11.73	14.72	14.78
Solar Panel Configuration (For 6.6KW)				
Numbers in series of MPPT1	7	7	9	9
Numbers of strings in MPPT1	2	2	1	1
Maximum input voltage of MPPT1 (V)	342.3	343	471.6	473.4
Input power of MPPT1 (W)	6300	6356	5535	5580
Numbers in series of MPPT2	7	6	9	9
Numbers of strings in MPPT2	2	2	1	1
Maximum input voltage of MPPT1 (V)	342.3	294	471.6	473.4
Input power of MPPT2 (W)	6300	5448	5535	5580
Total input power (W)	12600	11804	11070	11160
Solar Panel Configuration (For 8.6KW)				
Numbers in series of MPPT1	9	9	7	7

Numbers of strings in MPPT1	2	2	2	2
Maximum input voltage of MPPT1 (V)	440.1	441	366.8	368.2
Input power of MPPT1 (W)	8100	8172	8610	8680
Numbers in series of MPPT2	9	8	6	6
Numbers of strings in MPPT2	2	2	2	2
Maximum input voltage of MPPT1 (V)	440.1	392	314.4	315.6
Input power of MPPT2 (W)	8100	7264	7380	7440
Total input power (W)	16200	15436	15990	16120
Solar Panel Configuration (For 10.6KW)				
Numbers in series of MPPT1	9	9	7	7
Numbers of strings in MPPT1	2	2	2	2
Maximum input voltage of MPPT1 (V)	440.1	441	366.8	368.2
Input power of MPPT1 (W)	8100	8172	8610	8680
Numbers in series of MPPT2	9	9	7	7
Numbers of strings in MPPT2	2	2	2	2
Maximum input voltage of MPPT1 (V)	440.1	441	366.8	368.2
Input power of MPPT2 (W)	8100	8172	8610	8680
Total input power (W)	16200	16344	17220	17360

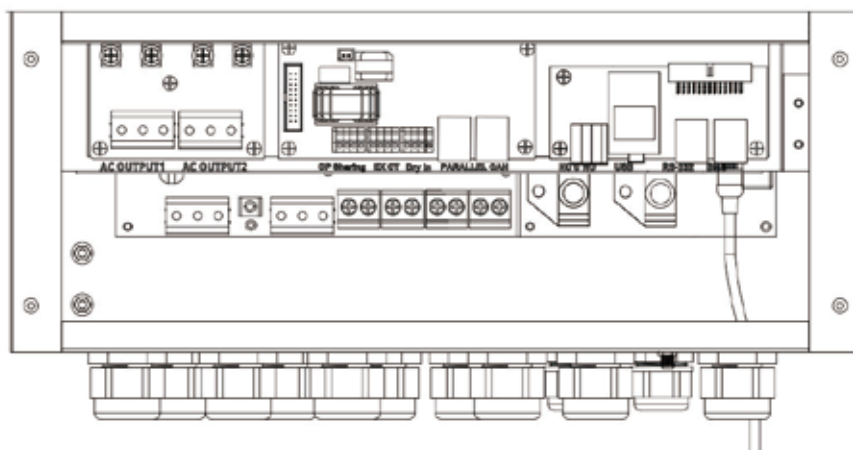
Communication Connection

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

For RS232 port, you should use a RJ45 cable as follows: PIN1: TXD, PIN2:RXD, PIN4:12V, PIN8:GND	For USB port, you should use a USB cable as follows:
 The RJ45 line sequence is as follows: 	

BMS Communication

For BMS port, you should use a RJ45 cable as follows:



It is recommended to purchase a special communication cable if you are connecting to Lithium-ion battery. Please use a RJ45 cable to connect BMS communication port as shown in below:

PIN Assignment	
PIN 3	RS485-B
PIN 5	RS485-A
PIN 8	GND

For more information, please refer to Appendix II: BMS Communication Installation.

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.

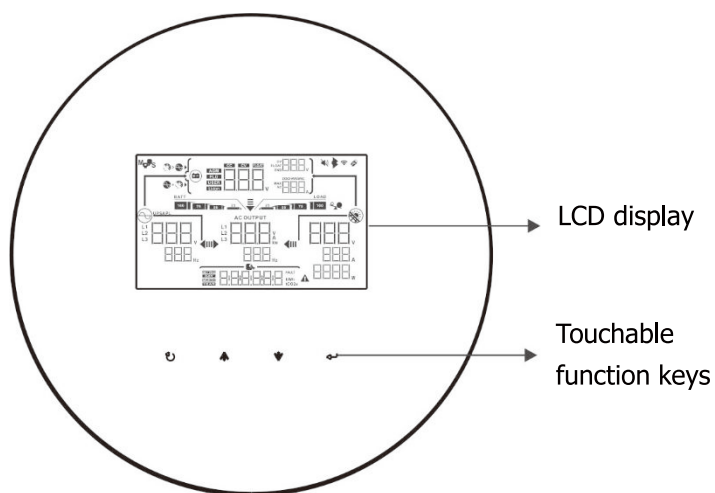
NOTE: Be sure to enable Dry contact setting first in LCD setting #41. Otherwise, the dry contact state is consistent with the power off state.

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.(Utility available)		Close	Open
	Generator Settings→ Generator ON voltage/SOC	When Battery voltage /SCO < Generator ON voltage/SOC	Open	Close
	Generator Settings→ Generator OFF voltage/SOC	When Battery voltage /SCO > Generator OFF voltage/SOC	Close	Open

OPERATION

Operation and Display Panel

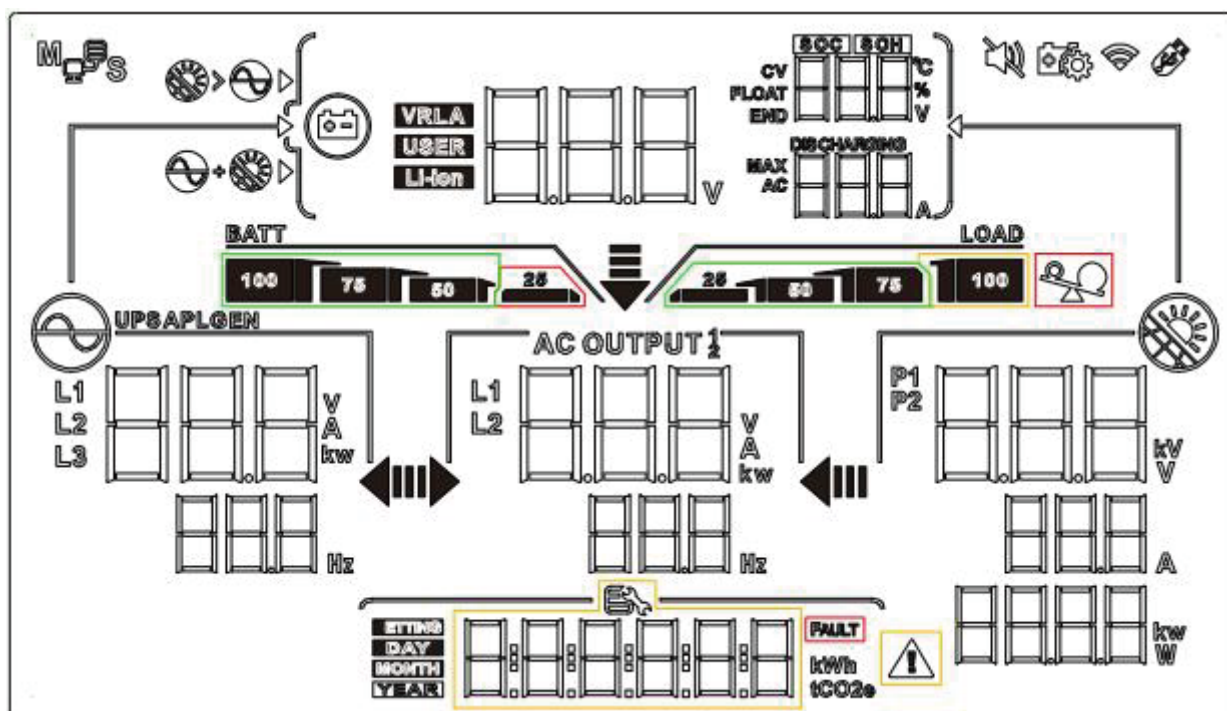
The operation LCD panel, shown in the chart below, includes four touchable function keys and a LCD display to indicate the operating status and input/output power information.



Touchable Function Keys

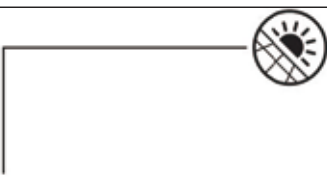
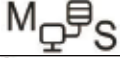
Function Key		Description
	ESC	To exit the setting mode
		To power off the inverter.
	Up	To last selection
	Down	To next selection
	Enter	To confirm/enter the selection in setting mode
		To power on the inverter
	Up+Down	To enter the setting mode

LCD Display Icons



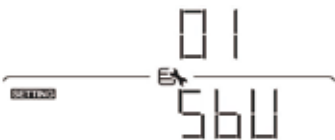
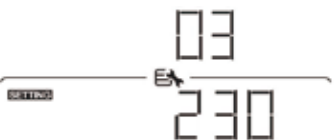
Icon	Function description
Input Source Information	
	Indicates the AC input voltage and frequency.
	Indicates the PV voltage, current and power.
	Indicates the battery voltage, charging stage, configured battery parameters, charging or discharging current.
Configuration Program and Fault Information	
	Indicates the setting programs.
	Indicates the warning and fault codes. Warning: 000 warning icon flashing with warning code. Fault: 000 FAULT lighting with fault code.
Output Information	

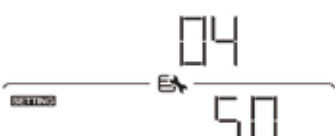
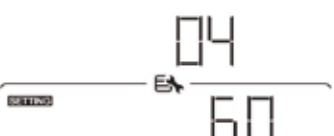
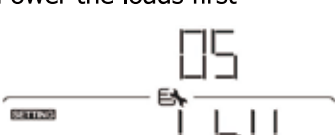
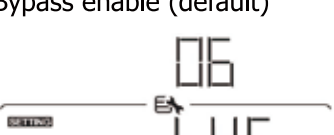
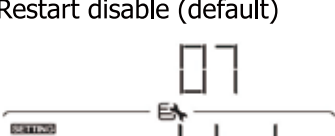
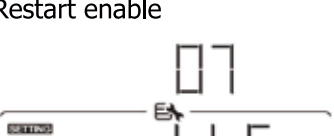
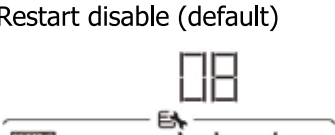
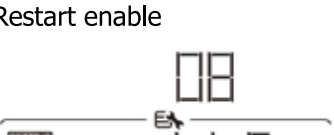
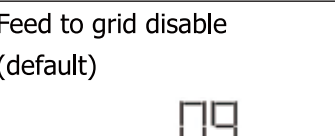
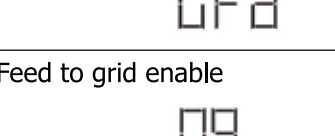
AC OUTPUT 1 V A W Hz	Indicate the output voltage, load in VA, load in Watt and output frequency.	
Battery Information		
BATT 100 75 50 25	Indicates battery level in battery mode and charging status in line mode by 0-24%, 25-49%, 50-74% and 75-100%.	
When battery is charging, it will present battery charging status.		
Status	Battery voltage	LCD Display
Constant Current mode / Constant Voltage mode	<2V/cell	4 bars will flash in turns.
	2 ~ 2.083V/cell	The right bar will be on and the other three bars will flash in turns.
	2.083 ~ 2.167V/cell	The right two bars will be on and the other two bars will flash in turns.
	> 2.167 V/cell	The right three bars will be on and the left bar will flash.
Floating mode. Batteries are fully charged.		4 bars will be on.
In battery mode, it will present battery capacity.		
Load Percentage	Battery Voltage	LCD Display
Load >50%	< 1.85V/cell	BATT 25
	1.85V/cell ~ 1.933V/cell	BATT 50 25
	1.933V/cell ~ 2.017V/cell	BATT 75 50 25
	> 2.017V/cell	BATT 100 75 50 25
Load < 50%	< 1.892V/cell	BATT 25
	1.892V/cell ~ 1.975V/cell	BATT 50 25
	1.975V/cell ~ 2.058V/cell	BATT 75 50 25
	> 2.058V/cell	BATT 100 75 50 25
Load Information		
	Indicates overload.	
LOAD 25 50 75 100	Indicates the load level by 0-24%, 25-49%, 50-74% and 75-100%.	
	0%~24%	25%~49%
	LOAD 25	LOAD 25 50
	50%~74%	75%~100%
	LOAD 25 50 75	LOAD 25 50 75 100
Charger Source Priority Setting Display		
>	Indicates setting program 10 "Charger source priority" is selected as "Solar first".	
+	Indicates setting program 10 "Charger source priority" is selected as "Solar and Utility".	

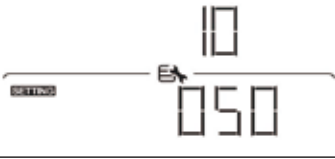
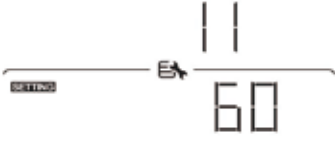
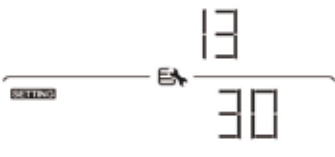
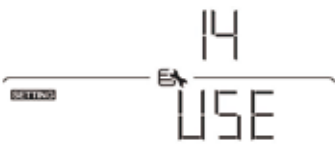
	Indicates setting program 10 "Charger source priority" is selected as "Solar only".
Output source priority setting display	
	Indicates setting program 01 "Output source priority" is selected as "SUB".
	Indicates setting program 01 "Output source priority" is selected as "SBU".
AC Input Voltage Range Setting Display	
UPS	Indicates setting program 02 is selected as "UPS". The acceptable AC input voltage range will be within 170-280VAC.
APL	Indicates setting program 02 is selected as "APL". The acceptable AC input voltage range will be within 90-280VAC.
GEN	The GEN AC input voltage range will be within 90-280VAC.
Operation Status Information	
	Indicates unit connects to the mains.
	Indicates unit connects to the PV panel.
	Indicates battery type.
	Indicates parallel operation is working.
	Indicates unit alarm is disabled.
	Indicates Wi-Fi transmission is working.
	Indicates USB disk is connected.

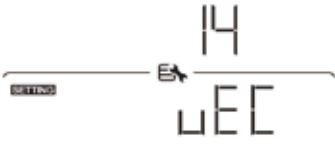
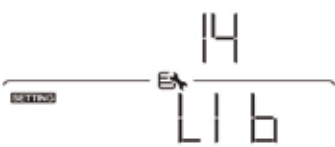
LCD Setting

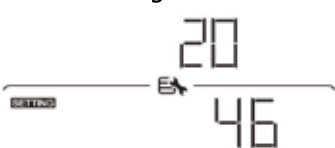
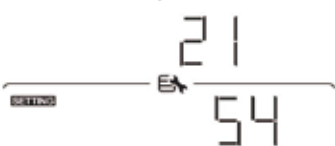
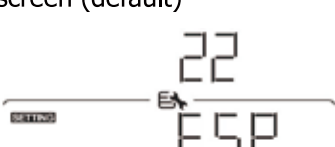
After pressing and holding "UP" and "DOWN" buttons for 1.5 seconds, the unit will enter setting mode. Press "UP" or "DOWN" button to select setting programs. And then, press "ENTER" button to confirm the selection or ESC button to exit.

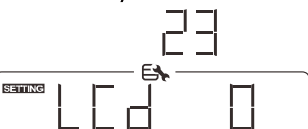
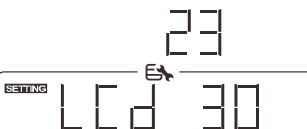
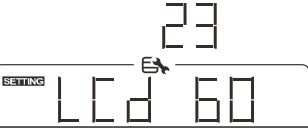
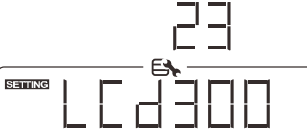
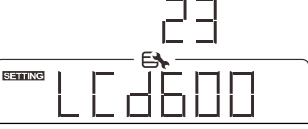
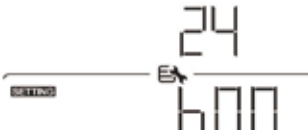
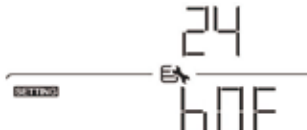
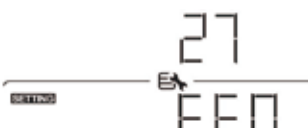
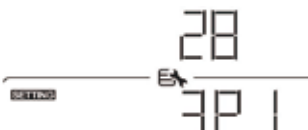
Program	Description	Selectable option	
00	Exit setting mode	Escape	
			
01	Output source priority selection	SUB(default)	Solar energy provides power to the loads as first priority. If solar energy is not sufficient to power all connected loads, Utility energy will supply power to the loads at the same time.
			
		SBU	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 20 or solar and battery is not sufficient.
			
02	AC input voltage range	Appliances (default)	If selected, acceptable AC input voltage range will be within 90-280VAC.
			
		UPS	If selected, acceptable AC input voltage range will be within 170-280VAC.
			
03	Output voltage	220Vac	
			
		230V (Default)	
			

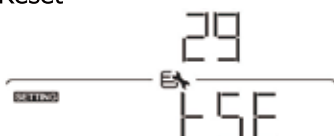
		240Vac 	
04	Output frequency	50Hz (default) 	60Hz 
05	Solar supply priority	Charge battery first (default) 	Solar energy provides power to charge battery as first priority.
		Power the loads first 	Solar energy provides power to the loads as first priority.
06	Overload bypass: When enabled, the unit will transfer to line mode if overload occurs in battery mode.	Bypass disable 	Bypass enable (default) 
		Restart disable (default) 	Restart enable 
08	Auto restart when over temperature occurs	Restart disable (default) 	Restart enable 
		Feed to grid disable (default) 	If selected, solar energy is not allowed to feed to the grid.
09	Solar energy feed to grid configuration	Feed to grid enable 	If selected, solar energy is allowed to feed to the grid.

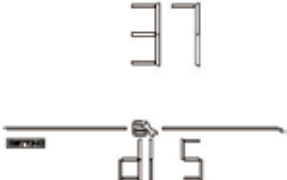
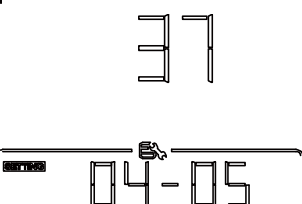
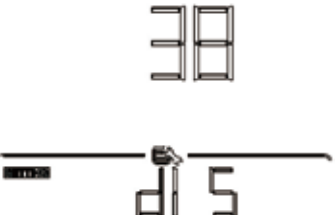
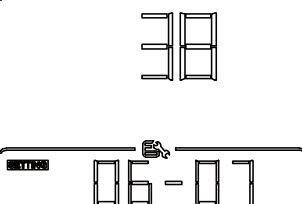
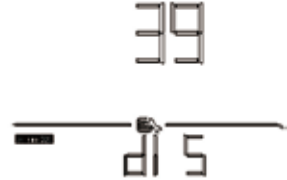
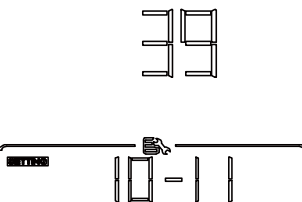
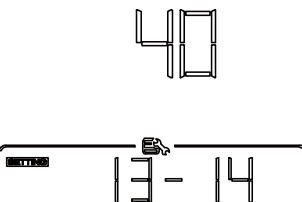
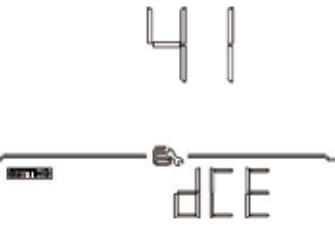
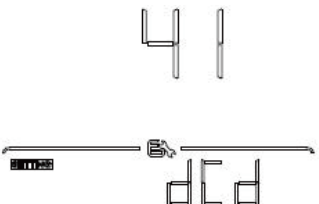
10	Charger source priority: To configure charger source priority	If this inverter/charger is working in Line, Standby or Fault mode, charger source can be programmed as below:	
		Solar first 	Solar energy will charge battery as first priority. Utility will charge battery only when solar energy is not available.
		Solar and Utility (default) 	Solar energy and utility will charge battery at the same time.
		Only Solar 	Solar energy will be the only charger source no matter utility is available or not.
11	Maximum charging current: To configure total charging current for solar and utility chargers. (Max. charging current = utility charging current + solar charging current)	60A (default) 	6.6K setting range is from 10A to 120A. 8.6K setting range is from 10A to 190A. 10.6K setting range is from 10A to 210A. Increment of each click is 10A.
13	Maximum utility charging current	30A (default) 	6.6K setting range is from 2A to 120A. 8.6K setting range is from 2A to 10A to 190A. 10.6K setting range is from 2A to 10A 210A. Increment of each click is 10A.
14	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 17, 18 and 19.
		Pylontech battery 	If selected, programs of 11, 17, 18 and 19 will be automatically set up. No need for further setting.

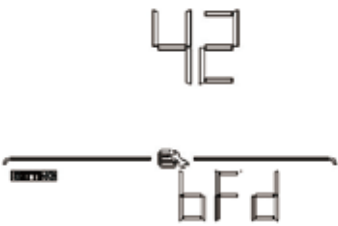
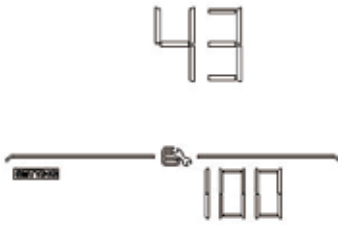
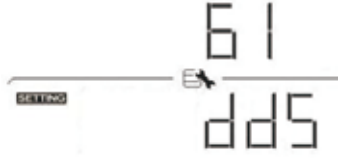
14	Battery type	WECO battery 	If selected, programs of 11, 17, 18, 19 and 20 will be auto-configured per battery supplier recommended. No need for further adjustment. Programs of 20 and 21 parameters refer to SOC of battery.
		Soltaro battery 	If selected, programs of 11, 17, 18 and 19 will be automatically 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 11, 17, 18 and 19 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.
16	Low DC cut off battery back voltage setting	AGM/FLD Default setting: 42.0V 	When the battery voltage is lower than program 19, the battery will be cut off. After it returns to this program value, the battery is allowed to discharge.
		User/Li-ON Default setting: 48.0V 	
17	Bulk charging voltage (C.V voltage)	Default setting: 56.4V 	If self-defined is selected in program 14, this program can be set up. Setting range is from 48.0V to 60.0V. Increment of each click is 0.1V.
18	Floating charging voltage	Default setting: 54.0V 	If self-defined is selected in program 14, this program can be set up. Setting range is from 48.0V to 60.0V. Increment of each click is 0.1V.

19	Low DC cut off battery voltage setting	Default setting: 40.8V 	If self-defined is selected in program 14, this program can be set up. Setting range is from 40.8V to 48.0V. Increment of each click is 0.1V. Low DC cut-off voltage will be fixed to setting value no matter what percentage of load is connected.
		10% (default) 	If any type of lithium battery is selected in program 14, the parameter will be fixed at 10% SOC of battery.
20	Battery stop discharging voltage when grid is available	default setting: 46V 	Setting range is from 44V to 51V and increment of each click is 1V.
		20% (default) 	If any type of lithium battery is selected in program 14, the parameter will be fixed at 20% SOC of battery.
21	Battery stop charging voltage when grid is available	Battery fully charged 	The setting range is from 48V to 58V and increment of each click is 1V.
		Default setting: 54V 	
		80% (default) 	If any type of lithium battery is selected in program 14, this parameter will refer to the SOC of battery and adjustable from 15 to 100%. Increment of each click is 5%.
22	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.

23	LCD off waiting time	LCD is always on 	The LCD shuts off after 30s 
		The LCD shuts off after 60s (default) 	The LCD shuts off after 300s. 
		The LCD shuts off after 600s 	
24	Alarm control	Alarm on (default) 	Alarm off 
25	Beeps while primary source is interrupted	Alarm on (default) 	Alarm off 
26	Max discharge current of the battery in the hybrid mode		The setting range for 6.6KW is from 10A to 135A. The setting range for 8.6KW is from 10A to 190A. The setting range for 10.6KW is from 10A to 210A.
27	Record Fault code	Record enable 	Record disable (default) 
28	AC output mode *This setting is only available when the inverter is in standby mode (Switch off).	Single: This inverter is used in single phase application. 	Parallel: This inverter is operated in parallel system. 
		L1 phase 	The inverter is operated in L1 phase in 3-phase application.

		L2 phase 	The inverter is operated in L2 phase in 3-phase application.
		L3 phase 	The inverter is operated in L3 phase in 3-phase application.
29	Reset PV energy storage	Not reset(Default) 	Reset 
32	Scheduled time for AC output on	00:00 (Default) 	The setting range of scheduled Time for AC output on is from 00:00 to 23:00, increment of each click is 1 hour.
33	Scheduled time for AC output off	00:00(Default) 	The setting range of scheduled Time for AC output off is from 00:00 to 23:00, increment of each click is 1 hour.
35	External CT function:	External CT disable (default) 	External CT enable: If selected, it's applied to application scenarios of family load balance and AC coupling. 
36	CT Ratio setting when external CT is enabled	Ratio select (default:2000:1) 	Support 500, 1000 and 2000 CT ratio.
37	The start and end time periods of AC charging 1	Set the start time and end time to allow AC to charge battery. The unit is hour (HH-HH). If the AC charging 1 time and discharging time overlaps, the inverter will operate according to the AC charging time. "00-00" indicates all-day permission.	

37	The start and end time periods of AC charging 1	disable(default) 	Setting 04 – 05 as AC charging 1 period. 
38	The start and end time periods of AC charging 2	Set the start time and end time to allow AC to charge battery. The unit is hour (HH-HH). If the AC charging 2 period and discharging time period overlaps, the inverter will operate according to the AC charging time. "00-00" indicates all-day permission. disable(default) 	Setting 06 – 07 as AC charging 2 period. 
39	In the hybrid mode, the start and end periods of the battery discharging 1	Set the start time and end time to allow battery discharging. The unit is hour (HH-HH). If the AC charging 1 period and discharging time period overlaps, the inverter will operate according to the AC charging time. "00-00" indicates all-day permission. disable(default) 	Setting 10 – 11 as battery discharging 1 period. 
40	In the hybrid mode, the start and end periods of the battery discharging 2	disable(default) 	Setting 13 – 14 as battery discharging 2 period. 
41	Dry contact Enable	Dry contact enable(default) 	Dry contact disable 

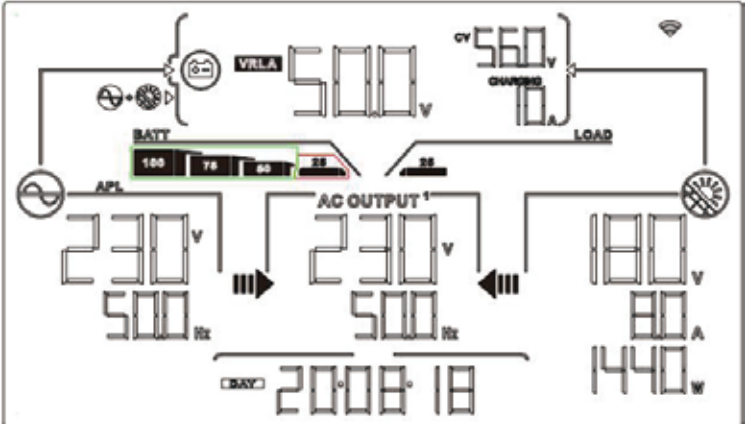
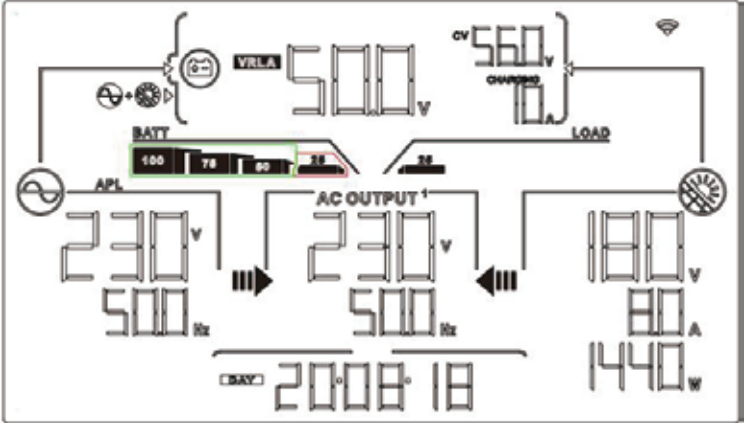
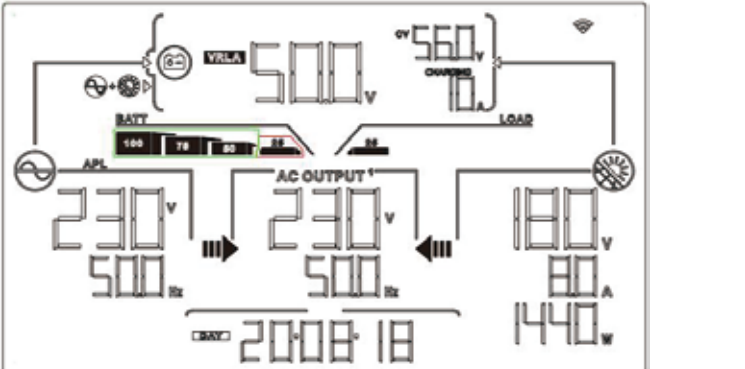
42	Battery feed-in grid	Battery feed-in grid disable (default) 	Battery feed-in grid enable 
43	Feed Grid power reverse adjust		Zero reference to adjust feed power in family loads. Setting Range 10W-300W
44	Lithium battery turn-on when the device is powered on	Turn-on immediately disable (default) 	Turn-on immediately enable 
60	Low DC cut off voltage on AC output 2	Default setting: 40.8V 	Setting range is from 40.8V to 48.0V. Increment of each click is 0.1V. This low DC cut-off voltage will be fixed to setting value no matter what percentage of load is connected.
		10% (default) 	If any type of lithium battery is selected in program 14, this parameter value will be displayed in percentage and value setting is based on battery capacity percentage. Setting range is from 0% to 95%. Increment of each click is 5%.
61	Setting discharge time on AC output 2	Disable (Default) 	Setting range is disable and then from 0 min to 990 min. Increment of each click is 5 min. *If the battery discharge time achieves the setting time in program 61 and the program 60 function is not triggered, the output will be turned off.
62	Scheduled time for AC output 2 on	00:00 (Default) 	Setting range is from 00:00 to 23:00. Increment of each click is 1 hour. Within scheduled on/off time setting in program 62 and 63, 2nd AC output will be turn off based on the setting value in program 60 or 61.

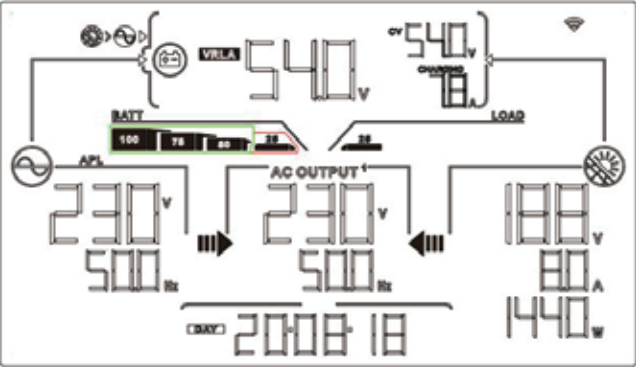
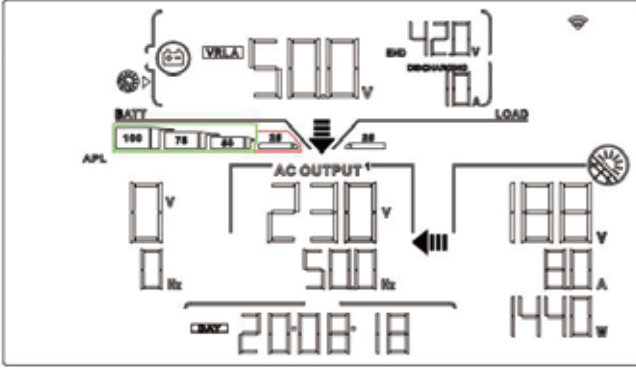
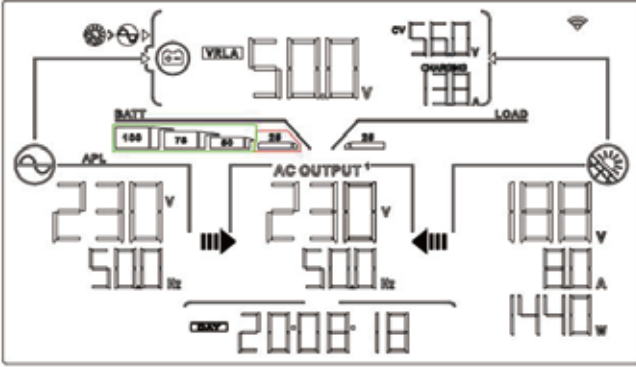
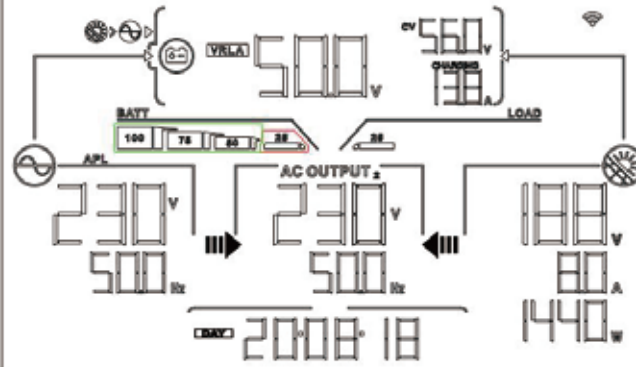
63	Scheduled time for AC output 2 off	00:00 (Default) 	Setting range is from 00:00 to 23:00. Increment of each click is 1 hour. Within scheduled on/off time setting in program 62 and 63, 2nd AC output will be turn off based on the setting value in program 60 or 61.
64	Battery re-discharging voltage on 2nd AC output	Default setting:48.0V 	Setting range is from 40V to 60V. Increment of each click is 0.1V.
		SOC 20%(default) 	If any lithium battery is selected in program 14, setting value will change to SOC automatically. Setting range is from 10% to 100%.Increment of each click is 5%.
65	GEN Charging enable	Charging disable (default) 	If selected, the generator will not be allowed to charge the battery
		Charging enable 	If selected, it will allow the generator to charge the battery
66	Maximum generator charging current	30A (default) 	If LCD program 65 is selected as "enable", setting range is from 2A to 120A. Increment of each click is 10A.
67	Generator dry contact connect	Default setting:46.0V 	Setting range is from 40.8V to 54.0V. Increment of each click is 0.1V. When the battery voltage drops to lower than this setting value, the generator dry contact will close.
		SOC 20%(default) 	If any lithium battery is selected in program 14, setting value will change to SOC automatically. Setting range is from 5% to 95%. Increment of each click is 5%.

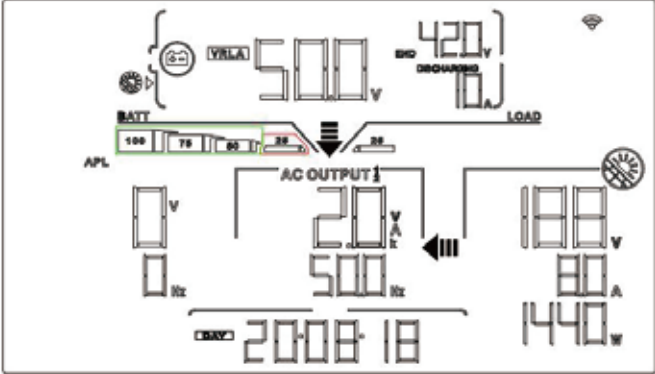
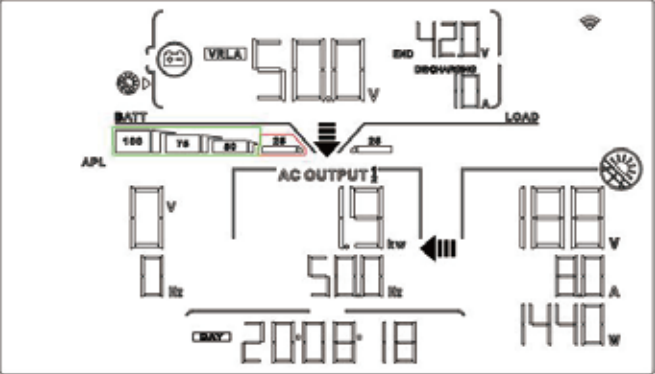
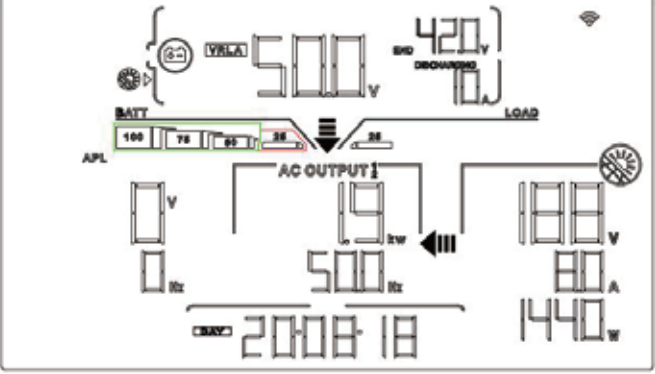
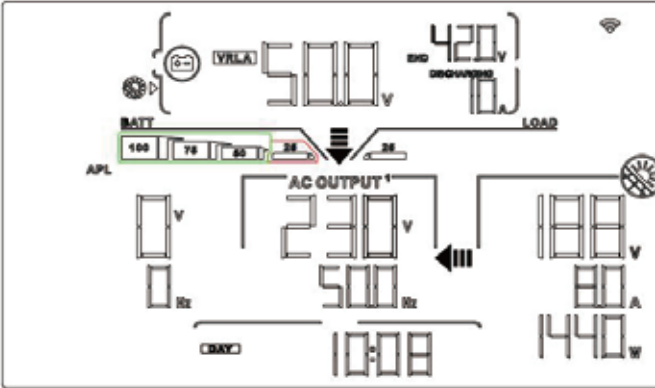
68	Generator dry contact disconnect	Default setting: 54.0V 	Setting range is from 40.8V to 60.0V. Increment of each click is 0.1V. When the battery voltage is higher than this setting value, the generator dry contact will be disconnected.
		SOC 80%(default) 	If any lithium battery is selected in program 14, setting value will change to SOC automatically. Setting range is from 10% to 100%. Increment of each click is 5%.
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 16 to 99.

Display Setting

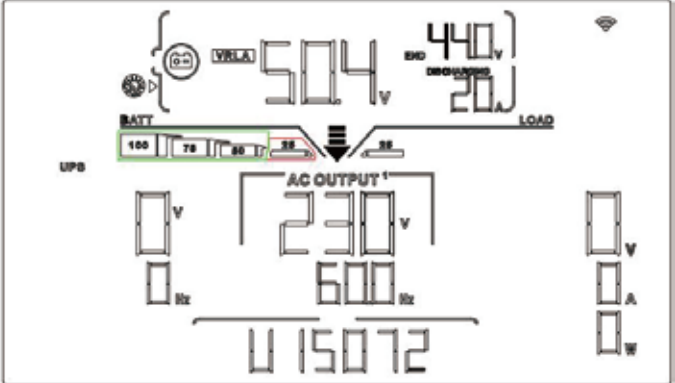
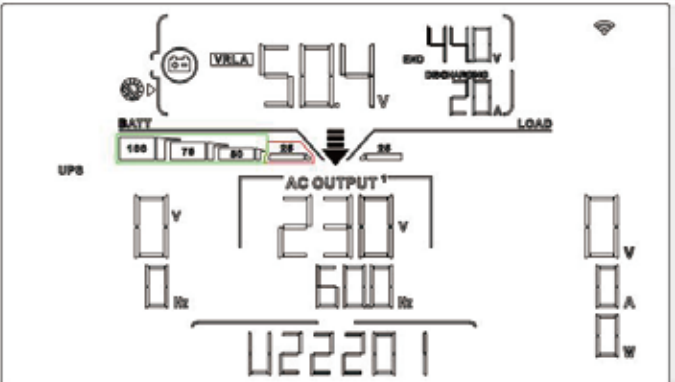
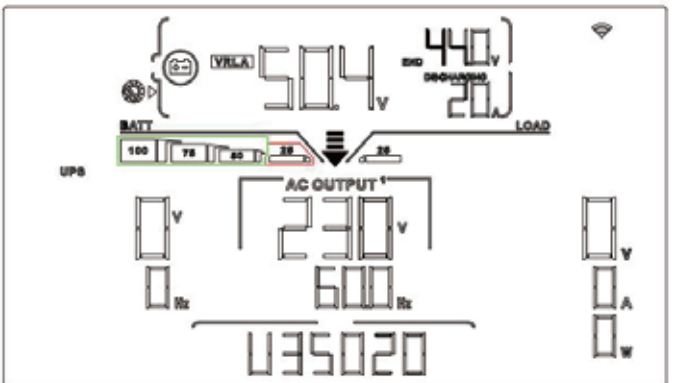
The LCD display information will be switched in turns by pressing "▲" or "▼" key. The selectable information is switched as the following table in order.

Selectable information	LCD display
Utility voltage/ Utility frequency	Input Voltage=230V, Input frequency=50Hz 
PV voltage/ PV current/ PV power	PV1 voltage=180V, PV1 current=8.0A, PV1 power=1440W 
Battery voltage, charging stage/ Configured battery parameters/ Charging or discharging current	Battery voltage=50.0V, Bulk charging voltage=56.0V, Charging current=10A 

Selectable information	LCD display
Default Display Screen	Battery voltage, charging stage/ Configured battery parameters/ Charging or discharging current
	Battery voltage=54.0V, Floating charging voltage=54.0V, Charging current=7.8A 
	Battery voltage=50.0V, Low DC cut-off voltage=42.0V, Discharging current=10A 
	L1 output voltage=230V, L1 output frequency=50Hz 
	L2 output voltage=230V, L2 output frequency=50Hz 

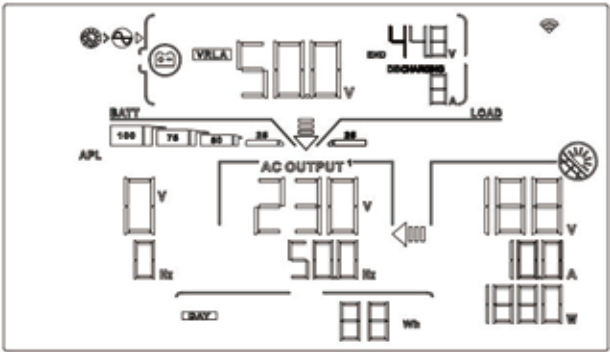
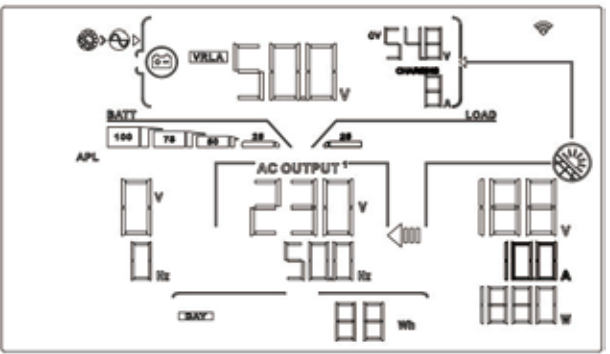
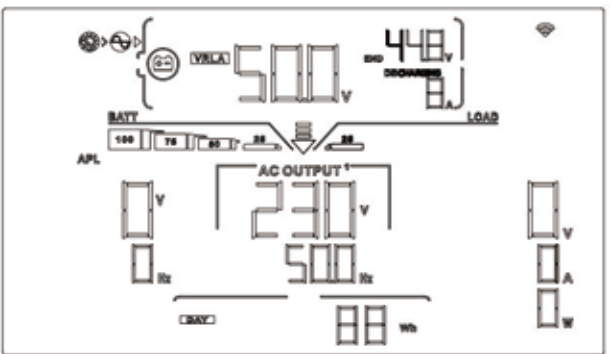
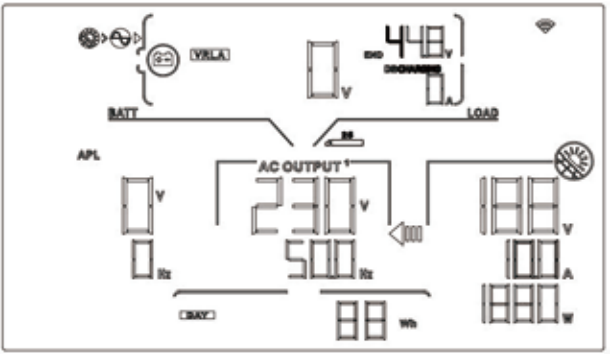
Selectable information	LCD display
Default Display Screen	L1 output voltage/output frequency, L2 output voltage/output frequency, load in VA, load in Watt switch every 5 second
	Total load in VA=2.0KVA, L1 output frequency=50Hz  The LCD display shows a schematic diagram of the power system. At the top, it indicates 'VRLA' battery status with a 500V rating and a 420V output. Below this, the 'BATT' section shows a 100Ah capacity. The 'AC OUTPUT 1' section displays a voltage of 200V and a frequency of 50Hz. The 'LOAD' section shows a total load of 1440W. The date '2008-18' is displayed at the bottom.
Real date.	Total load in Watt=1.9KW, L1 output frequency=50Hz  The LCD display shows the same schematic diagram as the previous screen. The 'AC OUTPUT 1' section now displays a voltage of 190V and a frequency of 50Hz. The 'LOAD' section shows a total load of 1440W. The date '2008-18' is displayed at the bottom.
Real time.	Real date 2020-08-18.  The LCD display shows the same schematic diagram. The date '2008-18' has been replaced with the real date '2020-08-18'. The 'AC OUTPUT 1' section displays a voltage of 190V and a frequency of 50Hz. The 'LOAD' section shows a total load of 1440W.
	Real time 10:08.  The LCD display shows the same schematic diagram. The time '10:08' is displayed at the bottom. The 'AC OUTPUT 1' section displays a voltage of 230V and a frequency of 50Hz. The 'LOAD' section shows a total load of 1440W.

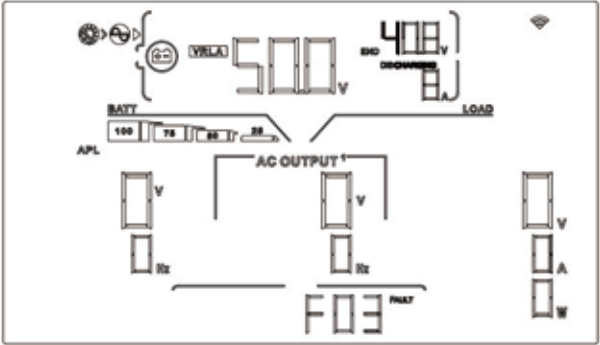
Selectable information	LCD display
PV energy generated today	PV energy generated today = 8Wh.
PV energy generated this month	PV energy generated this month = 8kWh.
PV energy generated this year	PV energy generated this year = 108kWh,
Total PV energy generation	Total PV energy generation = 108kWh.

Selectable information	LCD display
Main CPU version checking.	Main CPU version 00050.72. 
Secondary CPU version checking.	Secondary CPU version 00022.01. 
MCU version checking	MCU version 00050.20 

Operating Mode Description

Operating mode	Behaviors	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. *Power saving mode: If enabled, the output of inverter will be off when connected load is pretty low or not detected.	No output power, solar or utility charger available	Battery is charged by PV energy.
		No charging.
Line mode	Output power from utility. Charger is available	Utility charges battery and provides power to load.

		PV energy and battery energy supply power to the load. 
Battery mode	Output power from battery or PV	PV energy charges battery and provides power to the load. 
		Battery provides power to the load. 
Only PV mode	Output power from PV	PV provides power to the load. 

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.	No output, no charging.	No charging. 
---	--------------------------------	--

Warning Indicator

Warning Code	Warning Event	Icon flashing
01	Fan locked	01 
02	Over temperature	02 
03	Battery over charged	03 
04	Low battery	04 
07	Overload	07  
10	Inverter power derating	10 
bP	Battery is not connected	bP 
32	Communication lost between com. port and control board	32 

Faults Reference Code

Fault Code	Fault Event	Icon on
01	Fan is locked.	F01
02	Over temperature	F02
03	Battery voltage is too high.	F03
05	Output is short circuited.	F05
06	Output voltage is abnormal.	F06
07	Overload time out.	F07
08	Bus voltage is too high.	F08
09	Bus soft start failure.	F09
10	PV current is over.	F10
11	PV voltage is over.	F11
12	Charge current is over.	F12
13	Low battery power	F13
19	Battery Overcurrent	F19
21	Phase error in three phases system	F21
51	Over current or surge	F51
52	Bus voltage is too low.	F52
53	Inverter soft start failure.	F53
55	Over DC offset in AC output	F55
57	Current sensor failure.	F57
58	Output voltage is too low.	F58

SPECIFICATIONS

MODEL	MR-SPH6.6K-LP1-TL65E	MR-SPH8.6K-LP1-TL65E	MR-SPH10.6K-LP1-TL65E
RATED OUPUT POWER	6600W	8600W	10600W
PV INPUT (DC)			
Max. PV Power	12000W	16000W	18000W
Max. PV Array Open Circuit Voltage	500 VDC	500 VDC	500 VDC
MPPT Range @ Operating Voltage	120 VDC~450 VDC	120 VDC~450 VDC	120 VDC~450 VDC
Max. PV Array Maximum Imp/per MPPT	2*21A	2*27A	2*27A
Max. PV Array Maximum Isc/per MPPT	2*26.25A	2*34A	2*34A
Number of MPPT Tracker	2	2	2
GRID-TIE OPERATION			
GRID OUTPUT (AC)			
Nominal Output Voltage	220/230/240 VAC		
Feed-in Grid Voltage Range	195.5~253 VAC @India regulation 184 ~ 264.5 VAC @Germany regulation 184 ~ 264.5 VAC @South America regulation 195.5~253 VAC @ South Africa 182~260 VAC @ Pakistan		
Feed-in Grid Frequency Range	49~51Hz @India regulation 47.5~51.5Hz @Germany regulation 57~62Hz @South America 47~52Hz @ South Africa 45.1~54.9Hz @ Pakistan		
Nominal Output Current	28.7A	37.4A	46.1A
Power Factor Range	>0.99		
Maximum Conversion Efficiency (DC/AC)	97%		
OFF-GRID, HYBRID OPERATION			
GRID INPUT			
Acceptable Input Voltage Range	90 - 300 VAC or 170 - 300 VAC		
Frequency Range	50 Hz/60 Hz (Auto sensing)		
Transfer Time	< 10ms (for UPS) < 20ms (for home appliances) < 50ms (for parallel system operation)		
Rating of AC Transfer Relay	40A	60A	60A
GENERATOR INPUT			
Acceptable Input Voltage Range	90 - 300 VAC	90 - 300 VAC	90 - 300 VAC
Frequency Range	50 Hz/60 Hz (Auto sensing)	50 Hz/60 Hz (Auto sensing)	50 Hz/60 Hz (Auto sensing)
Rating of AC Transfer Relay	40A	60A	60A
BATTERY MODE OUTPUT (AC)			
Nominal Output Voltage	220/230/240 VAC		
Output Waveform	Pure Sine Wave		
Efficiency (DC to AC)	93%		
BATTERY & CHARGER			
Nominal DC Voltage	48 VDC		
Maximum Charging Current (from Grid)	135A	190A	210A
Maximum Charging Current (from PV)	135A	190A	210A
Maximum discharging Current	135A	190A	210A
GENERAL			
Dimension, D X W X H (mm)	633 x 418 x 192		
Net Weight (kgs)	23.5	28	29
INTERFACE			
Parallel-able	Yes		
External Safety Box (Optional)	Yes		
Communication	Dry-contact / USB / RS232 / BMS / WiFi Module		
ENVIRONMENT			
Humidity	0 ~ 95% RH (No condensing)		
Operating Temperature	-25°C to 50°C		

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.
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 10	Surge	Restart the unit, if the error happens again, please return to repair center.
	Fault code 12	DC/DC over current or surge.	
	Fault code 51	Over current or surge.	
	Fault code 52	Bus voltage is too low.	
	Fault code 55	Output voltage is unbalanced.	
	Fault code 11	Solar input voltage is more than 550V.	Solar input voltage is more than 550V.
	Fault code 13	The battery voltage is lower than 30V.	The battery voltage is lower than 30V.
	Fault code 19	The battery is over-discharged.	The discharge current of the battery needs to be reduced

Appendix I: Parallel function

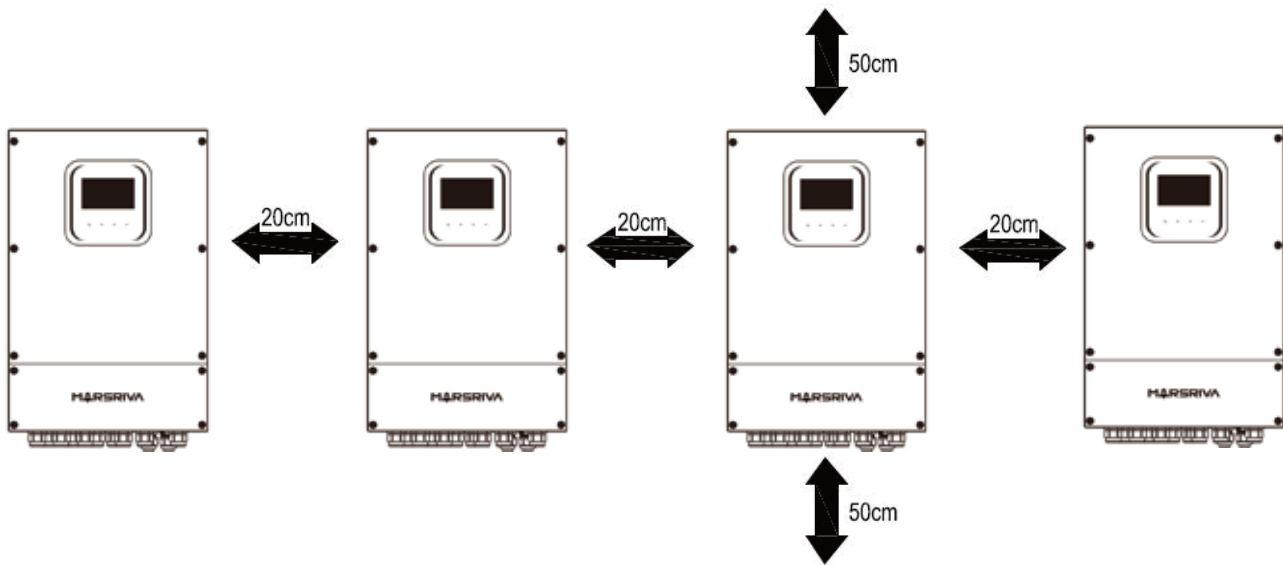
1. Introduction

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

1. Parallel operation in single phase with up to 9 units. The supported maximum output power is 54KW/54KVA.
2. Maximum nine units work together to support three-phase equipment. Seven units support one phase maximum. The supported maximum output power is 54KW/54KVA and one phase can be up to 42KW/42KVA.

2. Mounting the Unit

When installing multiple units, please follow below chart.



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

3. Wiring Connection

NOTICE: It's requested to connect to battery for parallel operation.

The cable size of each inverter is shown as below:

Recommended battery cable and terminal size for each inverter:

MODEL	AWG no.	Torque
6.6KW	1*2AWG	2~ 3 Nm
8.6KW/10.6KW	1*1/0 AWG	2~ 3 Nm

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
6.6KW	10 AWG	1.2~1.6Nm
8.6KW/10.6KW	8 AWG	1.2~1.6Nm

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

the number of inverters connected in parallel.
Regarding AC input and output, please also follow the same principle.

WARNING!! Make sure all output N wires of each inverter must be connected all the time. Otherwise, it will cause inverter fault in error code #72.

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*
6.6KW	140A/70VDC
8.6KW/10.6KW	220A/70VDC

*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 with single phase:

Model	2 units	3 units	4 units	5 units	6 units	7 units	8 units	9 units
6.6KW	80A/ 230VAC	120A/ 230VAC	160A/ 230VAC	200A/ 230VAC	240A/ 230VAC	280A/ 230VAC	320A/ 230VAC	360A/ 230VAC
8.6KW/10.6K	120A 230VAC	180A 230VAC	240A 230VAC	300A 230VAC	360A 230VAC	420A 230VAC	480A 230VAC	540A 230VAC

Note1: Also, you can use one unit of 50A 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

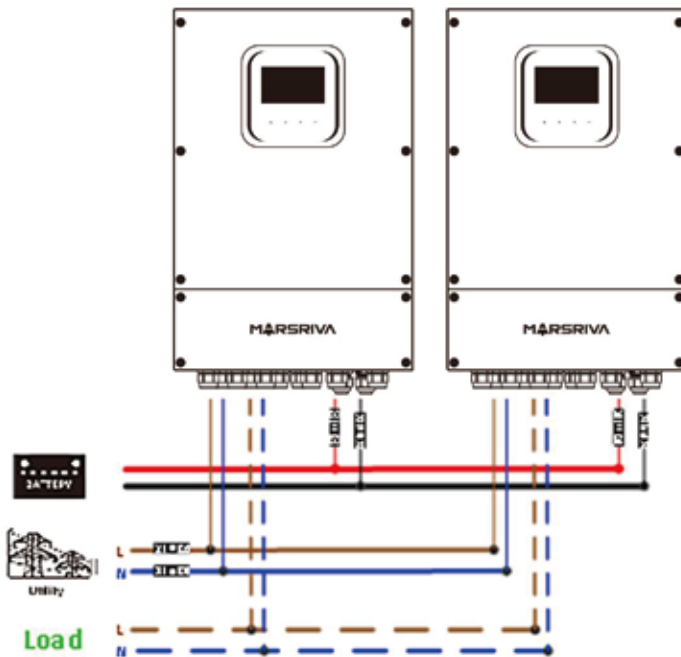
Inverter parallel numbers	2	3	4	5	6	7	8	9
Battery Capacity	400AH	600AH	800AH	1000AH	1200AH	1400AH	1600AH	1800AH

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

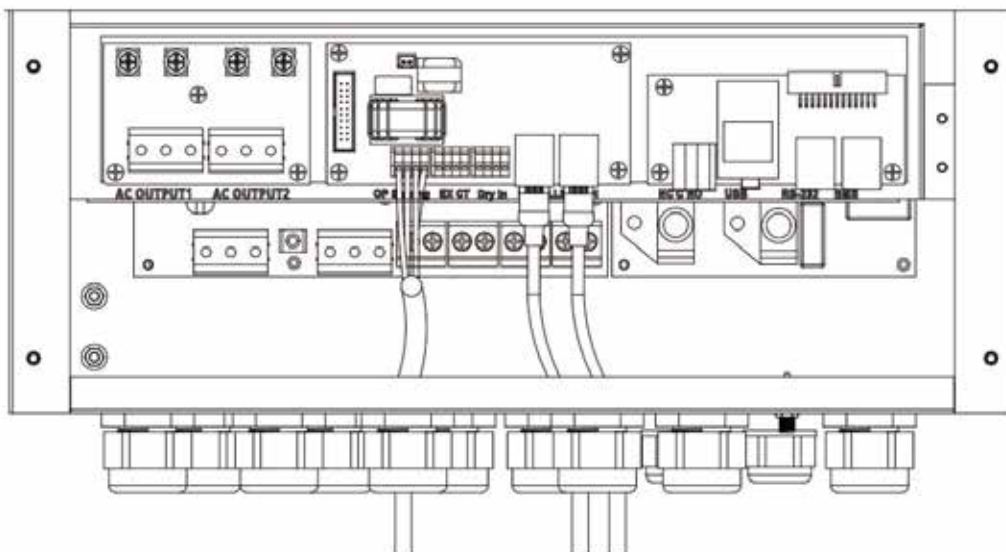
3-1. Parallel Operation in Single phase

Two inverters in parallel:

Power Connection

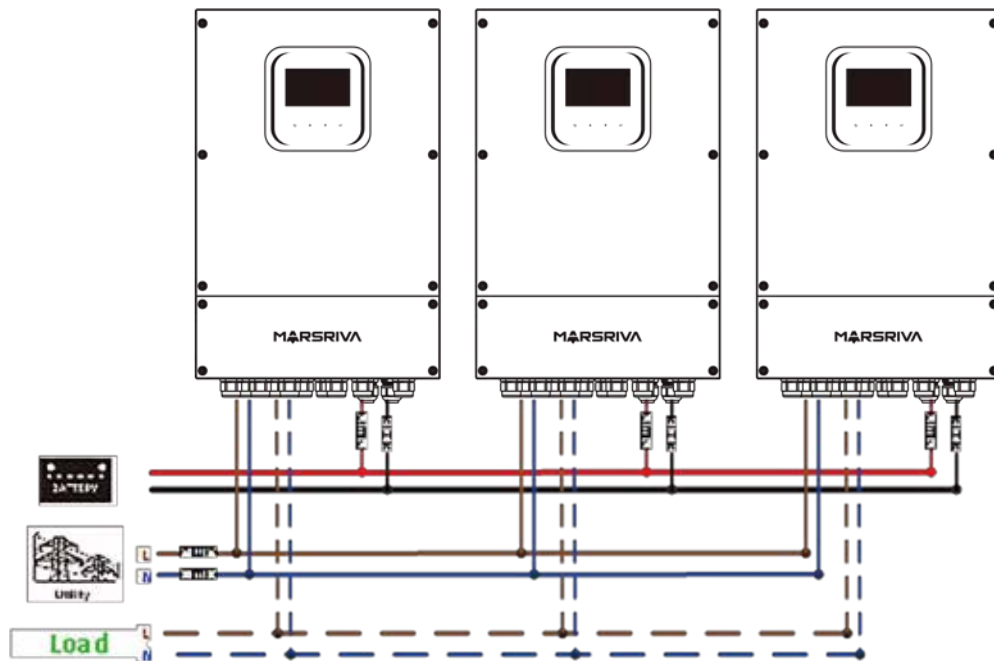


Communication Connection

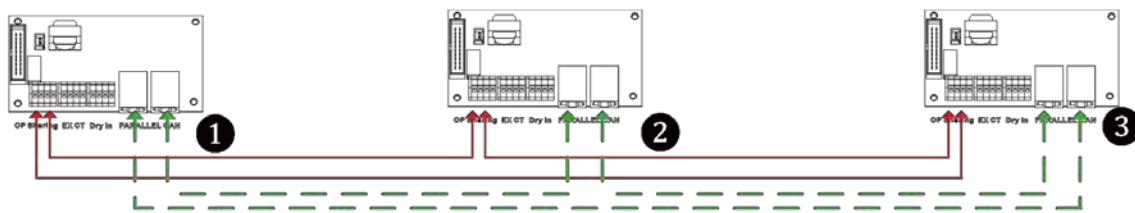


Three inverters in parallel:

Power Connection

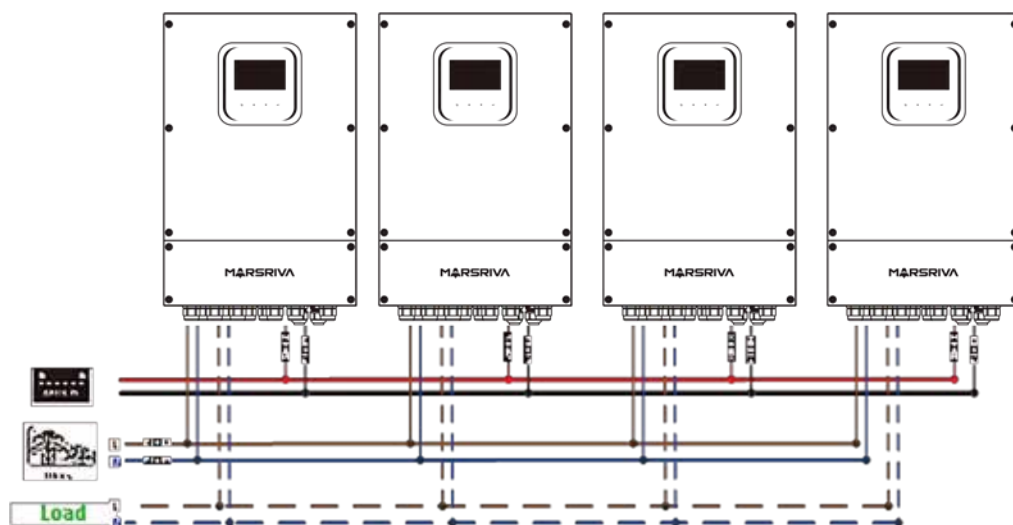


Communication Connection

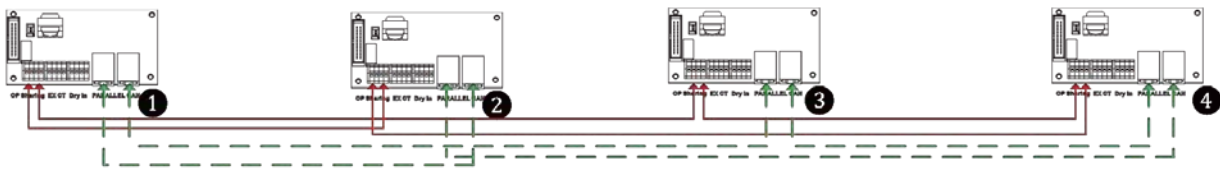


Four inverters in parallel:

Power Connection

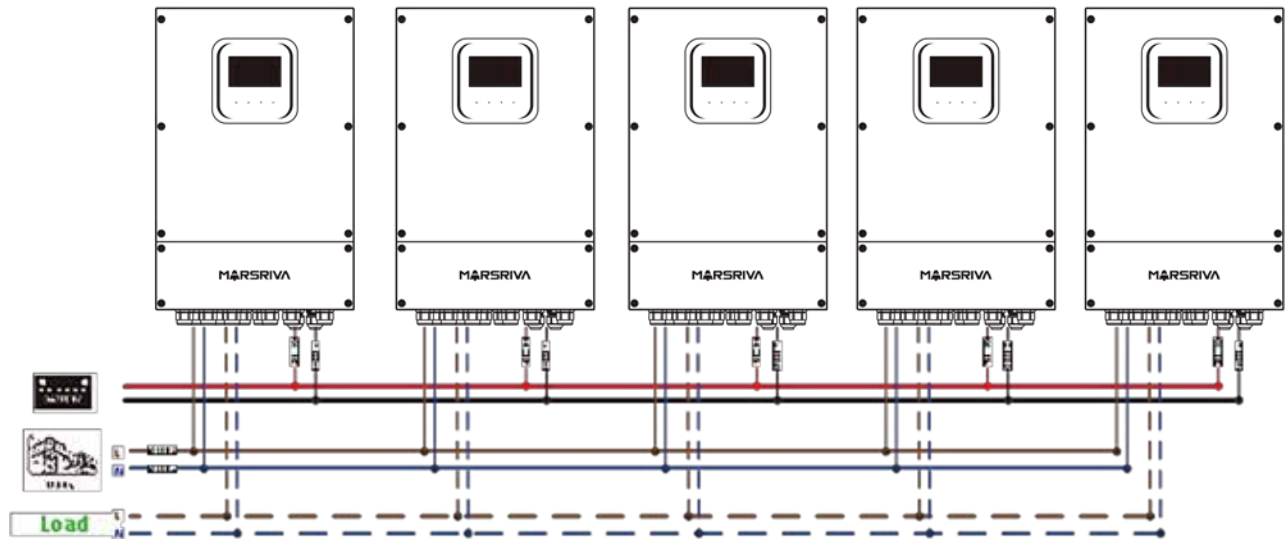


Communication Connection

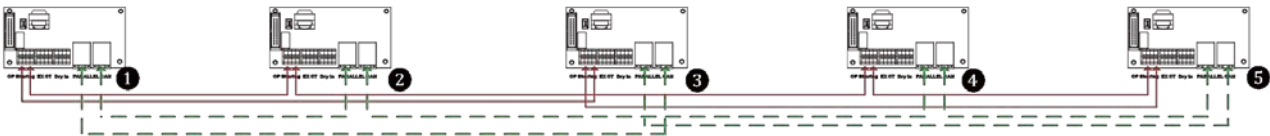


Five inverters in parallel:

Power Connection



Communication Connection

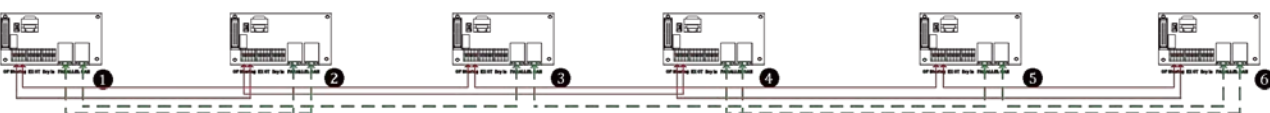


Six inverters in parallel:

Power Connection

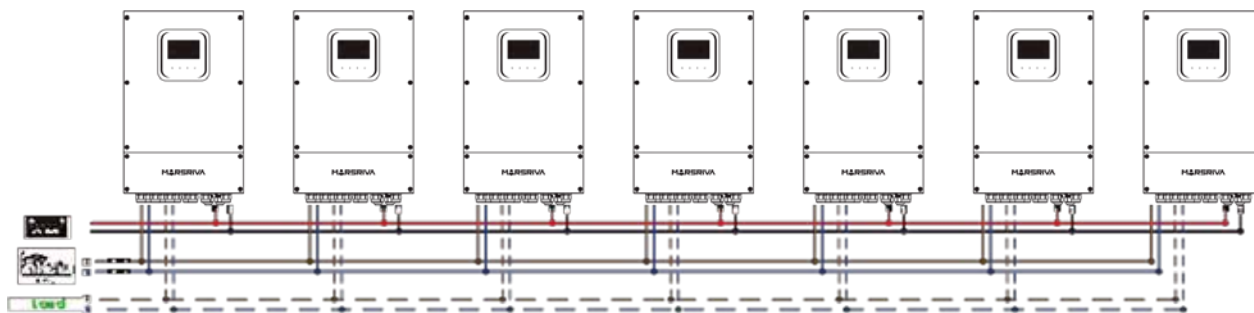


Communication Connection



Seven to nine inverters in parallel:

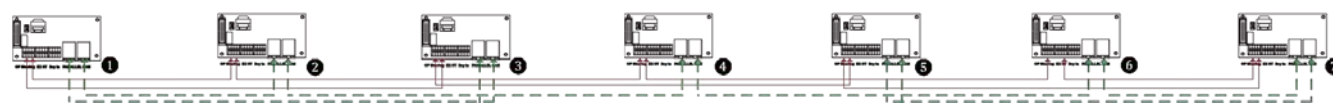
Power Connection



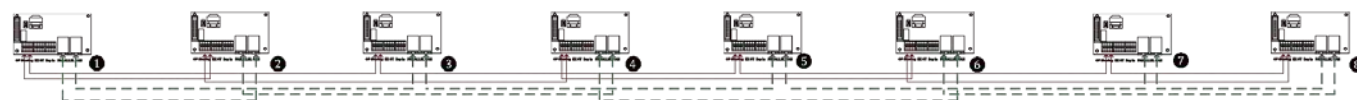
WARNING: When the number of parallel machines exceeds 6 PCS, add a magnetic ring to the output L cable. The magnetic ring is placed in the accessory bag of the inverter.

Communication Connection

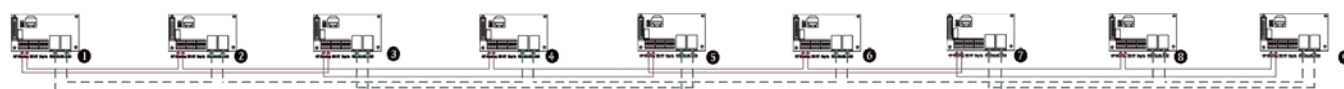
- Seven inverters in parallel



- Eight inverters in parallel



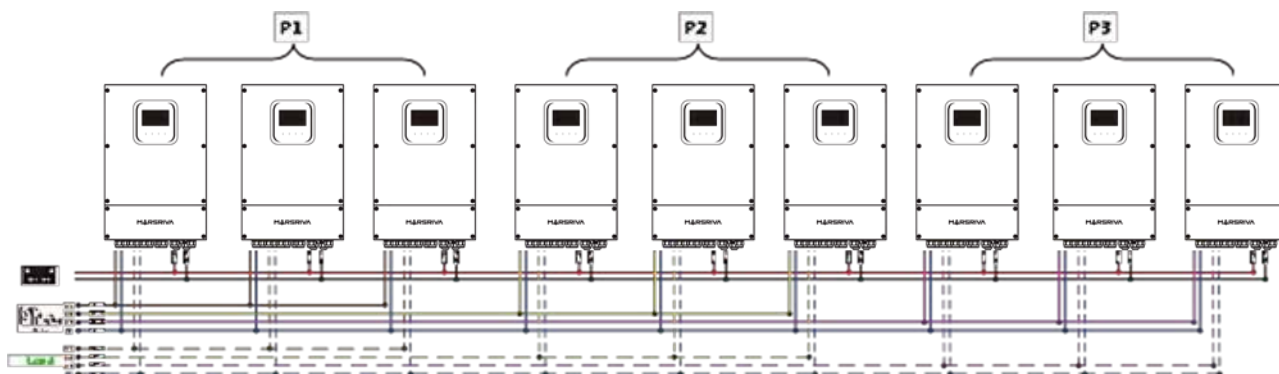
- Nine inverters in parallel



3-2. Support 3-phase equipment

Three inverters in each phase:

Power Connection

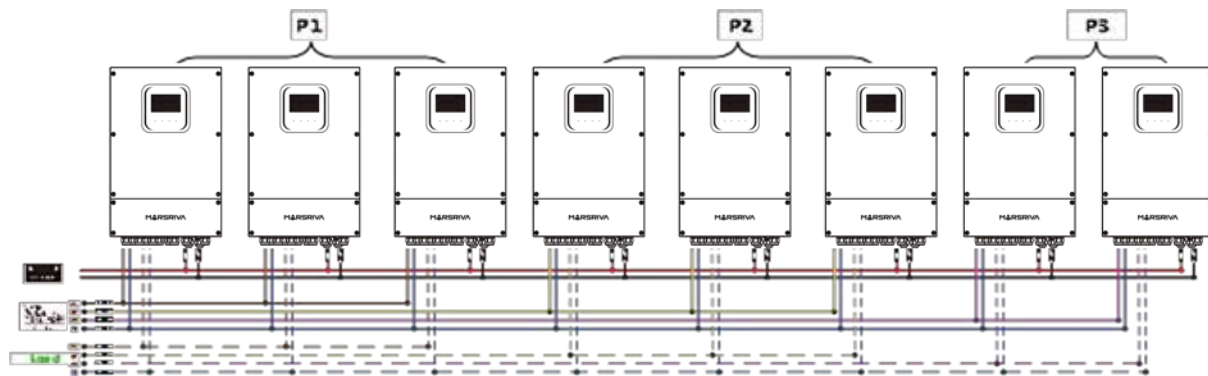


Communication Connection



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

Power Connection

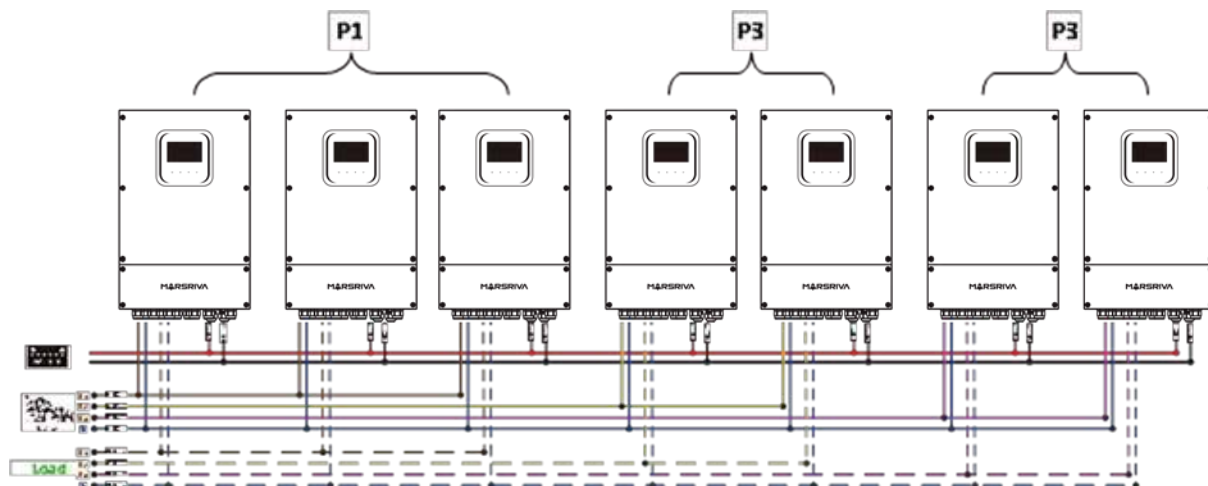


Communication Connection

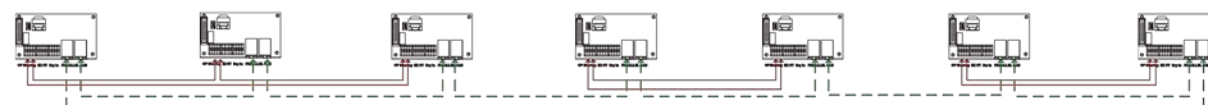


Three inverters in one phase, two inverters in second phase and two inverters for the third phase:

Power Connection

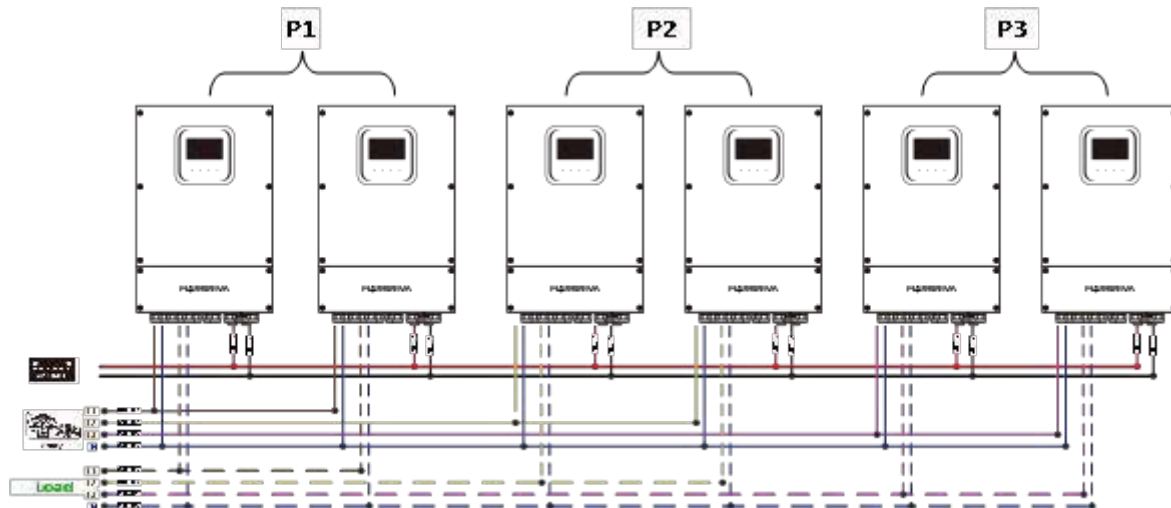


Communication Connection



Two inverters in each phase:

Power Connection

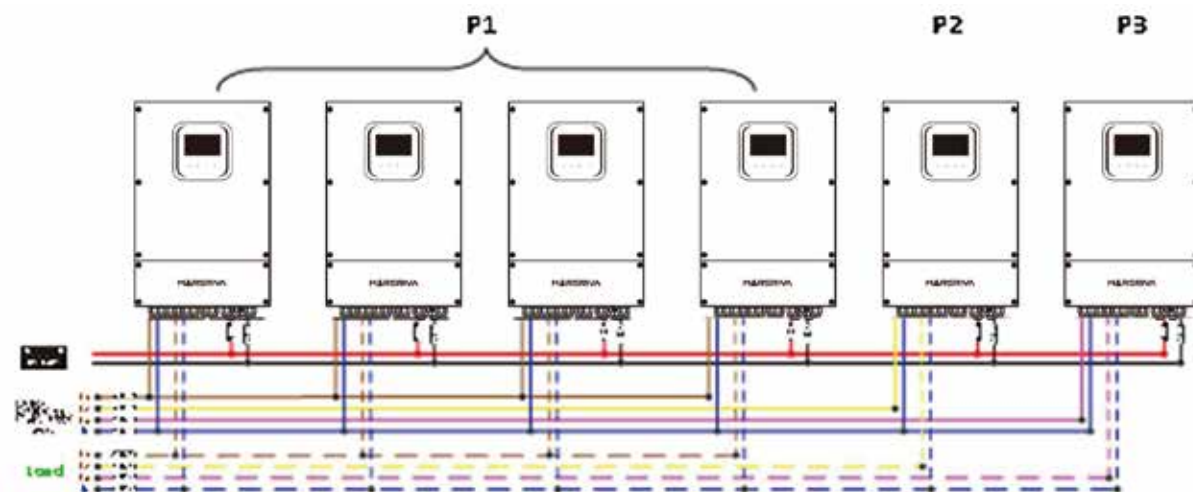


Communication Connection



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

Power Connection

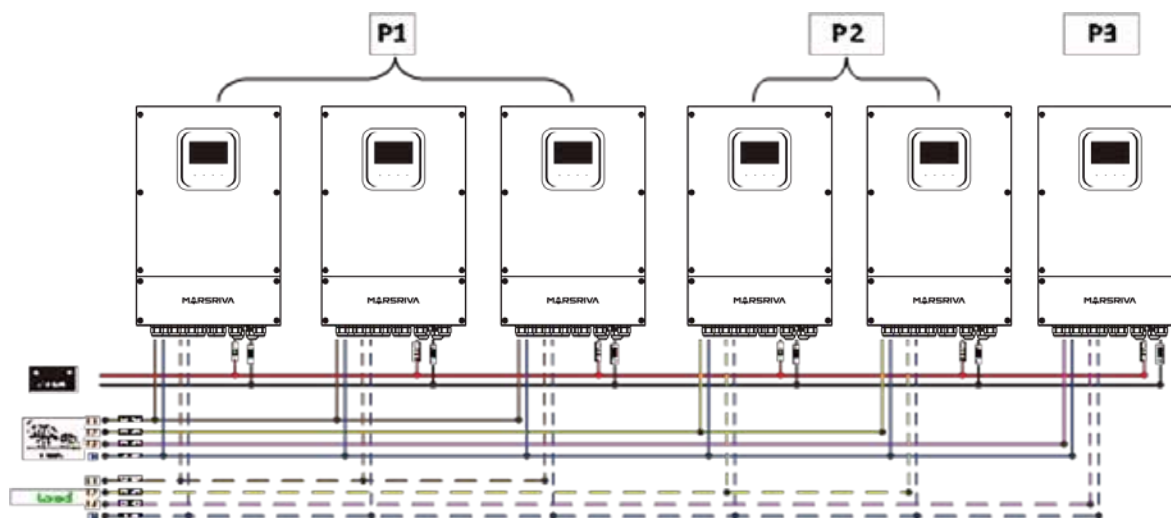


Communication Connection



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

Power Connection

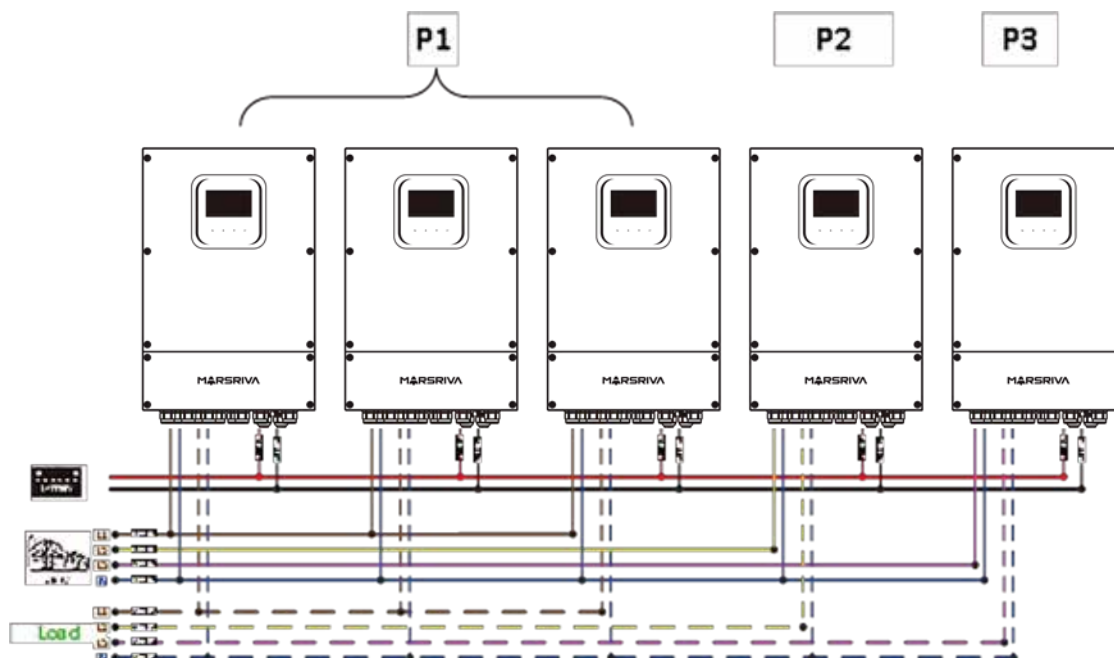


Communication Connection

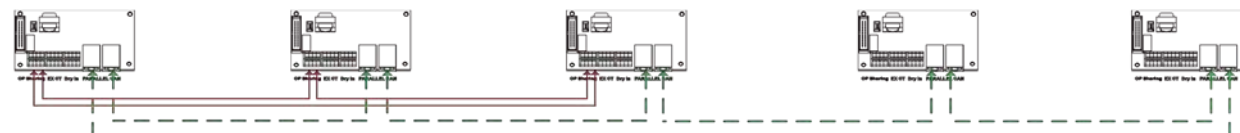


Three inverters in one phase and only one inverter for the remaining two phases:

Power Connection

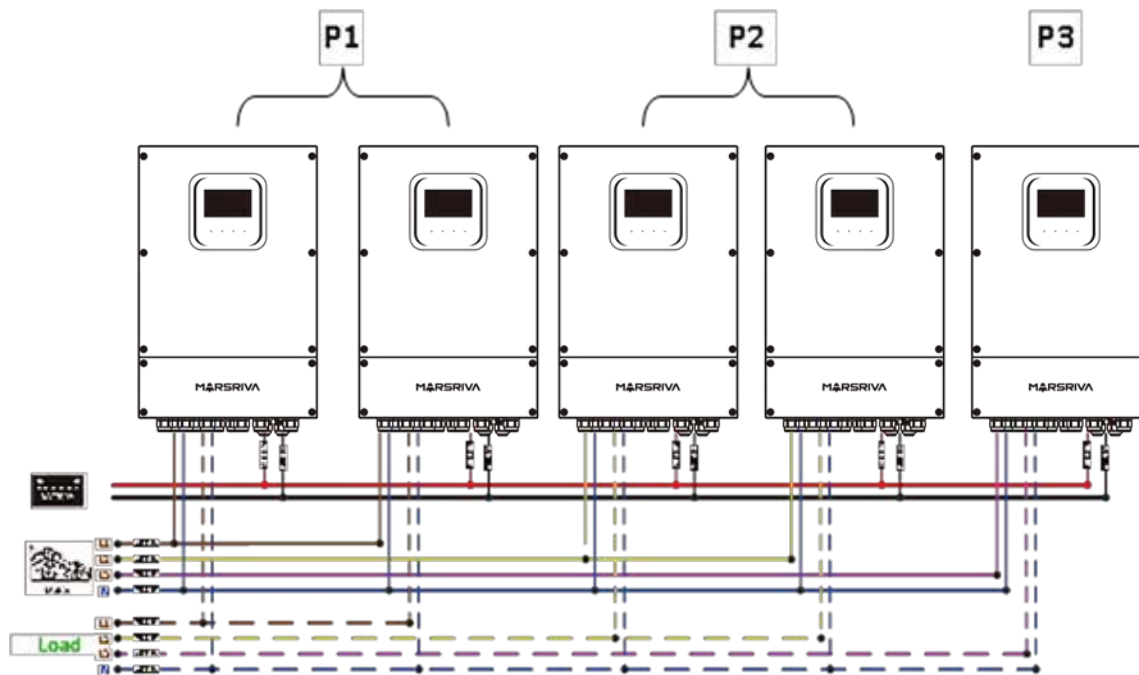


Communication Connection

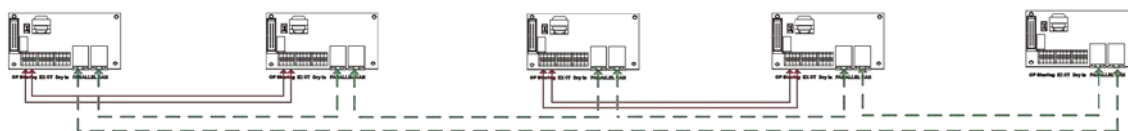


Two inverters in two phases and only one inverter for the remaining phase:

Power Connection

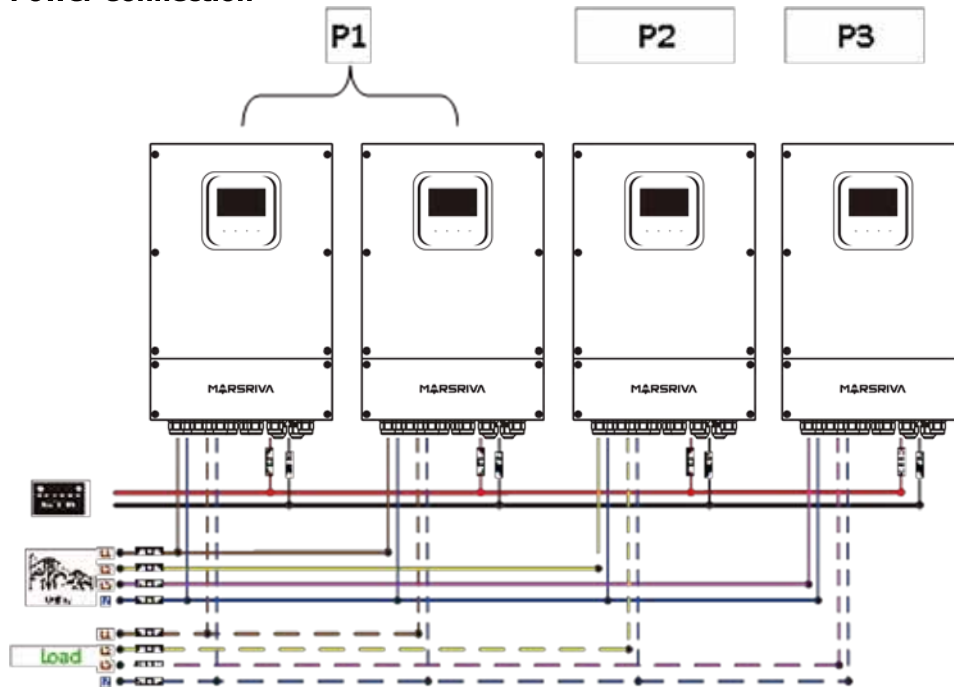


Communication Connection



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

Power Connection

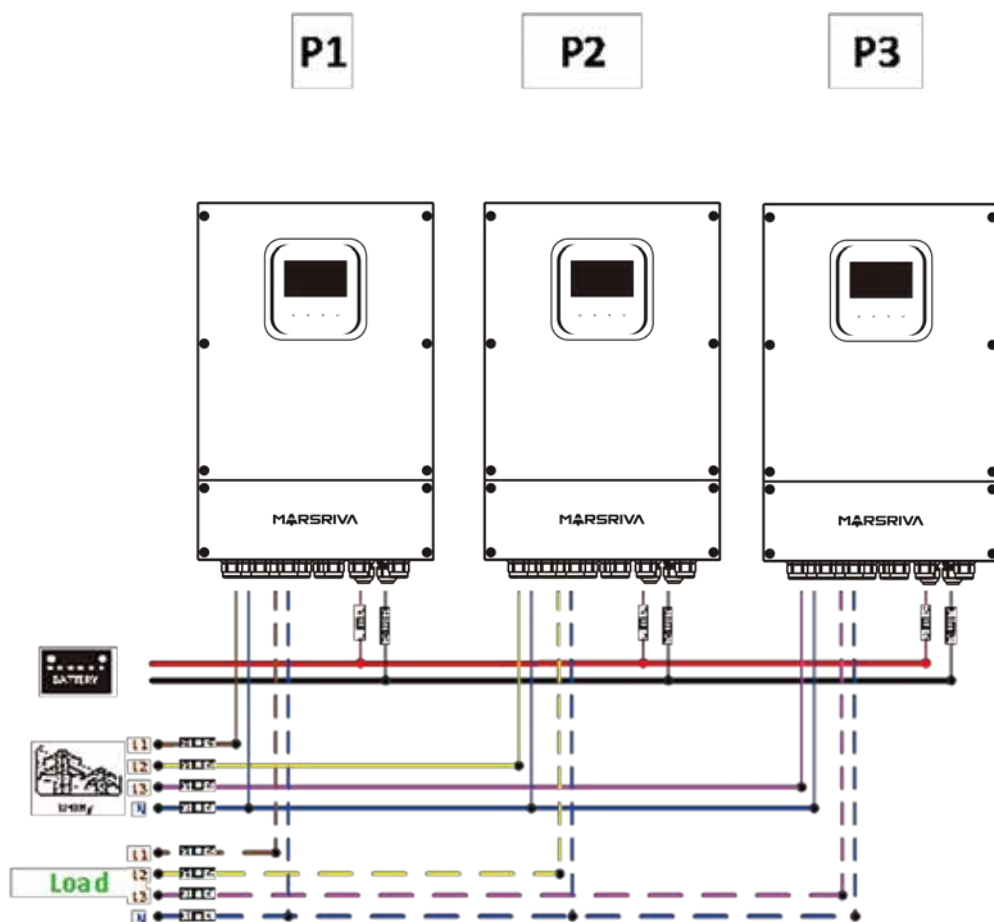


Communication Connection



One inverter in each phase:

Power Connection



Communication Connection



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

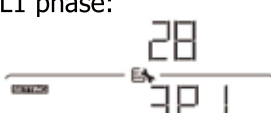
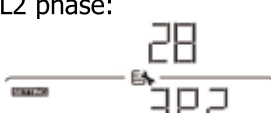
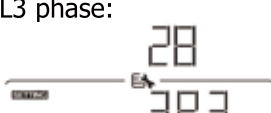
4. PV Connection

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

CAUTION: Each inverter should connect to PV modules separately.

6. LCD Setting and Display

Setting Program:

Program	Description	Selectable option	
28	AC output mode *This setting is only available when the inverter is in standby mode (Switch off).	Single: 	When the units are used in parallel with single phase, please select "PAL" in program 28.
		Parallel: 	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.
		L1 phase: 	
		L2 phase: 	
		L3 phase: 	Please select "3P1" in program 28 for the inverters connected to L1 phase, "3P2" in program 28 for the inverters connected to L2 phase and "3P3" in program 28 for the inverters connected to L3 phase. Be sure to connect share current cable to units which are on the same phase. Do NOT connect share current cable between units on different phases. Besides, power saving function will be automatically disabled.

Fault code display:

Fault Code	Fault Event	Icon on
71	Firmware version inconsistent	F71
80	CAN fault	F80
81	Host loss	F81
82	Synchronization loss	F82
83	Battery voltage detected different	F83
84	AC input voltage and frequency detected different	F84
86	AC output mode setting is different	F86
87	A single machine exists in parallel system	F87

Code Reference:

Code	Description	Icon on
NE	Un-identified unit for master or slave	NE
HS	Master unit	HS
SL	Slave unit	SL

7. Commissioning

Parallel in single phase

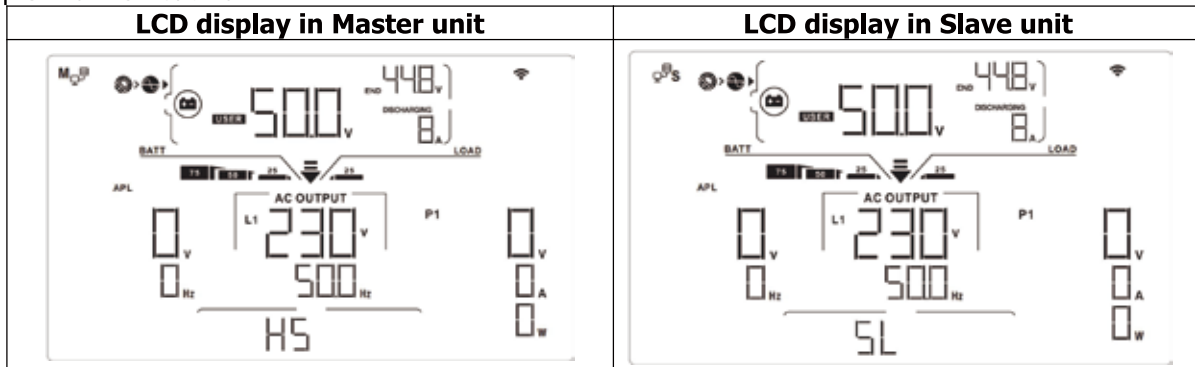
Step 1: Check the following requirements before commissioning:

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

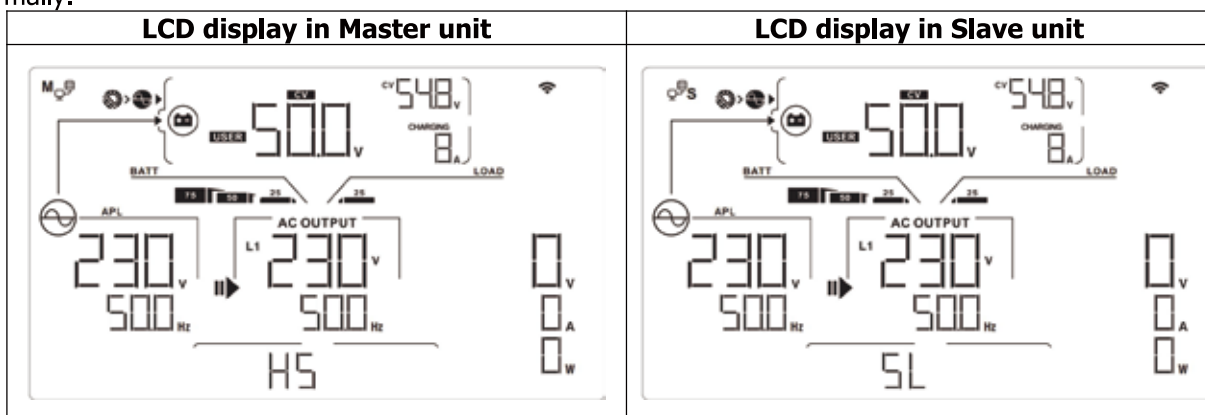
Step 2: Turn on each unit and set "PAL" in LCD setting program 28 of each unit. And then shut down all units.

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

Step 3: Turn on each unit.



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



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

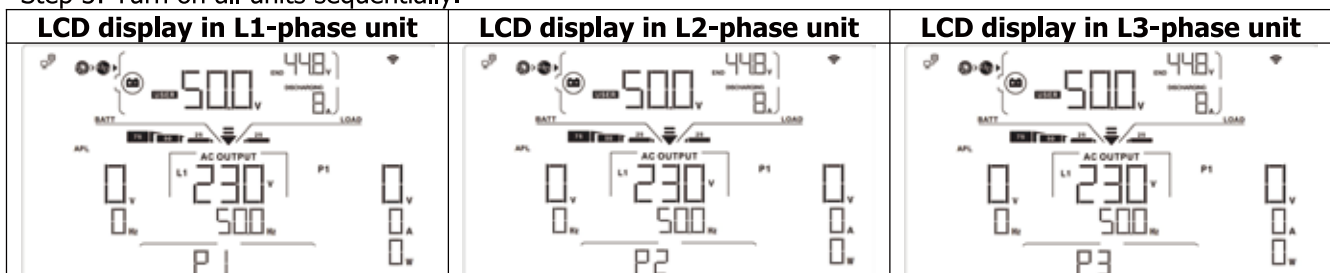
Step 1: Check the following requirements before commissioning:

- 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.



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.

8. 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 connection 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 supporting three-phase system, make sure no "PAL" is set on #28. 3. If the problem remains, please contact your installer.
87	Single Machine exists in parallel system	1. Check whether a single machine exists in parallel system.

Appendix II: BMS Communication Installation

1. Introduction

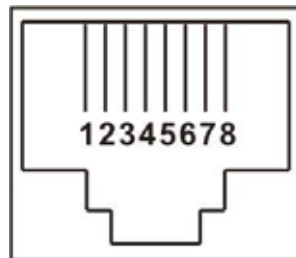
If connecting to lithium battery, it is recommended to purchase a custom-made RJ45 communication cable. Please check with your dealer or integrator for details.

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.

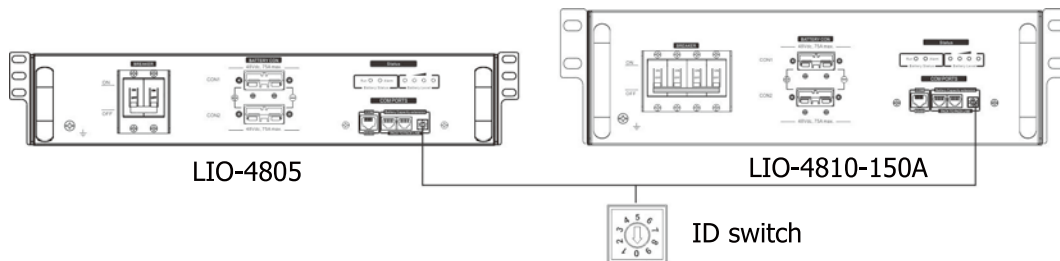
2. Pin Assignment for BMS Communication Port

	Definition
PIN 1	RS232TX
PIN 2	RS232RX
PIN 3	RS485B
PIN 4	NC
PIN 5	RS485A
PIN 6	CANH
PIN 7	CANL
PIN 8	GND

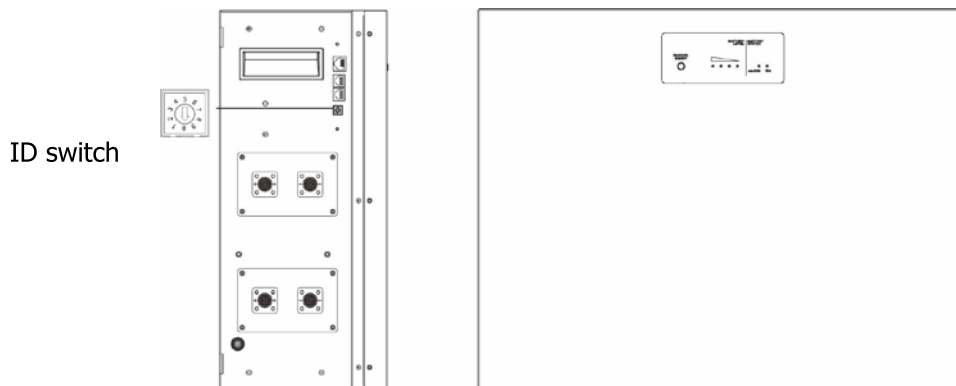


3. Lithium Battery Communication Configuration

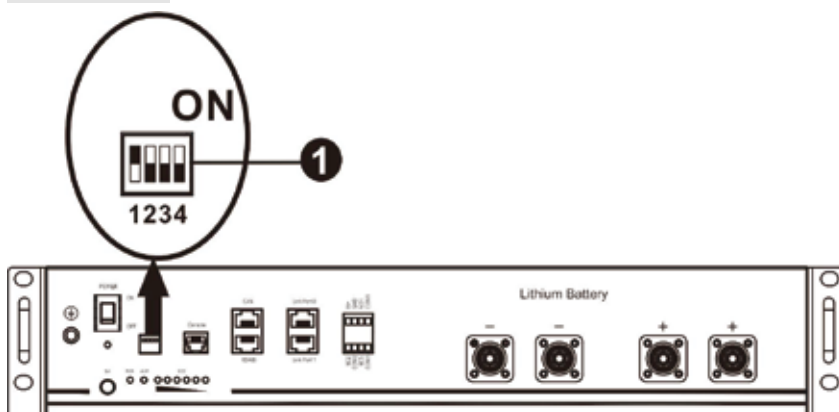
LIO-4805/LIO-4810-150A



LIO-II 4810



ID Switch indicates the unique ID code for each battery module. It's required to assign a unique ID to each battery module for normal operation. We can set up the ID code for each battery module by rotating the PIN number on the ID switch. From number 0 to 9, the number can be random; no particular order. Maximum 10 battery modules can be operated in parallel.



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 forth 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.

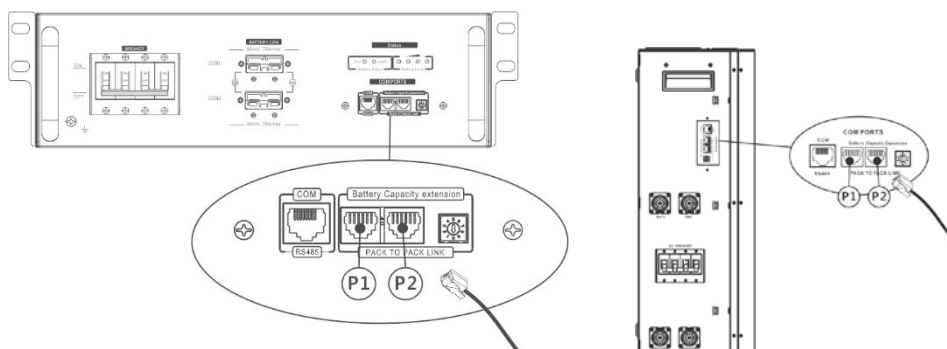
NOTE: The maximum groups of lithium battery is 5 and for maximum number for each group, please check with battery manufacturer.

4. Installation and Operation

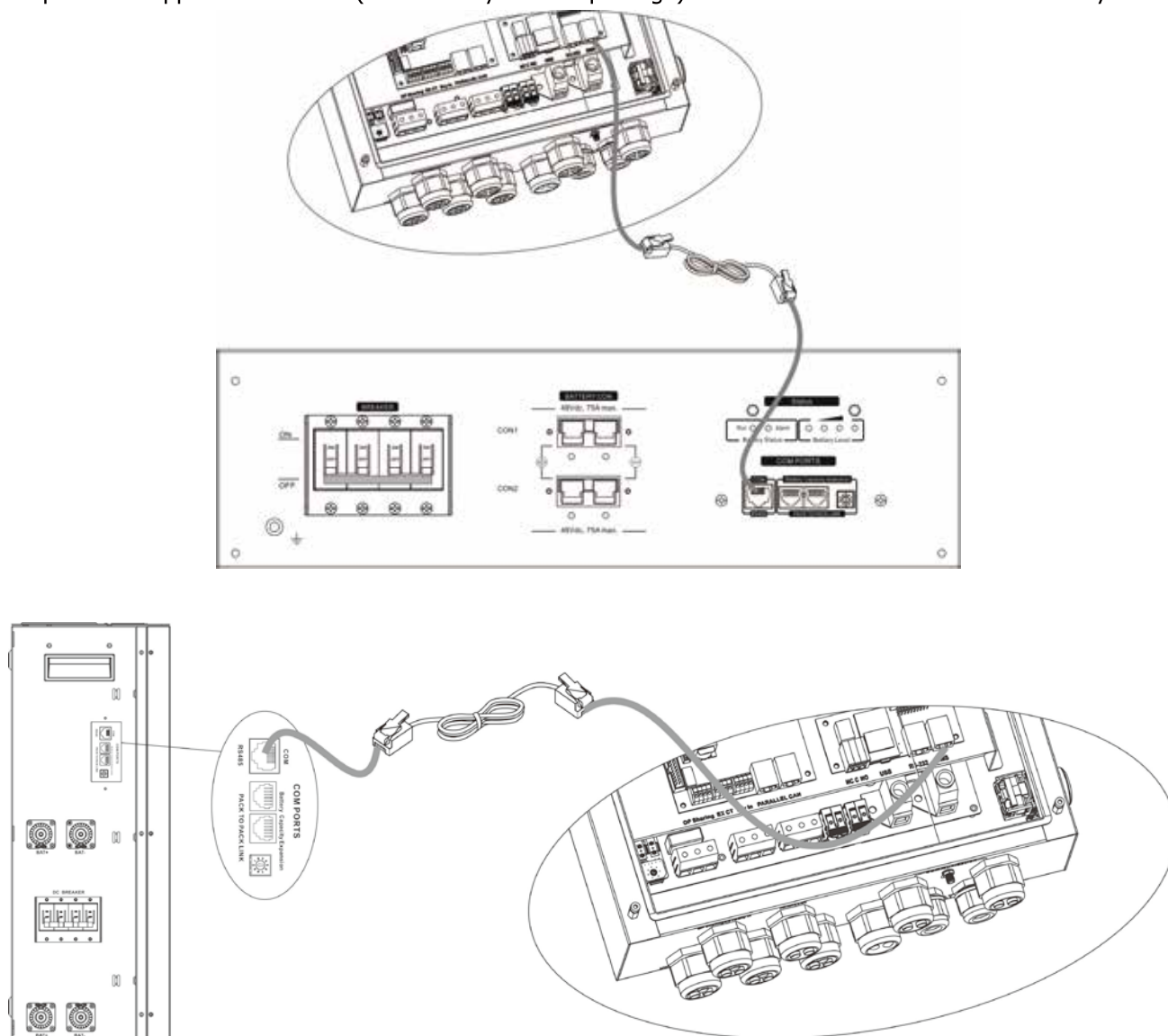
LIO-4805/LIO-4810-150A/ESS LIO-I 4810

After ID no. is assigned for each battery module, please set up LCD panel in inverter and install the wiring connection as following steps.

Step 1: Use supplied RJ11 signal cable to connect into the extension port (P1 or P2).



Step 2: Use supplied RJ45 cable (from battery module package) to connect inverter and Lithium battery.



*** For multiple battery connection, please check battery manual for the details.**

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 "LIB" in LCD program 5. Others should be "USE".

Step 3: Turn the breaker switch "ON". Now, the battery module is ready for DC output.

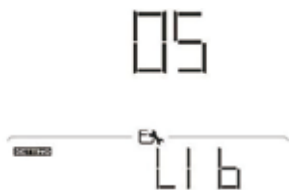


Step 4: Press Power on/off button on battery module for 5 secs, the battery module will start up.

*If the manual button cannot be approached, just simply turn on the inverter module. The battery module will be automatically turned on.

Step 5: Turn on the inverter.

Step 6. Be sure to select battery type as "LIB" in LCD program 5.

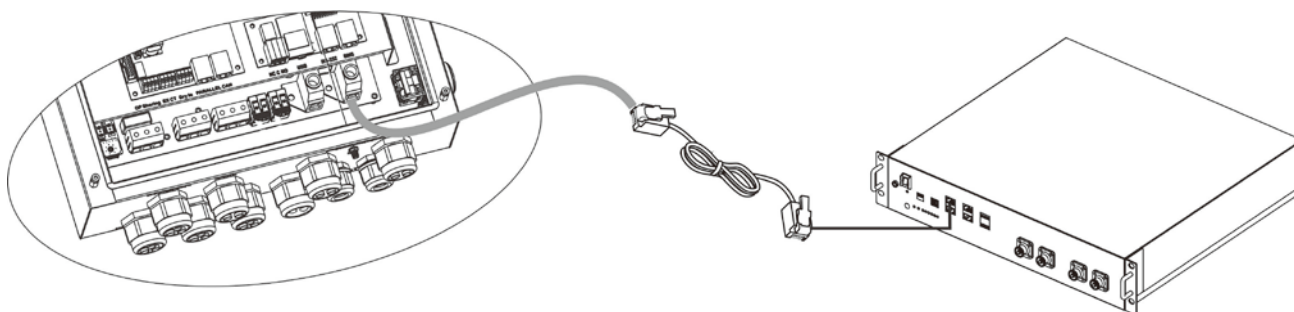


If communication between the inverter and battery is successful, the battery icon  on LCD display will flash. Generally speaking, it will take longer than 1 minute to establish communication.

PYLONTECH

After configuration, please set up LCD panel in inverter and make wiring connection to Lithium battery as the following steps.

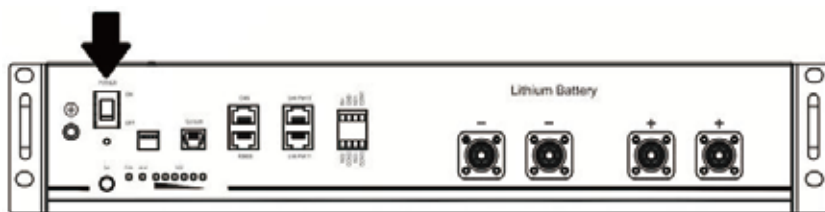
Step 1. Use custom-made RJ45 cable to connect inverter and Lithium battery.



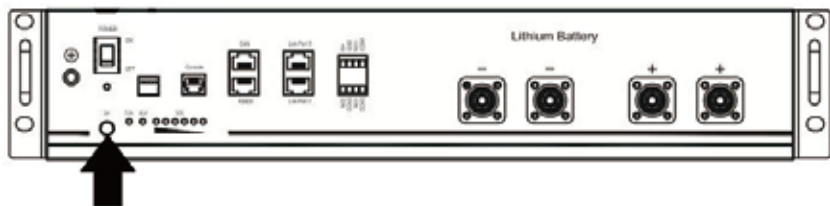
Note for parallel system:

3. Only support common battery installation.
4. 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.

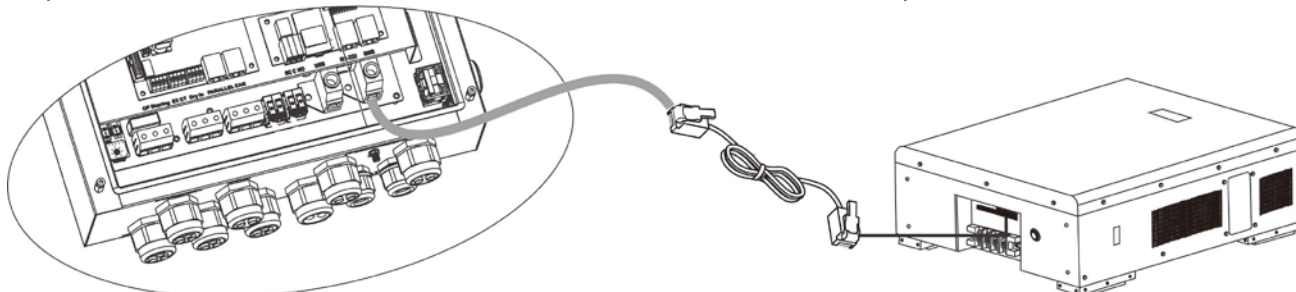
Step 5. Be sure to select battery type as "PYL" in LCD program 14.

05

PYL

WECO

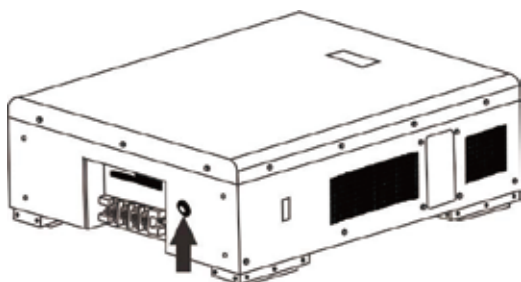
Step 1. Use custom-made RJ45 cable to connect inverter and Lithium battery.



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.

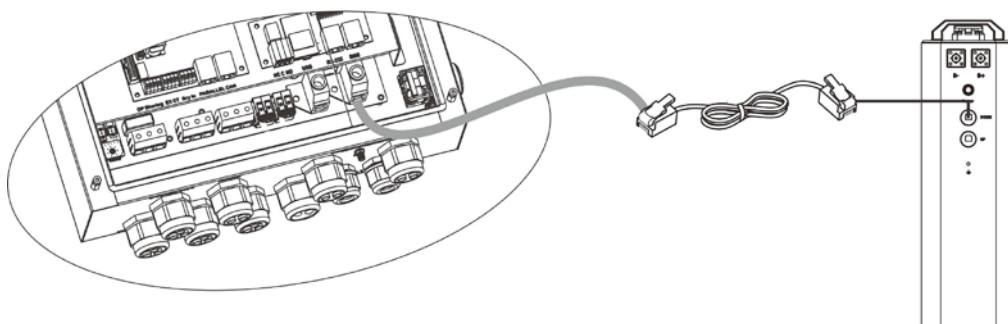
Step 4. Be sure to select battery type as "WEC" in LCD program 5.

05

WEC

SOLTARO

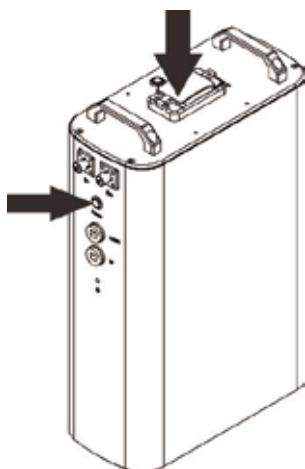
Step 1. Use custom-made RJ45 cable to connect inverter and Lithium battery.



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 The LCD screen displays various system metrics. At the top, it shows 'AGM' and '50.4 V'. To the right, '440 V' and '20 A' are shown. Below these, a 'BATT' bar graph shows a level around 75%. In the center, 'AC OUTPUT' is displayed with '230 V' and '500 Hz'. At the bottom, 'P03601' is shown. On the right side, there are indicators for 'V', 'A', and 'W'.

5. Code Reference

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

Code	Description
	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") • 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.
	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 discharge battery.

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

1. Introduction

The Wi-Fi module can enable wireless communication between off-grid inverters and monitoring platform. Users have a complete and remote monitoring and controlling experience for inverters when combining Wi-Fi module with the MarsES 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 settings after installation.
- Notifies users when a warning or alarm occurs.
- Allows users to query inverter history data.



2. MarsES App

2-1. Installation

Please scan the following QR code with your smart phone and download MarsES APP.

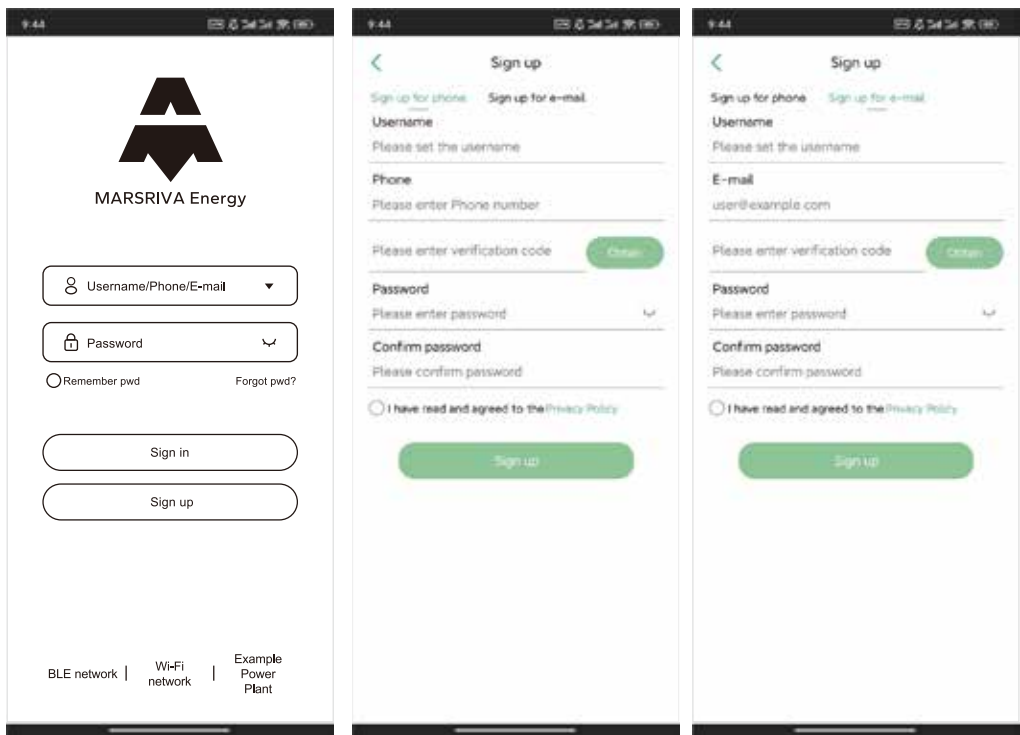


2-2. Login and register

• Sign up

Phone & E-mail Sign up

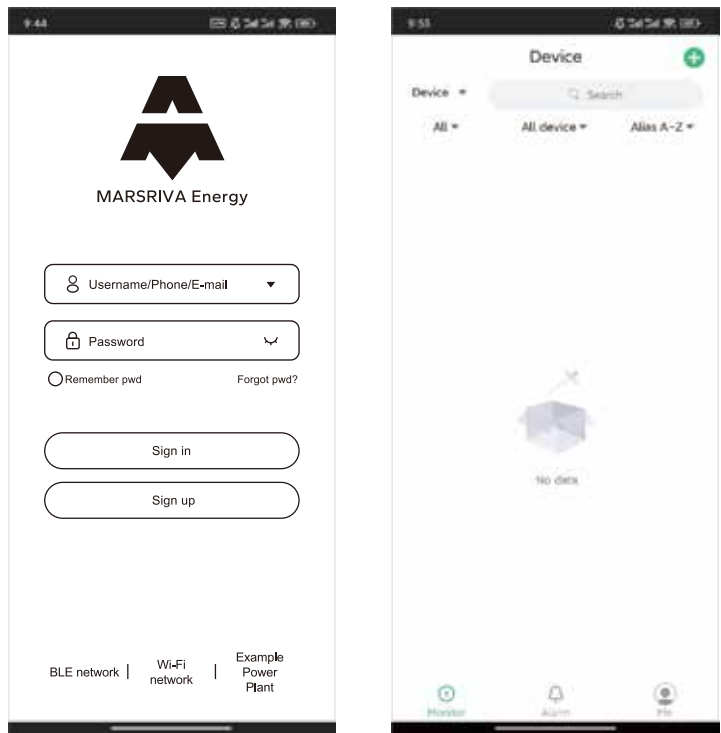
Open the APP and click the "Sign up" button to enter the registration page. You can register using your **phone number and e-mail address**, then click "Obtain" to get the verification code. After entering the verification code and all information, click "Sign up" to complete the account registration.



• Login

Password login

Enter the Username/Phone/E-mail and password you just used to register, and click "Sign in". Then you will enter the APP homepage.



2-3. Add devices

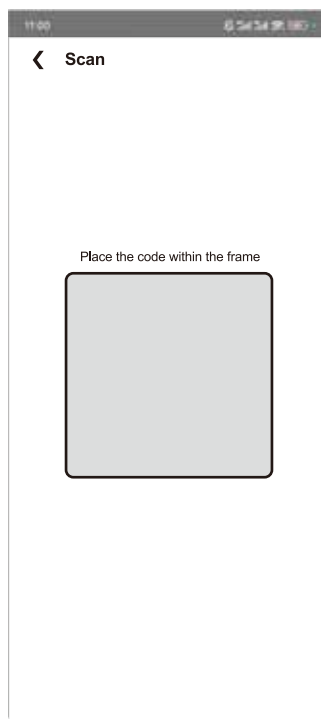
- **Entry**

Go to the Homepage and click Add "+" icon in the upper right corner.



- **Add a device**

Enter the PN number on the device or scan the QR code / Bar code, then complete the device information. This inverter has a PN bar code, near the communication ports at the bottom of the inverter.



- **Add successfully**

After completing the device information. On the "Monitor" page, select "Datalogger" in the upper left corner to see the device/datalogger you just added. However, because the network has not been configured, the Datalogger is in an offline state, and the inverter is not recognized.



2-4. Device Distribution Network

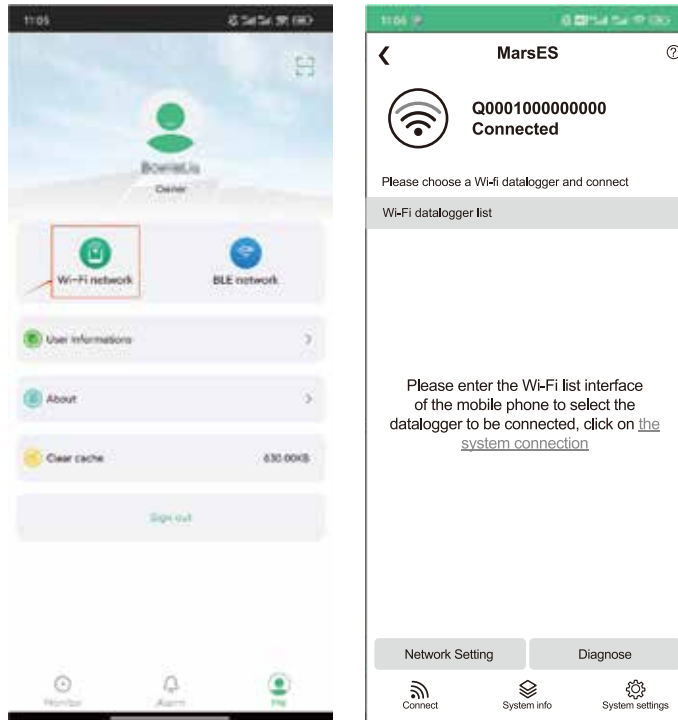
Because the Datalogger is the Wi-Fi module, after adding a device, you need to configure the network before you can see the inverter working status.

• Network access

After the device is added, it automatically enters the configuration network.

Or manually click the "Me" page → "Wi-Fi network" to enter the network setting page.

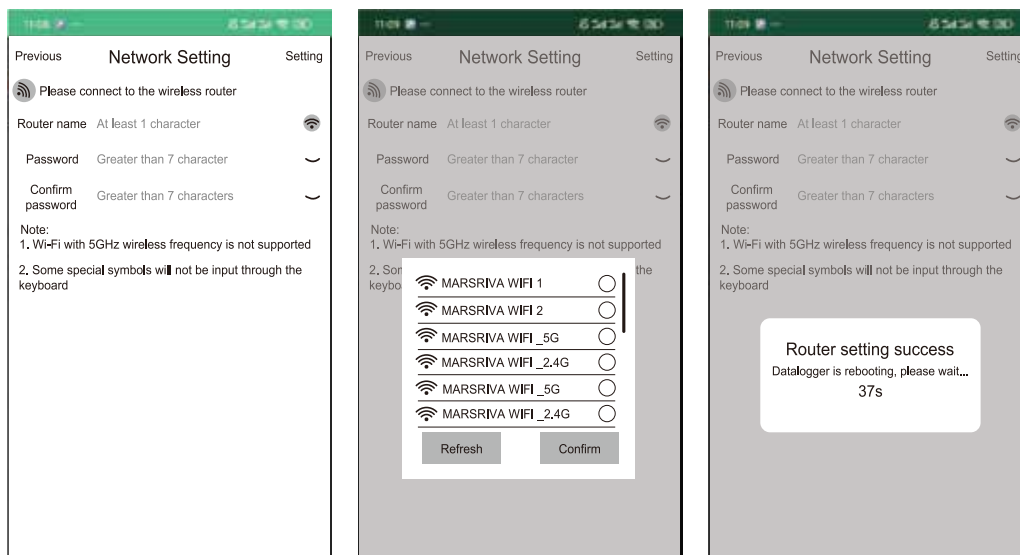
Then open "Wi-Fi" in the "Settings" of your mobile phone, and then select the Wi-Fi that is consistent with the PN number of your digital device to connect (The initial password is 12345678). After the connection is successful, return to the energy storage APP and click "Network Setting".



• Configure the router network for the device

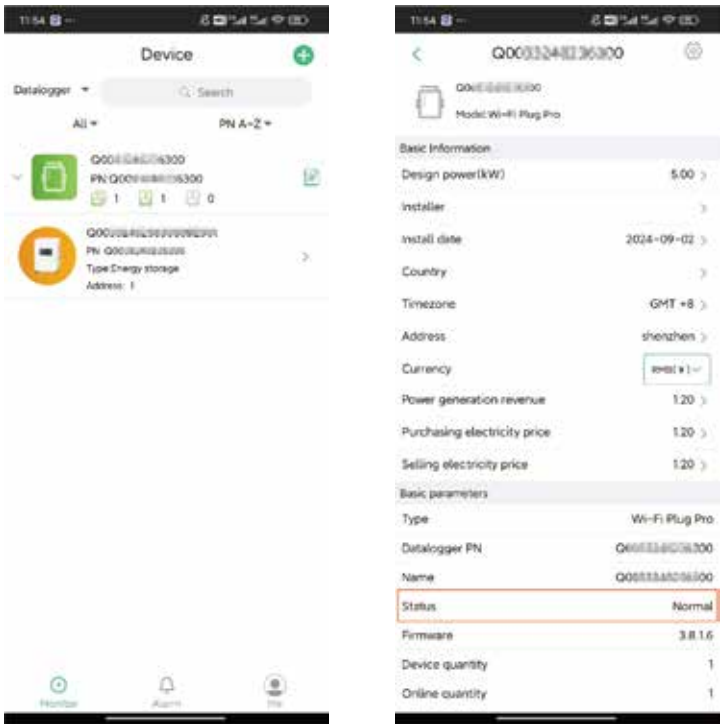
Select the router WiFi network, the Datalogger will automatically use it for work in the future.

- Note:**
1. Please ensure that the signal connected to the network is good and the network is unblocked.
 2. Currently, routers in 5G band are not supported. Please use routers in 2.4G Band.
 3. Make sure that the router's password is correct. If you enter an incorrect password, it may appear that the connection was successful, but nothing has actually changed.



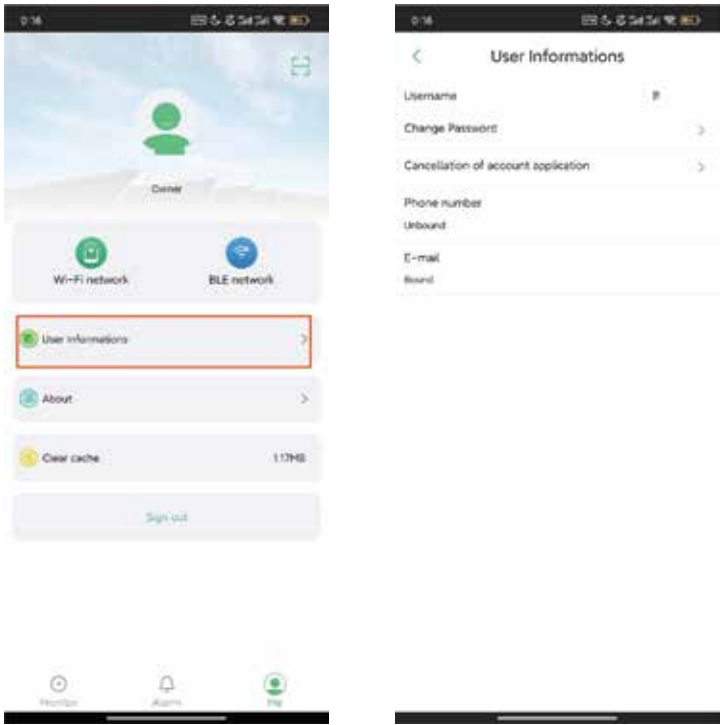
• **View the distribution results**

If the network configuration is successful, the device data can be seen in about 5 minutes.
The home page will display the device using Datalogger, and you can tap it to see the working status of your device. In the Datalogger information, its status is displayed as "Normal".
If the network configuration fails, troubleshoot the problem according to the repair suggestions on the actual page.



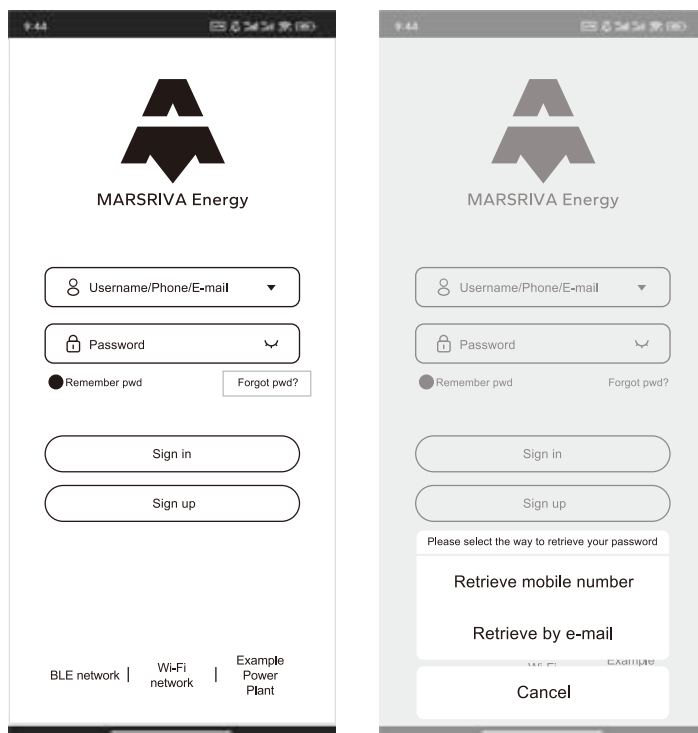
2-5. Account Security

To ensure that your account cannot be retrieved due to the loss of your account, we recommend that you bind at least one email address or mobile phone number to your account.
Click "User Information" to bind email address and phone number to improve account security, or change the password.



• Forgot Password

If you forget your password when logging in, you can click the forgot password button on the APP login page. The APP supports retrieving your password through your phone/email.



2-6. Monitor-Device

• Device

The device displays all the devices under the current account. You can view the device status and basic parameters.



- Green indicates that the equipment is normal;
- Gray indicates that the device is offline;
- Red indicates equipment failure;
- Yellow indicates a device warning;
- Blue indicates the standby of the device.

• **Device Details**

① **Energy flow**

You can view the working status and real-time power of the device. The important parameters of the equipment are displayed below. Click the equipment icon to view the relevant parameters of the equipment, photovoltaic panel, power grid, battery and load.



② **Chart**

You can view the total data chart of the device.

- Day:** The 24-hour real-time power area chart of the current day. (Update data in 5 minutes)
- Month:** The column chart of the daily power consumption of the current month.
- Year:** The column chart of the monthly electricity consumption of the current year.
- Total:** the column chart of the power consumption during the entire lifetime of the equipment.



③ Analysis

You can select a device parameter or multiple parameters of the same dimension to view the line chart for data analysis and comparison.



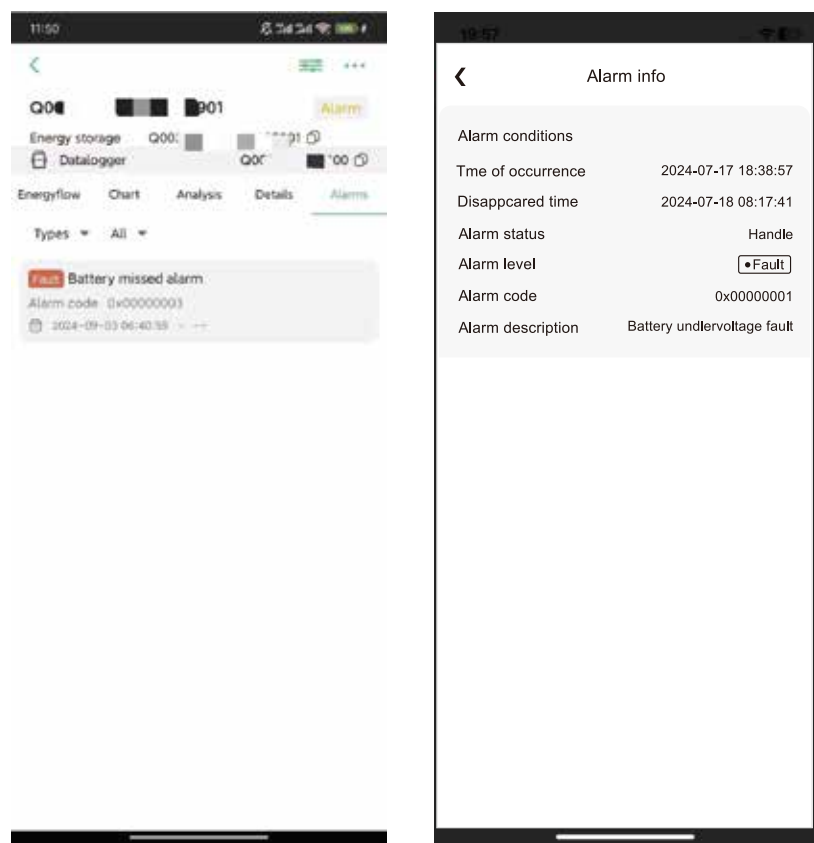
④ Details

You can view the data details recorded by the device every five minutes.

Timestamp	Data name	Data
11:47:12	MachType	Control reverse machine
11:42:31	Current state of machine	manual shutdown
	BatVolt	0.5V
	ChargeCurr	0.8A
	BatSoc	0%
	BatTypeSet	Standard colloidal cell
	BusVolt	81.3V
	Mains voltage	200.0V
	Grid current	0.0A
	GridFreq	50.00Hz
	Mains Current	0.0A
	PvinpuVolt	0.0V
	PvinpuCurr	0.0A
	PV charging power	0W
	PvCurr	0.0A

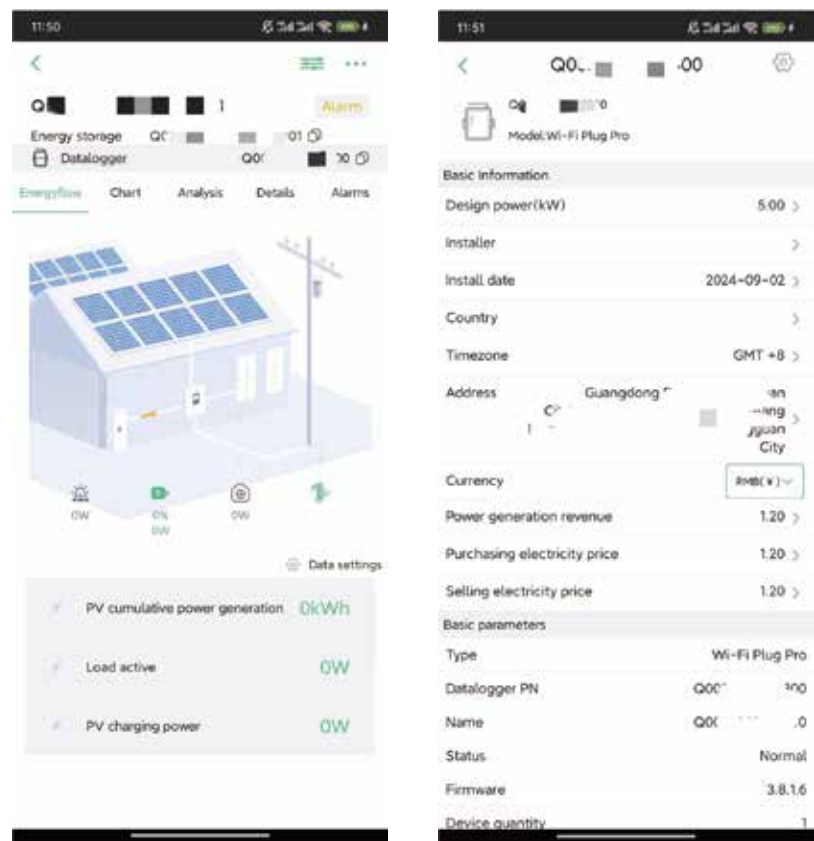
⑤ Alarms

You can view all alarms and alarm statuses generated by the current device.



⑥ View the Datalogger to which it belongs

Click the Datalogger PN to view the information of the Datalogger and Datalogger connected to the device.



⑦ Edit the device name

Click in the upper right corner “edit name” to customize the device name.



⑧ Delete device

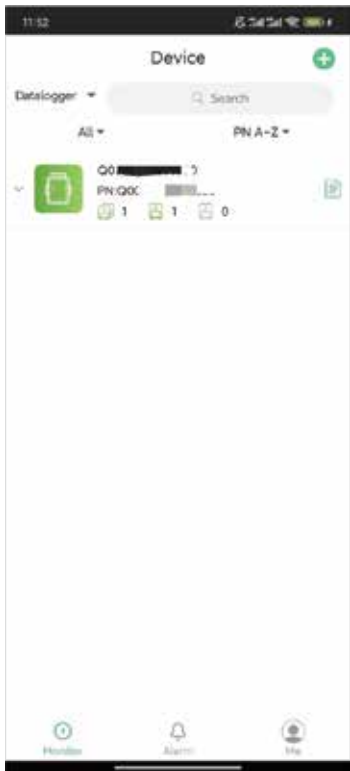
Click in the upper right corner “Remove” to delete the device.



2-7. Monitor-Datalogger

• Datalogger

Displays all datalogger under your account. You can view the status, basic parameters, and connected devices of the datalogger.



- Green represents that the Data logger is normal;
- Gray indicates that the Data logger is offline;

• Datalogger details

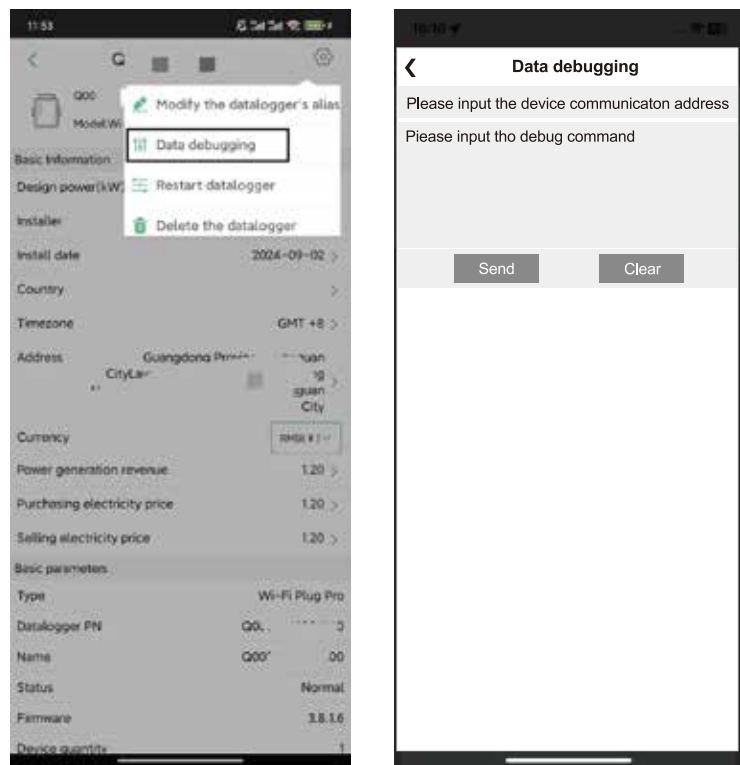
① Datalogger information

Click  Icon to view the Datalogger information.



② Debugging of Datalogger

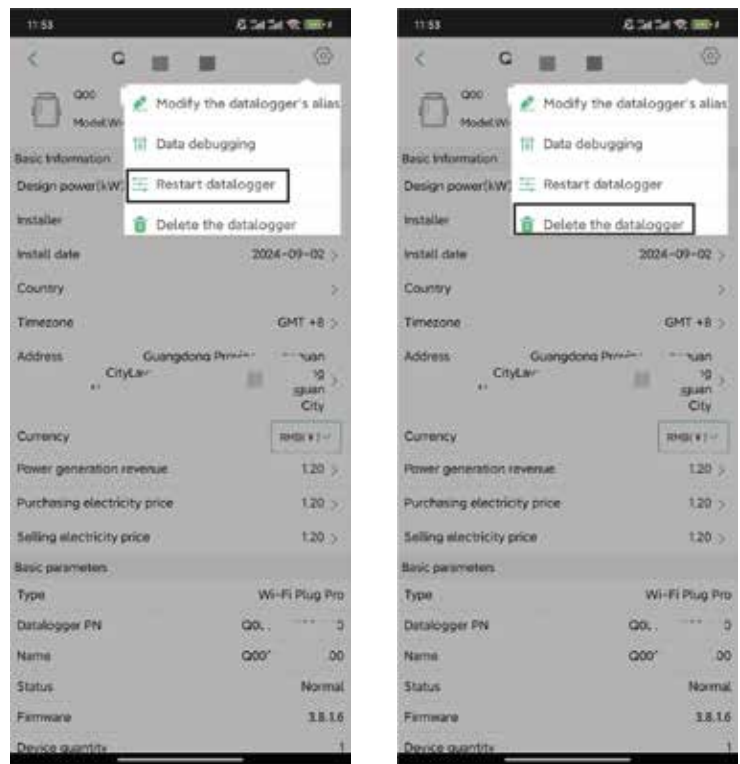
By issuing hexadecimal debugging instructions to a device address, you can obtain device information to remotely debug the device.



③ Restart the datalogger / Delete datalogger

This feature allows you to remotely restart the datalogger.

Note: you must delete the device before delete datalogger



MARSRIVA Technology Co., Ltd.

Website: www.marsriva.com

E-mail: support@marsriva.com

Made in China



Specifications are subject to change without notice, all product drawings are for reference only.