

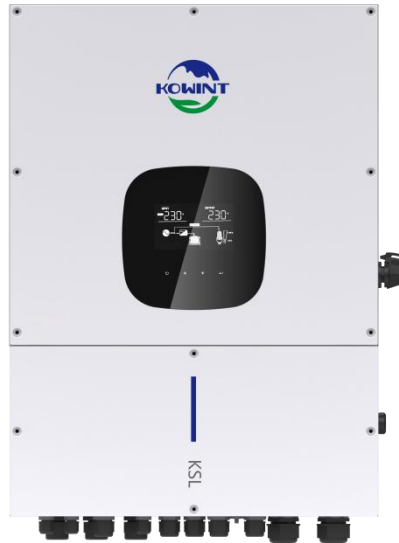


Energy storage system
solutions experts!

科维特能源 (深圳) 有限公司
KOWINT ENERGY (SHENZHEN) CO.,LTD



User Manual



KOWINT Hybrid LV 12KW PV Inverter

Version: 1.0



www.kowint.com

KOWINT ENERGY (SHENZHEN) CO., LTD.

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1. Introduction

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

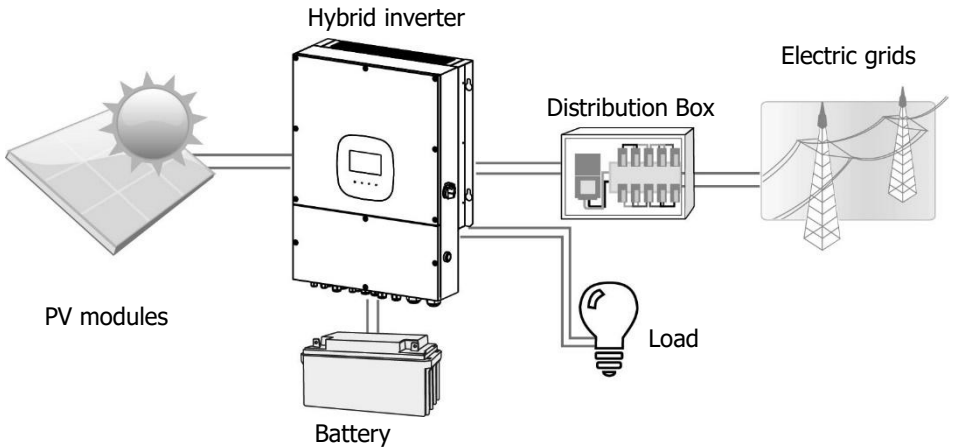


Figure 1 Basic hybrid PV System Overview

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. This inverter is only compatible with PV module types of single crystalline and poly crystalline. Do not connect any PV array types other than these two types of PV modules to the inverter. Do not connect the positive or negative terminal of the solar panel to the ground. See Figure 1 for a simple diagram of a typical solar system with this hybrid inverter.



2. Important Safety Warning

Before using the inverter, please read all instructions and cautionary markings on the unit and this manual. Store the manual where it can be accessed easily.

This manual is for qualified personnel. The tasks described in this manual may be performed by qualified personnel only.

General Precaution-

Conventions used:

WARNING! Warnings identify conditions or practices that could result in personal injury;

CAUTION! Caution identify conditions or practices that could result in damaged to the unit or other equipment connected.



WARNING! Before installing and using this inverter, read all instructions and cautionary markings on the inverter and all appropriate sections of this guide.



WARNING! Normally grounded conductors may be ungrounded and energized when a ground fault is indicated.



WARNING! This inverter is heavy. It should be lifted by at least two persons.



CAUTION! Authorized service personnel should reduce the risk of electrical shock by disconnecting AC, DC and battery power from the inverter before attempting any maintenance or cleaning or working on any circuits connected to the inverter. Turning off controls will not reduce this risk. Internal capacitors can remain charged for 5 minutes after disconnecting all sources of power.



CAUTION! Do not disassemble this inverter yourself. It contains no user-serviceable parts. Attempt to service this inverter yourself may cause a risk of electrical shock or fire and will void the warranty from the manufacturer.



CAUTION! To avoid a risk of fire and electric shock, make sure that existing wiring is in good condition and that the wire is not undersized. Do not operate the Inverter with damaged or substandard wiring.



CAUTION! Under high temperature environment, the cover of this inverter could be hot enough to cause skin burns if accidentally touched. Ensure that this inverter is away from normal traffic areas.



CAUTION! Use only recommended accessories from installer. Otherwise, not-qualified tools may cause a risk of fire, electric shock, or injury to persons.



CAUTION! To reduce risk of fire hazard, do not cover or obstruct the cooling fan.



CAUTION! Do not operate the Inverter if it has received a sharp blow, been dropped, or otherwise damaged in any way. If the Inverter is damaged, please call for an RMA (Return Material Authorization).



CAUTION! AC breaker, DC switch and Battery circuit breaker are used as disconnect devices and these disconnect devices shall be easily accessible.

Before working on this circuit

- Isolate inverter/Uninterruptible Power System (UPS)
- Then check for Hazardous Voltage between all terminals including the protective earth.



Risk of Voltage Backfeed

Symbols used in Equipment Markings

	Refer to the operating instructions
	Caution! Risk of danger
	Caution! Risk of electric shock
	Caution! Risk of electric shock. Energy storage timed discharge for 5 minutes.

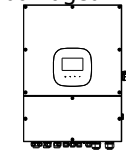


Caution! Hot surface

3. Unpacking & Overview

3-1. Packing List

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:



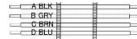
Inverter unit



RS-232 cable



Parallel cable



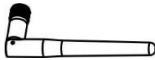
Share current wires



Manual

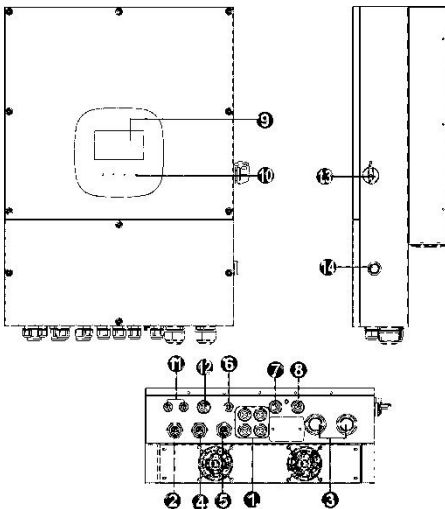


Fixing screws



WiFi antenna

3-2. Product Overview



- 1) PV connectors
- 2) AC Grid connectors
- 3) Battery connectors
- 4) AC output connectors (Load connection)
- 5) Generator input
- 6) External sensor port (reserved)
- 7) Dry contact & USB communication port
- 8) BMS & RS-232 communication port
- 9) LCD display panel (Please check section 10 for detailed LCD operation)
- 10) Operation buttons
- 11) Current sharing port



- 12) Parallel communication port
- 13) PV switch

- 14) Power on/off switch

4. Installation

4-1. Precaution

This hybrid inverter is designed for indoor or outdoor use (IP65), 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.
- Not in environment of precipitation or humidity (>95%).

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

4-2. Selecting Mounting Location

- 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 -25~60°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 the front.

4.3. Mounting Unit

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

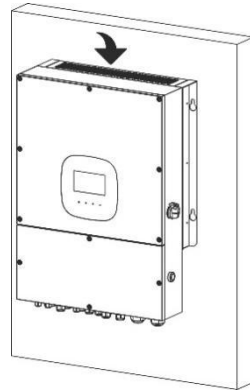
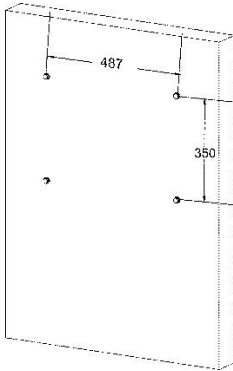
Installation to the wall should be implemented with the proper screws. After that, the device should be bolted on securely.



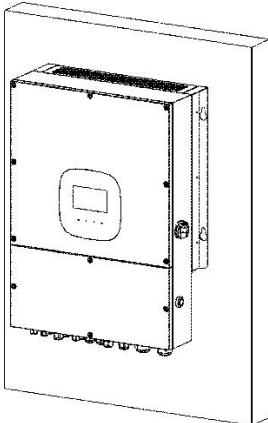
The inverter only can be used in a CLOSED ELECTRICAL OPERATING AREA. Only service person can enter into this area.

WARNING!! FIRE HAZARD.
SUITABLE FOR MOUNTING ON CONCRETE OR OTHER NON-COMBUSTIBLE SURFACE ONLY.

1. Fix four screws as shown in the chart (width: 487mm, height: 350mm). The reference tightening torque is 35 N.m.
2. Raise the inverter and place it over the four screws.



3. Check if the inverter is firmly secured.





5. Grid (Utility) Connection

5-1. Preparation

NOTE 1: The overvoltage category of the AC input is III. It should be connected to the power distribution.

NOTE 2: Before connecting to grid, please install a separate AC breaker between inverter and grid. This will ensure the inverter can be securely disconnected during maintenance and fully protected from over current. The recommended of AC breaker is 40A/300V.

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

Suggested cable requirement for AC wire

Nominal Grid Voltage	120VAC per phase
Conductor cross-section (mm ²)	10-16
AWG no.	8-6

5-2. Connecting to the AC Utility

Please follow below steps to implement AC input connection:

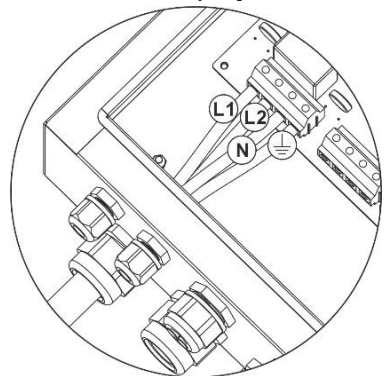
1. Before making AC input connection, be sure to open DC protector or disconnector first.
2. Remove insulation sleeve 7mm for four conductors.
3. Insert AC input wires according to polarities indicated on terminal block and tighten the terminal screws. Be sure to connect PE protective conductor (⊕) first.

⊕ → **Ground (yellow-green)**

L1 → **LINE (black)**

L2 → **LINE (brown)**

N → **Neutral (blue)**



WARNING:

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



6. Generator Connection

6-1. Preparation

NOTE 1: The overvoltage category of the AC input is III. It should be connected to the power distribution.

NOTE 2: Before connecting to grid, please install a separate AC breaker between inverter and grid. This will ensure the inverter can be securely disconnected during maintenance and fully protected from over current. The recommended of AC breaker is 40A/300V.

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

Suggested cable requirement

Nominal Grid Voltage	120VAC per phase
Conductor cross-section (mm ²)	10-16
AWG no.	8-6

6-2. Connecting to the Generator Input

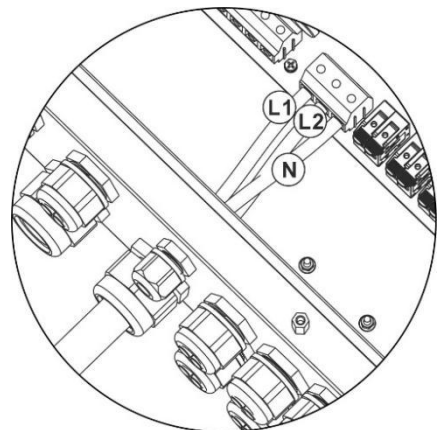
Please follow below steps to implement generator input connection:

1. Before making generator input connection, be sure to open DC protector or disconnecter first.
2. Remove insulation sleeve 7mm for four conductors.
3. Insert input wires according to polarities indicated on terminal block and tighten the terminal screws. Be sure to connect PE protective conductor (⊕) first.

L1→LINE (black)

L2→LINE (brown)

N→Neutral (blue)





WARNING:

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

7. PV Module (DC) Connection

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

NOTE1: Please use 1000VDC/20A circuit breaker.

NOTE2: The overvoltage category of the PV input is II.

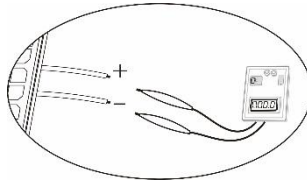
Please follow below steps to implement PV module connection:

WARNING: Because this inverter is non-isolated, only **two** types of PV modules are acceptable: single crystalline and poly crystalline with class A-rated.

To avoid any malfunction, do not connect any PV modules with possibility of leakage current to the inverter. For example, grounded PV modules will cause leakage current to the inverter.

CAUTION: It's requested to have PV junction box with surge protection. Otherwise, it will cause inverter damage when lightning occurs on PV modules.

Step 1: Check the input voltage of PV array modules. The acceptable input voltage of the inverter is 120VDC - 600VDC. This system is applied with two strings of PV array. Please make sure that the maximum current load of each PV input connector is 18A.



CAUTION: Exceeding the maximum input voltage can destroy the unit!! Check the system before wire connection.

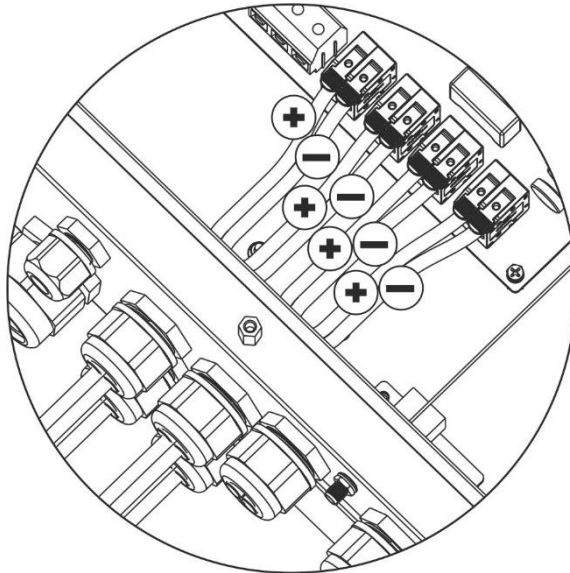
Step 2: Disconnect the circuit breaker and switch off the DC switch.

Step 3: Remove insulation sleeve 7 mm for positive and negative conductors.

Step 4: 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.



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.

Conductor cross-section (mm ²)	AWG no.
4	12

CAUTION: Never directly touch terminals of the inverter. It will cause lethal electric

CAUTION: Do NOT touch the inverter to avoid electric shock. When PV modules are exposed to sunlight, it may generate DC voltage to the inverter.



Recommended Panel Configuration

Specifications	Solar panel			
	520	535	560	580
Nominal Max. Power (Pmax) (W)	520	535	560	580
Opt. Operating Voltage (Vmp) (V)	41.6	41.9	44.31	44.78
Opt. Operating Current (Imp) (A)	12.5	12.77	12.64	12.96
Open Circuit Voltage (Voc) (V)	49.14	49.44	52.90	53.30
Short Circuit Current (Isc) (A)	13.23	13.5	13.50	13.82
For 12KW input recommendation				
Numbers in series of MPPT1	11	11	10	10
Numbers of strings in MPPT1	1	1	1	1
Maximum input voltage of MPPT1 (V)	540.5	543.8	529	533
Input power of MPPT1 (W)	5720	5885	5600	5800
Numbers in series of MPPT2	11	11	10	10
Numbers of strings in MPPT2	1	1	1	1
Maximum input voltage of MPPT1 (V)	540.5	543.8	529	533
Input power of MPPT2 (W)	5720	5885	5600	5800
Total input power (W)	11440	11770	11200	11600
Minimum input recommendation				
Numbers in series of MPPT1	4	4	4	4
Numbers of strings in MPPT1	1	1	1	1
Maximum input voltage of MPPT1 (V)	196.6	197.6	211.6	213.2
Input power of MPPT1 (W)	2080	2140	2240	2320
Numbers in series of MPPT2	4	4	4	4
Numbers of strings in MPPT2	1	1	1	1
Maximum input voltage of MPPT1 (V)	196.6	197.6	211.6	213.2
Input power of MPPT2 (W)	2080	2140	2240	2320
Total input power (W)	4160	4280	4480	4640



8. Battery Connection

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

NOTE1: Please only use sealed lead acid battery, vented and Gel battery. Please check maximum charging voltage and current when first using this inverter. If using Lithium iron or Nicd battery, please consult with installer for the details.

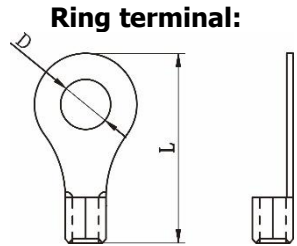
NOTE2: Please use 60VDC/250A circuit breaker.

NOTE3: The overvoltage category of the battery input is II.

Please follow below steps to implement battery connection:

Step 1: Check the nominal voltage of batteries. The nominal input voltage for inverter is 48VDC.

Step 2: Use two battery cables. Remove insulation sleeve 10 mm and insert conductor into cable ring terminal. Refer to right chart.



Recommended battery cable and terminal size for each inverter:

Wire Size	Cable mm ²	Ring Terminal Dimensions		Torque value
		D (mm)	L (mm)	
		3/0AWG	85	

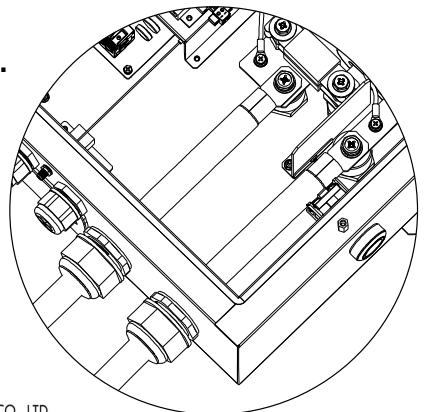
WARNING: Be sure the length of all battery cables is the same. Otherwise, there will be voltage difference between inverter and battery to cause parallel inverters not working.

Step 3: 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.

RED cable to the positive terminal (+);
BLACK cable to the negative terminal (-).

WARNING! Wrong connections will damage the unit permanently.

Step 4: Make sure the wires are securely





connected. The reference tightening torque is 5.5~7.0 N.m.

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 size as below.

Nominal Battery Voltage	48V
Conductor cross-section (mm ²)	85
AWG no.	3/0
Protective earthing (battery side)	150mm ² (300kcmil)

9. Load (AC Output) Connection

9-1. Preparation

CAUTION: To prevent further supply to the load via the inverter during any mode of operation, an additional disconnection device should be placed on in the building wiring installation.

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

Nominal Grid Voltage	120/208/240 VAC per phase
Conductor cross-section (mm ²)	10-16
AWG no.	8-6

9-2. Connecting to the AC output

Step 1: Before making output connection, be sure to open DC protector or disconnector first.

Step 2: Remove insulation sleeve 7mm for four conductors.

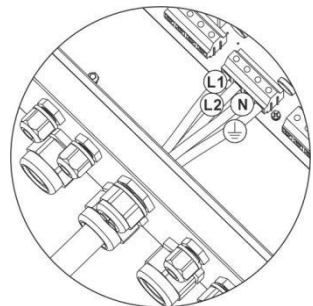
Step 3: Insert AC input wires according to polarities indicated on terminal block and tighten the terminal screws. Be sure to connect PE protective conductor (⊕) first.

⊕ → **Ground (yellow-green)**

L1 → **LINE (black)**

L2 → **LINE (brown)**

N → **Neutral (blue)**



The reference tightening torque is 1.0-1.5 N.m.



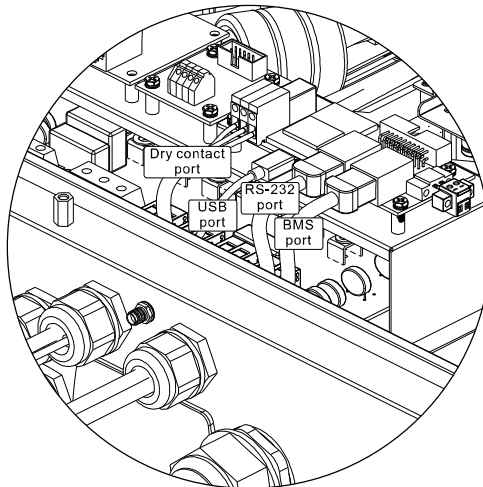
Step 4: Make sure the wires are securely connected.

CAUTION: Do NOT connect the utility to "AC Output Connector (Load connector)".
CAUTION: Be sure to connect L terminal of load to L terminal of "AC Output Connector(Load connector)" and N terminal of load to N terminal of "AC Output Connector(Load connector)". The G terminal of "AC Output Connector" is connected to grounding of the load. Do NOT mis-connect.

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.

10. Communication

The inverter is equipped with several communication ports to communicate .Follow below procedure to connect communication wiring .



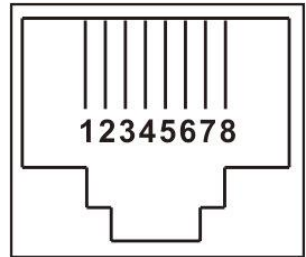


10-1. Wi-Fi Connection

This unit is equipped with a Wi-Fi transmitter. Wi-Fi transmitter can enable wireless communication between off-grid inverters and monitoring platform.

10-2. Pin Assignment for RS-232 Communication Port

	Definition
PIN 1	RS232TX
PIN 2	RS232RX
PIN 3	NC
PIN 4	NC
PIN 5	NC
PIN 6	NC
PIN 7	NC
PIN 8	GND



10-3. 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

10-4. Dry Contact Signal

There is one dry contact available on the bottom panel. It could be used to remote control for external generator.


Electric Parameter

Parameter	Symbol	Max.	Unit
Relay DC voltage	Vdc	30	V
Relay DC current	Idc	1	A

Note: The application of the dry contact should not exceed the electric parameter shown as above. Otherwise, the internal relay will be damaged.

Function Description



Unit Status	Condition	 Dry contact port: NC C NO	
		NO&C	NC&C
Power Off	Unit is off and no output is powered.	Open	Close
Power On	Battery voltage is lower than setting battery cut-off discharging voltage when grid is available.	Close	Open
	Battery voltage is lower than setting battery cut-off discharging voltage when grid is unavailable.	Close	Open
	Battery voltage is higher than below 2 setting values: 1. Battery re-discharging voltage when grid is available. 2. Battery re-discharging voltage when grid unavailable.	Open	Close

11. Commissionin

Step 1: Check the following requirements before commissioning:

- Ensure the inverter is firmly secured
- Check if the open circuit DC voltage of PV module meets requirement (Refer to Section 6)
- Check if the open circuit utility voltage of the utility is at approximately same to the nominal expected value from local utility company.
- Check if connection of AC cable to grid (utility) is correct if the utility is required.
- Full connection to PV modules.
- AC circuit breaker (only applied when the utility is required), batter circuit breaker, and DC circuit breaker are installed correctly.

Step 2: Switch on the battery circuit breaker and then switch on PV DC breaker. After that, if there is utility connection, please switch on the AC circuit breaker. At this moment, the inverter is turned on already. However, there is no output generation for loads. Then:

- If LCD lights up to display the current inverter status, commissioning has been successfully. After pressing "ON" button for 1 second when the utility is detected, this inverter will start to supply power to the loads. If no utility exists, simply press "ON" button for 3 seconds. Then, this inverter will start to supply power to the loads.

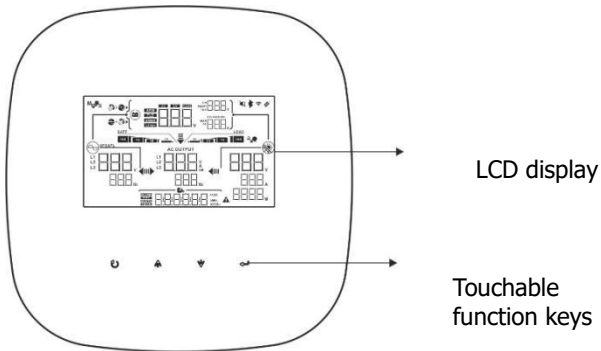


- If a warning/fault indicator appears in LCD, an error has occurred to this inverter. Please inform your installer.

12. Operation

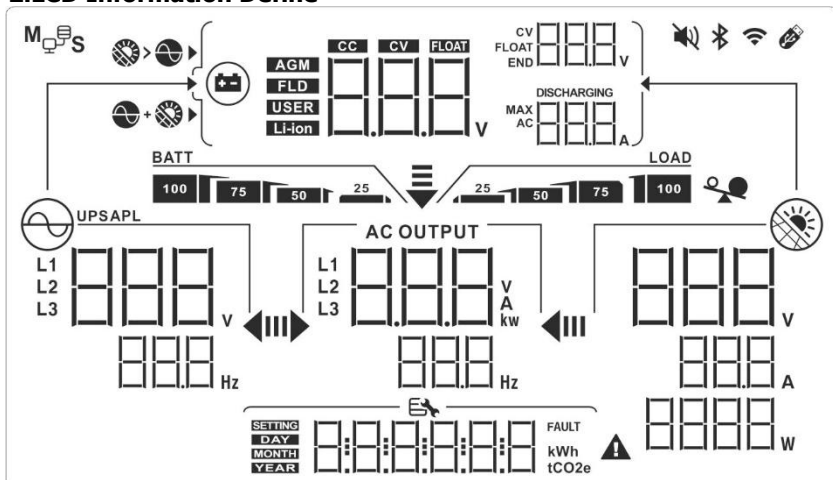
12-1. Interface

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.



NOTICE: To accurately monitor and calculate the energy generation,.

12-2.LCD Information Define





Display	Function
<p>UPS APL L1 L2 L3 V Hz</p>	<p>Indicates AC input voltage and frequency. V: voltage, Hz: frequency, L1/L2/L3: Line phase</p>
<p>AC OUTPUT L1 L2 L3 V A kw Hz</p>	<p>Indicates AC output power, voltage, frequency, or current. kw: active power, V: voltage, Hz: frequency, A: current L1/L2/L3: AC output phase</p>
<p>P1 P2 V A W</p>	<p>Indicates PV input voltage, power or current. V: voltage, W: power, P1: PV input 1, P2: PV input 2 A: current</p>
	<p>Allow AC and PV charging</p>
	<p>Only PV charging is allowed</p>
<p>BATT CV FLOAT END V DISCHARGING A Li-ion</p>	<p>Indicates battery voltage, battery current, charging status or battery parameters V: voltage, A: current, Li-ion: Lithium-ion battery type</p>
<p>BATT 100 75 50 25</p>	<p>Indicates battery level in battery mode.</p>
<p>FAULT</p>	<p>Indicates the warning and fault codes.</p>
<p>DATE MONTH YEAR kWh</p>	<p>Indicates date and time or the date and time users set for querying energy generation.</p>
	<p>Indicates solar panels. Icon flashing indicates PV input voltage is out of range.</p>
	<p>Indicates utility. Icon flashing indicates utility voltage or frequency is out of range.</p>
<p>BATT 100 75 50 25</p>	<p>Indicates battery condition. And the lattice of the icon indicates battery capacity.</p>



	<p>Icon flashing indicates battery is not allowed to discharge.</p>
	<p>Icon flashing indicates the battery voltage is too low.</p>
	<p>Indicates AC output for loads is enabled and inverter is providing power to the connected loads.</p>
	<p>This icon lighting indicates SW button is on and AC output is turned on. This icon flashing indicates SW button is off but there is AC output. NOTICE: Be careful to take notice of this icon status. If SW button is off with this icon flashing, inverter will not provide backup power to AC output while AC power failure occurs at the same time.</p>
	<p>Indicates overload.</p>
	<p>Indicates parallel operation is working.</p>

13-1. Touchable function keys

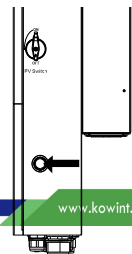
Function Key	Operation	Function
	Enter	Quick touch. To confirm/enter the selection in setting mode
	ESC	Quick touch. Exit the setting.
	Up	Quick touch. Select last selection or increase value.
	Down	Quick touch. If it's in query menu, press this button to jump to next selection or decrease value. Mute alarm in standby mode or battery mode.

NOTE: If backlight shuts off, you may activate it by touching any button.

12-3.SW ON/OFF Operation (located on the side of the inverter)

- Quick press to wake up inverter when the input power is supplied from battery only.
- Press and hold the buttons for 3 seconds to turn on or off the AC output of the inverter.

NOTICE: Be careful to take notice of "AC OUTPUT" icon status. If SW


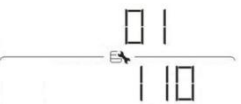
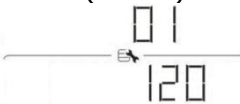
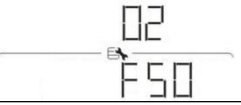
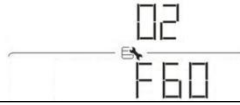
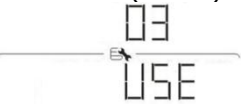
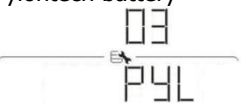
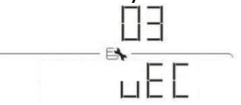




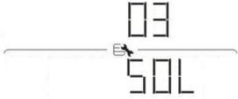
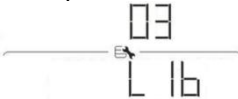
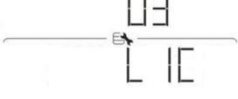
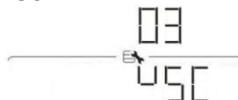
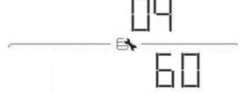

button is off with this icon flashing, inverter will not provide backup power to AC output while AC power failure occurs at the same time.

12-4. LCD Setting








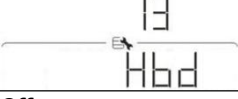
After touching and holding "Enter" button for 2 seconds, the unit will enter setting mode. Press "UP" or "DOWN" button to select setting programs. And then, press "ENTER" button to confirm the selection or ESC button to exit.

Program	Description	Selectable option	
00	Exit setting mode	Escape 	
01	Output voltage	110Vac 	120Vac(default) 
02	Output frequency	50Hz 	60Hz(default) 
03	Battery type	User-Defined(default) 	If "User Defined" is selected, battery charge voltage and low DC cut off voltage can be set up in program 4, 7, 8 and 9.
		Pylontech battery 	If selected, programs of 4, 7, 8 and 9 will be automatically set up. No need for further setting.
		WECO battery 	If selected, programs of 4, 7, 8 and 9 will be auto-configured per battery supplier recommended. No need for further adjustment.
		Soltaro battery	If selected, programs of 4, 7, 8 and 9 will be automatically set up. No need for further



			setting.
		<p>LIB-protocol compatible battery</p> 	Select "LIB" if using Lithium battery compatible to Lib protocol. If selected, programs of 4, 7, 8 and 9 will be automatically set up. No need for further setting.
		<p>3rdparty Lithium battery</p> 	If selected, programs of 4, 7, 8 and 9 will be automatically set up. No need for further setting. Please contact the battery supplier for installation procedure.
		<p>VSC</p> 	If selected, standard CAN protocol will be supported.
04	<p>Maximum charging current: To configure total charging current for solar and utility chargers. (Max. charging current = utility charging current + solar charging current)</p>	<p>60A(default)</p> 	<p>Setting range is 1A, then from 10A to 200A. Increment of each click is 10A.</p>
05	<p>Maximum utility charging current</p>	<p>60A(default)</p> 	<p>Setting range is from 10A to 200A. Increment of each click is 10A.</p>



06	Maximum discharging current	200A(default) 	Setting range is from 10A to 200A. Increment of each click is 10A.
07	Bulk charging voltage (C.V voltage)	Default setting: 56.0V 	Setting range is from 48.0V to 60.0V. Increment of each click is 0.1V.
08	Floating charging voltage	Default setting: 54.0V 	Setting range is from 48.0V to 60.0V. Increment of each click is 0.1V.
09	Low DC cut off battery voltage setting when grid is unavailable	Default setting: 42.0 	Setting range is from 40V to 60V. Increment of each click is 0.1V.
10	Battery re-discharging voltage when grid is unavailable	Default setting: 48.0 	Setting range is form 40V to 60V. Increment of each click is 0.1V
11	Low DC cut off battery voltage when grid is available	Default setting: 48.0 	Setting range is from 42V to 60V voltage. Increment of each click is 0.1V
12	Battery re-discharging voltage when grid is available	Default setting: 54.0 	Setting range is from 42V to 60V voltage. Increment of each click is 0.1V
13	Operation Mode	Grid-tie with backup 	PV power can feed-in back to grid, provide power to the load and charge battery.
		Off-Grid	PV power only provides power to the load and charge battery. No feed-in back to grid is allowed.

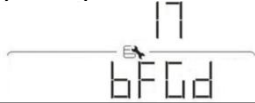
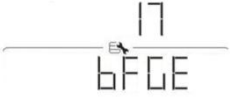
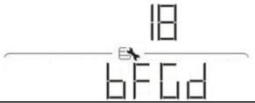

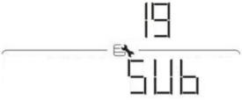
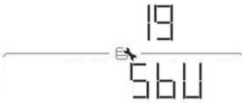
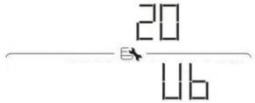
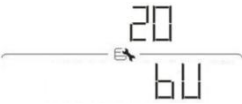



		Grid- 	PV power only can feed-in back to grid.
		Tie 	
14	PV energy supply priority setting	Grid-tie with backup Mode	
		Grid-tie with backup I 	Battery-Load-Grid: PV power will charge battery first, then provide power to the load. If there is any remaining power left, it will feed-in to the grid.
		Grid-tie with backup II 	Load-Battery-Grid: PV power will provide power to the load first. Then, it will charge battery. If there is any remaining power left, it will feed-in to the grid.
		Grid-tie with backup III 	Load-Grid-Battery: PV power will provide power to the load first. If there is more PV power available, it will feed-in to the grid. If feed-in power reaches max. feed-in power setting, the remaining power will charge battery.
		Grid-tie with backup IV 	If selected, it is only allowed to set up peak time and off-peak for electricity demand. Programs of 15, 17, 18, 19 and 20 can't be set and only programs of 21, 22, 23 and 24 can be set.
		Off-Grid Mode	
		Off-Grid I 	Load-Battery: PV power will provide power to the load first and then charge battery. Feed-in to the grid is not allowed under



			this mode. At the same time, the grid relay is
		Off-Grid II 	Battery-Load: PV power will charge battery first. After battery is fully charged, if there is remaining PV power left, it will provide power to the load. Feed-in to the grid is not allowed under this mode. At the same time, the grid relay is connected.
		Off-Grid III 	Load-Battery: PV power will provide power to load first and then charge battery. Feed-in to the grid is not allowed under this mode. The grid relay is NOT connected.
		Grid-Tie Mode 	PV power only feeds-in to the grid. No priority setting is available.
15	Charger source priority	Solar and Utility(default) 	If there is remaining PV power after supporting the loads, it will charge battery first. Only until PV power is not available, grid will charge battery.
		Only Solar 	It is only allow PV power to charge battery.
		None 	It is not allowed to charge battery no matter it's PV power or grid.
16	Feed to grid function	Feed to grid disable (default) 	Feed to grid enable



17	Battery energy feed to grid function when PV energy is available	Battery feed to grid disable (default) 	Battery feed to grid enable 
18	Battery energy feed to grid function when PV energy is unavailable.	Battery feed to grid disable (default) 	Feed to grid enable 
19	Load supply source (PV is available)	SUB(default) 	Solar-grid-battery: PV power will provide power to the load first. If it's not sufficient, grid will provide power to the load. If grid is not available at the same time, battery power will back up.
		SBU 	Solar-Battery-Grid: PV power will provide power to the load first. If it's not sufficient, battery power will provide power to the load. When battery power is running out or not available, grid will back up the load.
20	Load supply source (PV is unavailable)	UB(default) 	Grid-Battery: Grid will provide power to the load at first. If grid is not available, battery power will provide power backup.
		BU 	Battery-Grid: Battery power will provide power to the load at first. If battery power is running out, grid will back up the load. This setting is ineffective during of AC charging.
21	Start charging time for first duration of AC charge	00:00 (Default) 	The setting range of start charging time for AC charger is from 00:00 to 23:00. Increment of each click is 1 hour.


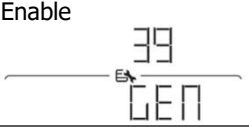
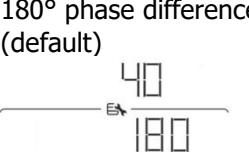
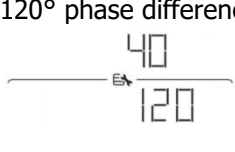
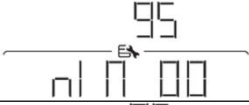






22	Stop charging time for first duration of AC charge	00:00 (Default) 22 560000	The setting range of stop charging time for AC charger is from 00:00 to 23:00. Increment of each click is 1 hour.
23	Start charging time for second duration of AC charge	00:00 (Default) 23 5E8000	The setting range of start charging time for AC charger is from 00:00 to 23:00. Increment of each click is 1 hour.
24	Stop charging time for second duration of AC charge	00:00 (Default) 24 5E0000	The setting range of start charging time for AC charger is from 00:00 to 23:00. Increment of each click is 1 hour.
25	Scheduled time for AC output on	00:00 (Default) 25 000000	The setting range of AC output on is from 00:00 to 23:00. Increment of each click is 1 hour.
26	Scheduled time for AC output off	00:00 (Default) 26 0F0000	The setting range of AC output off is from 00:00 to 23:00. Increment of each click is 1 hour.
27	LCD off waiting time	LCD is always on 27 LCD 0	The LCD turns off after 30s 27 LCD 30
		The LCD turns off after 60s(default) 27 LCD 60	The LCD turns off after 300s. 27 LCD 300
		The LCD turns off after 600s 27 LCD 600	
28	Alarm control	Alarm on(default) 28 600	Alarm off 28 60F
29	Alarm control	Alarm on in standby	Alarm off in standby mode



	at standby mode	mode(default) 29 5t60N	29 5t60F
30	Alarm control at battery mode	Alarm on in battery mode (default) 30 6t60N	Alarm off in battery mode 30 6t60F
31	Activate lithium battery when the device is powered on	Activate lithium battery disable(default) 31 6Ad	Activate lithium battery enable 31 6AE
32	AC output mode	Single: This inverter is used in single phase application (default) 32 5 IG	Parallel: This inverter is operated in parallel system. 32 PAL
33	Generator as AC source	Disable(default) 33 dG d IS	Enable 33 dG EN
34	Wide AC input range	Disable(default) 34 uAC d IS	Enable 34 uAC EN
36	External CT function (Refer to Appendix III for the details)	Disable (default) 36 CTd	Enable 36 CTE
37	PV parallel	Disable(default) 37 PPd	Enable 37 PPE
39	Generator port function (Refer to	Disable(default)	If selected, the input/output of generator port will be disabled.



	Appendix IV for the details)		
		Enable 	If selected, genertor port will be activated. However, this port will not function in parallel mode.
40	Phase difference	180° phase difference (default) 	120° phase difference 
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 17 to 99.

12-5. Query Menu Operation

The display shows current contents that have been set. The displayed contents can be changed in query menu via button operation. Press 'Enter' button to enter query menu. There are seven query selections:

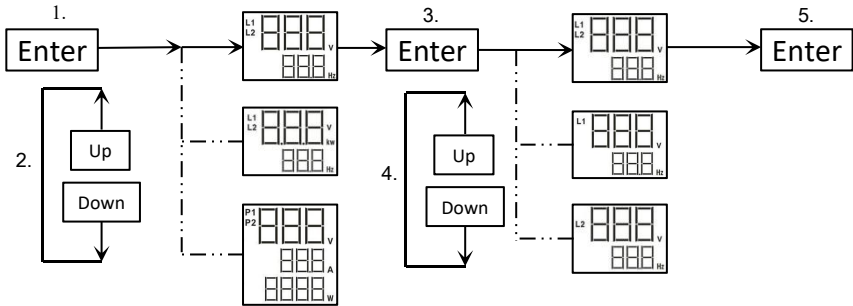
- Input voltage or frequency of AC input.
- Frequency, voltage, power or load percentage of AC output.
- Input voltage or power of PV input.
- Battery voltage or capability percentage.



Setting Display Procedure

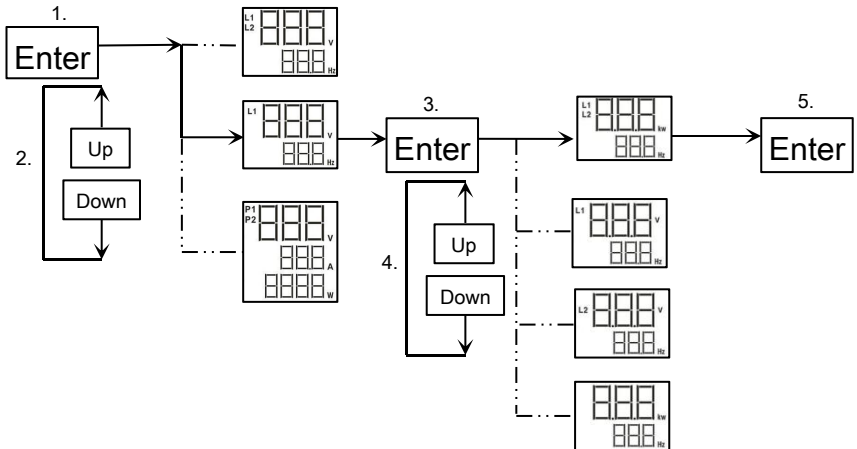
● Input voltage or frequency of AC input

Procedure



● Frequency, voltage, power or percentage of AC output

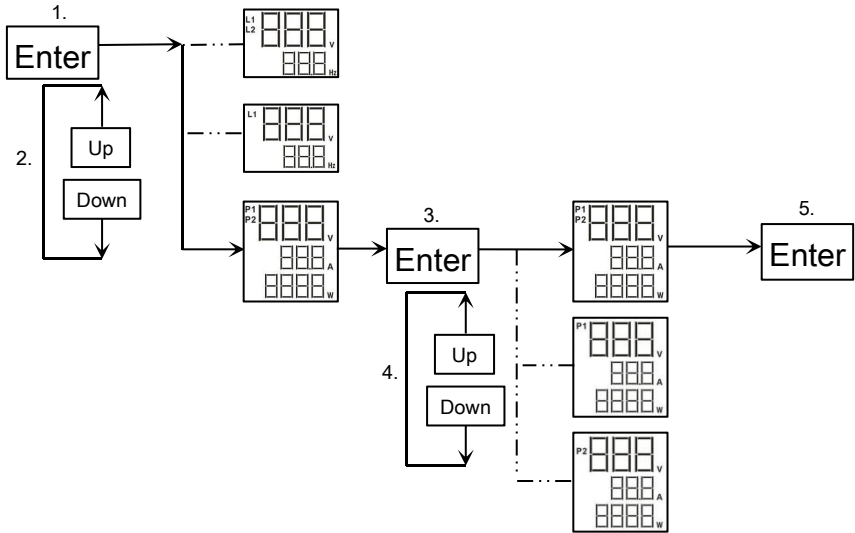
Procedure





● **Input voltage or power of PV input.**

Procedure



Switch LCD Displayed Information

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

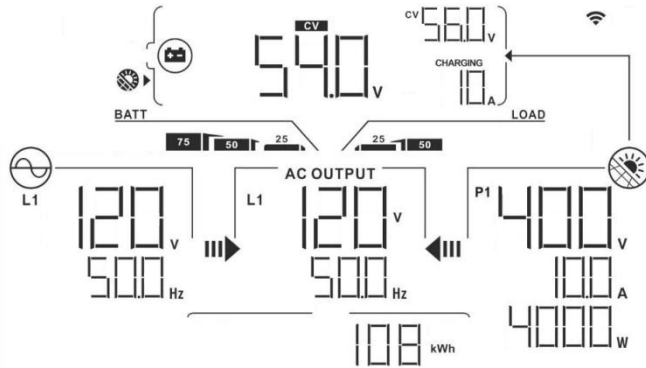
Selectable information	LCD display
Real date	<p>Real date: 2020-08-18</p> <p>The LCD display shows a comprehensive system status. At the top, it displays 'CV 560V' and 'CHARGING 10A'. Below this, there are icons for 'BATT' (battery) and 'LOAD' (load). The main display area shows 'AC OUTPUT' with 'L1 120V' and '500Hz' for two channels. On the right, it shows 'P1 4000V', '100A', and '4000W'. At the bottom, the date 'DAY 2020.08.18' is displayed.</p>



<p>Real time</p>	<p>Real time: 10:08</p> <p>BATT: 75% (50, 25), CV 540 V, CHARGING 10 A, LOAD 4000 W</p> <p>AC OUTPUT: 120 V, 500 Hz</p> <p>P1: 4000 V, 100 A, 4000 W</p> <p>DAY: 10:08</p>
<p>PV energy generated today.</p>	<p>PV energy generated this month = 8Wh.</p> <p>BATT: 75% (50, 25), CV 540 V, CHARGING 10 A, LOAD 4000 W</p> <p>AC OUTPUT: 120 V, 500 Hz</p> <p>P1: 4000 V, 100 A, 4000 W</p> <p>DAY: 8 Wh</p>
<p>PV energy generated this year.</p>	<p>PV energy generated this year = 108kWh</p> <p>BATT: 75% (50, 25), CV 540 V, CHARGING 10 A, LOAD 4000 W</p> <p>AC OUTPUT: 120 V, 500 Hz</p> <p>P1: 4000 V, 100 A, 4000 W</p> <p>YEAR: 108 kWh</p>

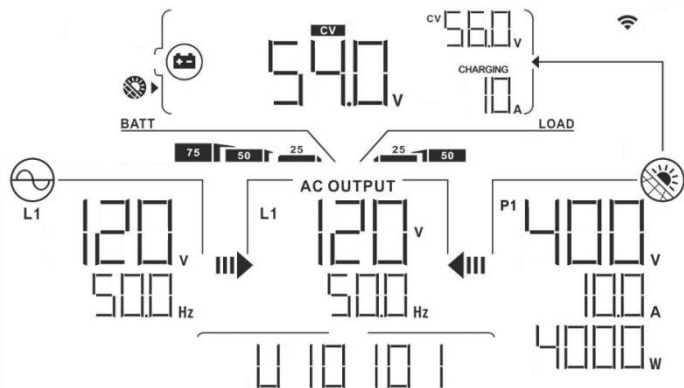


Total PV energy generation = 108kWh.



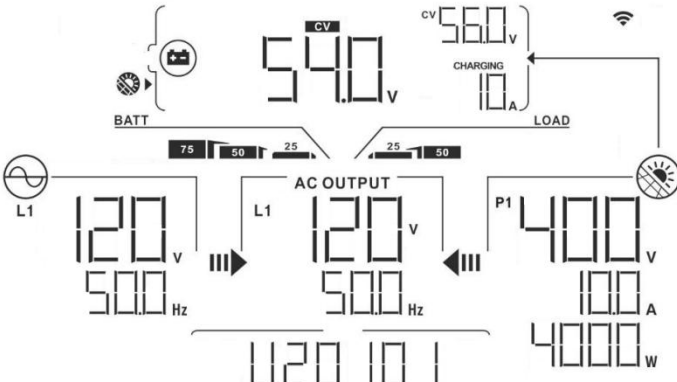
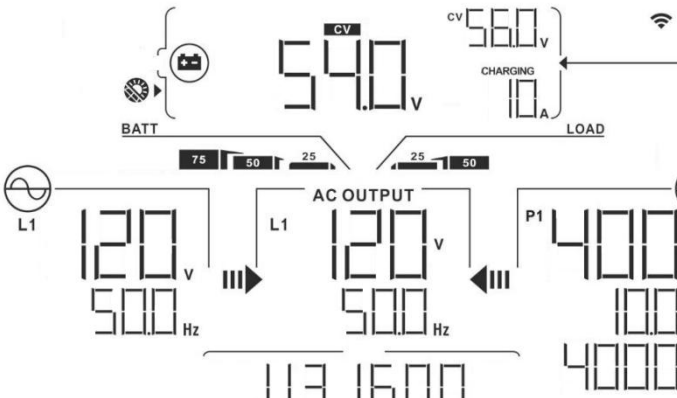
PV energy
generated
totally.

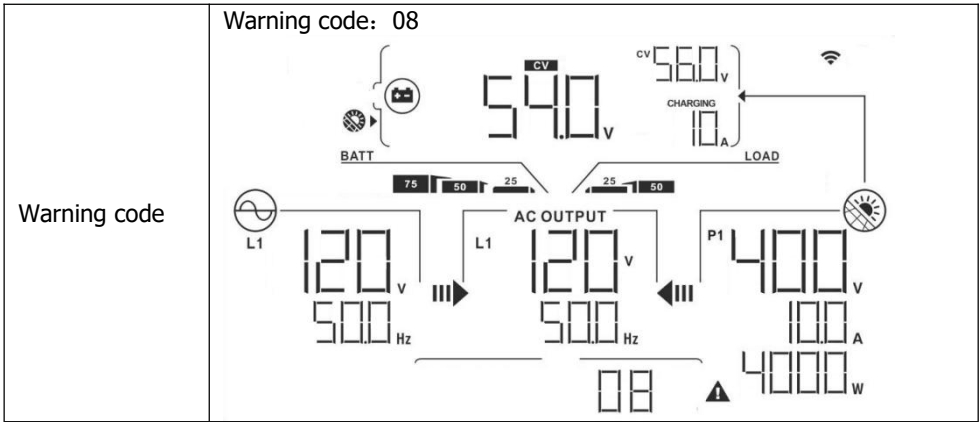
Main CPU version 01.01.



Main CPU
version checking.



<p>Secondary CPU version checking.</p>	<p>Secondary CPU version 01.01.</p>  <p>The diagram shows a digital display for the Secondary CPU version 01.01. At the top, it displays 'CV 560 V' and 'CHARGING 10 A'. Below this, a large '540 V' is shown. A battery icon is labeled 'BATT' and a sun icon is labeled 'LOAD'. In the center, 'AC OUTPUT' is shown with '120 V' and '500 Hz' on both sides. On the right, 'P1' is shown with '400 V', '100 A', and '4000 W'. At the bottom, the version number 'U20 10 1' is displayed. A Wi-Fi symbol is in the top right corner.</p>
<p>Remote panel version checking</p>	<p>Remote panel version 16.00</p>  <p>The diagram shows a digital display for the Remote panel version 16.00. It features the same layout as the Secondary CPU version 01.01, but with a different version number 'U3 16 00' at the bottom. The 'CV 560 V', 'CHARGING 10 A', '540 V', 'AC OUTPUT 120 V 500 Hz', and 'P1 400 V 100 A 4000 W' information is identical to the previous diagram.</p>



12-6. Operation Mode & Display

Below is only contained LCD display for **grid-tie with backup mode (I)**. If you need to know other operation mode with LCD display, please check with installer.

Inverter mode with grid connected

This inverter is connected to grid and working with DC/INV operation.

LCD Display	Description
	<p>PV power is sufficient to charge battery, provide power to loads, and then feed in to the grid.</p>
	<p>PV power is sufficient to charge the battery first. However, remaining PV power is not sufficient to back up the load. Therefore, remaining PV power and the utility are supplying power to the connected load.</p>



<p>The diagram shows a power system with a PV source, a battery (BATT), and a load. The PV source is connected to a DC bus with a voltage of 520V and a charging current of 20A. The battery is also connected to this DC bus. The AC output is 120V, 500Hz. The load is 400V, 20A, 800W. The utility is also connected to the AC output. The date is 2008.18.</p>	<p>PV power is generated, but not sufficient enough to charge battery by itself. PV power and the utility are charging battery at the same time. And the utility is also supplying power to the connected load.</p>
<p>The diagram shows the same power system. The PV source is now providing 420V to the DC bus. The battery is not charging. The AC output is 120V, 500Hz. The load is 400V, 100A, 4000W. The utility is also connected to the AC output. The date is 2008.18.</p>	<p>PV power is sufficient to provide power to loads and feed power back to the grid.</p>
<p>The diagram shows the same power system. The PV source is providing 420V to the DC bus. The battery is not charging. The AC output is 120V, 500Hz. The load is 400V, 100A, 4000W. The utility is also connected to the AC output. The date is 2008.18.</p>	<p>PV power and utility are providing power to the connected loads because of insufficient PV power.</p>
<p>The diagram shows the same power system. The PV source is providing 540V to the DC bus. The battery is charging at 20A. The AC output is 120V, 500Hz. The load is 400V, 0A, 0W. The utility is also connected to the AC output. The date is 2008.18.</p>	<p>Only utility is charging battery and providing power to connected loads.</p>



Inverter mode without grid connected

This inverter is working with DC/INV operation and not connecting to the grid.

LCD Display	Description
	<p>PV power is sufficient to charge battery and provide power to the connected loads.</p>
	<p>PV power is generated, but not sufficient to power loads by itself. PV power and battery are providing power to the connected loads at the same time.</p>
	<p>Only battery power is available to provide power to connected loads.</p>
	<p>Only PV power supplies power to connected loads. Notice: The inverter doesn't support battery hot pluggable. When the inverter is working with solar input, turn off the inverter first and then connect the battery.</p>



Bypass mode

The inverter is working without DC/INV operation and connecting to the loads.

LCD Display	Description
	<p>Only utility is available to provide power to connected loads.</p>

Standby mode :

The inverter is working without DC/INV operation and load connected.

LCD Display	Description
	<p>This inverter is disabled on AC output or even AC power output is enabled, but an error occurs on AC output. Only PV power is sufficient to charge battery.</p>
	<p>If PV, battery or utility icons are flashing, it means they are not within acceptable working range. If they are not displayed, it means they are not detected.</p>

13. Charging Management

Charging Parameter	Default Value	Note
Charging current	60A	
Floating charging voltage (default)	54.0 Vdc	
Max. absorption charging voltage (default)	56.0 Vdc	
Battery overcharge protection	64.0 Vdc	



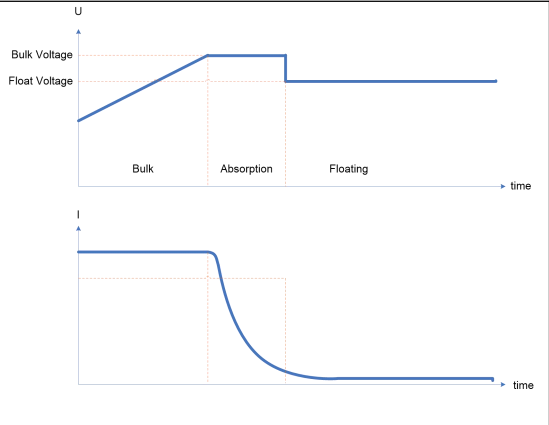
Charging process based on default setting.

3 stages:

First – max. charging voltage increases to 56V;

Second- charging voltage will maintain at 56V until charging current is down to 12 Amp;

Third- go to floating charging at 54V.



This inverter can connect to battery types of sealed lead acid battery, vented battery, gel battery and lithium battery. The detail installation and maintenance explanations of the external battery pack are provided in the manufacturer’s external battery pack of manual.

If using sealed lead acid battery, please set up the max. charging current according to below formula:

$$\text{The maximum charging current} = \text{Battery capacity (Ah)} \times 0.2$$

For example, if you are using 300 Ah battery, then, maximum charging current is $300 \times 0.2 = 60$ (A). Please use at least 50Ah battery because the settable minimum value of charging current is 10A. If using AGM/Gel or other types of battery, please consult with installer for the details.

14. Maintenance & Cleaning

Check the following points to ensure proper operation of whole solar system at regular intervals.

- Ensure all connectors of this inverter are cleaned all the time.
- Before cleaning the solar panels, be sure to turn off PV DC breakers.
- Clean the solar panels, during the cool time of the day, whenever it is visibly dirty.
- Periodically inspect the system to make sure that all wires and supports are securely fastened in place.

WARNING: There are no user-replaceable parts inside of the inverter. Do not attempt to service the unit yourself.



Battery Maintenance

- Servicing of batteries should be performed or supervised by personnel knowledgeable about batteries and the required precautions.
- When replacing batteries, replace with the same type and number of batteries or battery packs.
- The following precautions should be observed when working on batteries:
 - a) Remove watches, rings, or other metal objects.
 - b) Use tools with insulated handles.
 - c) Wear rubber gloves and boots.
 - d) Do not lay tools or metal parts on top of batteries.
 - e) Disconnect charging source prior to connecting or disconnecting battery terminals.
 - f) Determine if battery is inadvertently grounded. If inadvertently grounded, remove source from ground. Contact with any part of a grounded battery can result in electrical shock. The likelihood of such shock can be reduced if such grounds are removed during installation and maintenance (applicable to equipment and remote battery supplies not having a grounded supply circuit).

CAUTION: A battery can present a risk of electrical shock and high short-circuit current.


CAUTION: Do not dispose of batteries in a fire. The batteries may explode.




CAUTION: Do not open or mutilate batteries. Released electrolyte is harmful to the skin and eyes. It may be toxic.

15. Trouble Shooting

















When there is no information displayed in the LCD, please check if PV module/battery/grid connection is correctly connected.

15-1. Warning List


There are 17 situations defined as warnings. When a warning situation occurs,  icon will flash. Touch "up" or "down" to select displaying warning code. If there are several codes, it will display in sequences. Please contact your installer when you couldn't handle with the warning situations.

Code	Warning Event	Icon (flashing)	Description
01	Line voltage high loss		Grid voltage is too high.
02	Line voltage low loss		Grid voltage is too low.
03	Line frequency high loss		Grid frequency is too high.



04	Line frequency low loss		Grid frequency is too low.
05	Line voltage loss for long time		Grid voltage is higher than 253V.
06	Ground Loss		Ground wire is not detected.
07	Island detect		Island operation is detected.
08	Line waveform loss		The waveform of grid is not suitable for inverter.
09	Line phase loss		The phase of grid is not in right sequence.
10	EPO detected		EPO is open.
11	Overload		Load exceeds rating value.
12	Over temperature		The temperature is too high inside.
13	Batter voltage low		Battery discharges to low alarm point.
14	Battery under-voltage when grid is loss		Battery discharges to shutdown point.
15	Battery open		Battery is unconnected or too low.
16	Battery under-voltage when grid is OK		Battery stops discharging when the grid is OK.
17	Solar over voltage		PV voltage is too high.
18	RSD is close		RSD is close
32	Communication lost between DSP and communication board		Communication lost between DSP and communication board

15-2. Fault Reference Codes

When a fault occurs, the icon  will flash as a reminder. See below for fault codes for reference.

Situation			Solution
Fault Code	Fault Event	Possible cause	
01	Bus voltage over	Surge	1. Restart the inverter. 2. If the error message still remains, please contact your



			installer.
02	BUS voltage under	PV or battery disconnect suddenly	1. Restart the inverter 2. If the error message still remains, please contact your installer.
03	BUS soft start time out	Internal components failed.	Please contact your installer.
04	INV soft start time out	Internal components failed.	Please contact your installer.
05	INV over current	Surge	1. Restart the inverter. 2. If the error message still remains, please contact your installer.
06	Over temperature	Internal temperature is too high.	1. Check the ambient temperature and fans. 2. If the error message still remains, please contact your installer.
07	Relay fault	Internal components failed.	Please contact your installer.
08	CT sensor fault	Internal components failed.	Please contact your installer.
09	Solar input power abnormal	1. Solar input driver damaged. 2. Solar input power is too much when voltage is more than 600V.	1. Please check if solar input voltage is higher than 600V. 2. Please contact your installer.
11	Solar over current	Surge	1. Restart the inverter. 2. If the error message still remains, please contact your installer.
12	GFCI fault	Leakage current exceeds the limit.	1. Check the wire and panels which may cause the leakage.
13	PV ISO fault	The resistance between PV and ground is too low.	2. If the error message still remains, please contact your installer.
14	INV DC current over	Utility fluctuates.	1. Restart the inverter. 2. If the error message still



			remains, please contact your installer.
16	GFCI sensor fault	GFCI sensor failed.	Please contact your installer.
17	DSP and MCU Com. Loss	Communication loss between DSP and MCU	Please contact your installer.
22	Battery high voltage fault	Battery voltage exceeds the limit.	1. Check the battery voltage. 2. If the error message still remains, please contact your installer.
23	Over load	The inverter is loaded with more than 110% load and time is up.	Reduced the connected load by switching off some equipment.
26	INV short	Output short circuited.	Check if wiring is connected well and remove abnormal load.
27	Fan lock	Fan failed.	Please contact your installer.
32	DC/DC over current	Battery voltage fluctuates.	1. Restart the inverter. 2. If the error message still remains, please contact your installer.
33	INV voltage low	Internal components failed.	Please contact your installer.
34	INV voltage high	Internal components failed.	Please contact your installer.
35	Wire connection fault	Internal wires loosen.	Please contact your installer.
36	OP voltage fault	Grid connects to output terminal	Don't connect the grid to the output terminal.
38	Short circuited on PV input	Short circuited on PV input	Please contact your installer.
47	The L1/L2 of the inverter is short-circuited.	Output short circuited.	Check if all wiring is connected well and remove abnormal loads.
60	Current feedback into the inverter is detected.		1. Restart the inverter. 2. Check if L1/L2/N cables are not connected with wrong sequence in all inverters.



			<p>3. Make sure the sharing cables are connected in all inverters.</p> <p>4. If the problem remains, please contact your installer.</p>
71	The firmware version of each inverter is not the same.	Software differences do not support parallel.	<p>1. Update all inverter firmware to the same version.</p> <p>2. After updating, if the problem still remains, please contact your installer.</p>
72	The output current of each inverter is different.		<p>1. Check if sharing cables are connected well and restart the inverter.</p> <p>2. If the problem remains, please contact your installer.</p>
80	CAN data loss		<p>1. Check if communication cables are connected well and restart the inverter.</p> <p>2. If the problem remains, please contact your installer.</p>
81	Host data loss		
82	Synchronization data loss		
88	BUS Balances overcurrent	Internal components failed.	Please contact your installer.
89	BUS balance hardware Fault	Internal components failed.	Please contact your installer.

16. Specifications

MODEL	12KW
RATED POWER	10000 W
PV INPUT (DC)	
Maximum DC Power	12000 W
Nominal DC Voltage	360 VDC
Maximum DC Voltage	600 VDC



Working DC Voltage Range	120 VDC ~ 550 VDC
Start-up Voltage / Initial Feeding Voltage	125 VDC / 160 VDC
MPP Voltage Range / Full Load MPP Voltage Range	120 VDC ~ 550 VDC
Maximum Input Current	2 x 18 A (MAX 30 A)
Isc PV (absolute maximum)	2 x 18 A (MAX 30 A)
Max. inverter back feed current to the array	0 A
GRID OUTPUT (AC)	
Nominal Output Voltage	120 VAC (P-N) / 208 VAC (P-P)/ 240 VAC(P-P)
Output Voltage Range	105.5 - 132 VAC per phase
Output Frequency Range	47.5 ~ 51.5 Hz or 59.3~ 60.5Hz
Nominal Output Current	41.7A per phase
Inrush Current/Duration	50 A per phase / 20ms
Maximum Output Fault Current/Duration	90 A per phase / 1ms
Maximum Output Overcurrent Protection	90 A per phase
Power Factor Range	0.9 lead – 0.9 lag
AC INPUT	
AC Start-up Voltage	85 VAC per phase
Auto Restart Voltage	90 VAC per phase
Acceptable Input Voltage Range	85 - 140 VAC per phase
Nominal Frequency	50 Hz / 60 Hz
AC Input Power	10000VA/10000W
Maximum AC Input Current	60 A
Inrush Input Current	60 A / 1ms
BATTERY MODE OUTPUT (AC)	
Nominal Output Voltage	120 VAC (P-N) / 208 VAC (P-P)/ 240 VAC(P-P)
Output Frequency	50 Hz / 60 Hz (auto sensing)
Output Waveform	Pure sine wave
Output Power	10000VA/10000W
Efficiency (DC to AC)	91%
BATTERY & CHARGER (Lead-acid/Li-ion)	
DC Voltage Range	40 – 62 VDC
Nominal DC Voltage	48 VDC
Maximum Battery Discharging Current	200 A
Maximum Charging Current	200 A

GENERAL	
PHYSICAL	
Dimension, D X W X H (mm)	215.5 x 515 x 715
Net Weight (kgs)	45



INTERACE	
Communication Port	RS-232/USB
Intelligent Slot	RS232/USB,BMS, WIFI
ENVIRONMENT	
Protective Class	I
Ingress Protection Rating	IP65
Humidity	0 ~ 90% RH (No condensing)
Operating Temperature	-25 to 60°C (Power derating above 45°C)
Altitude	Max. 2000m*

* Power derating 1% every 100m when altitude is over 1000m.

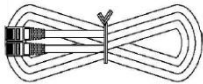
Appendix I: Parallel Installation Guide

Introduction

This inverter can be used in parallel with maximum 6 units. The supported maximum output power is 60KW/60KVA.

Parallel cable

You will find the following items in the package:

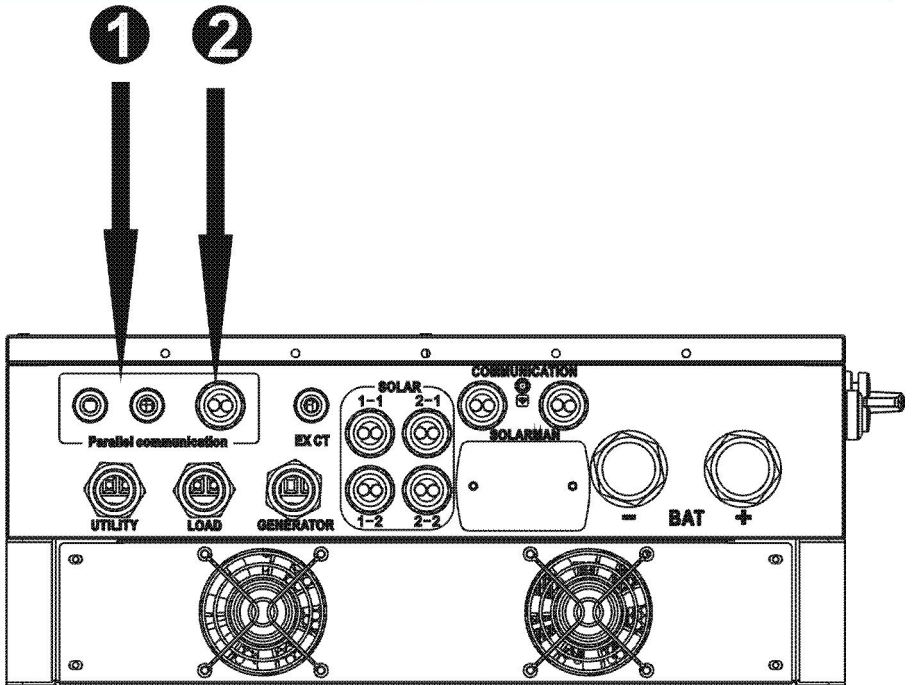


Parallel communication cable



Current sharing wires

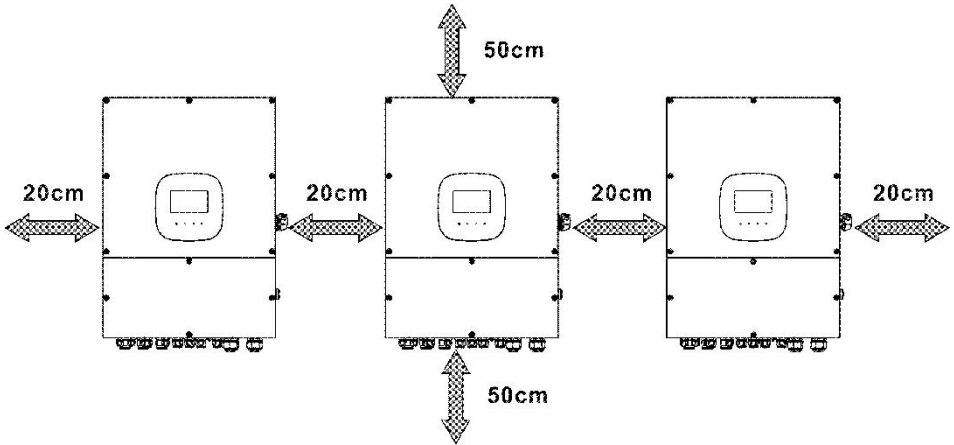
Overview



1. Current sharing port
2. Parallel communication port

Mounting the Unit

When installing multiple units, please follow below chart.



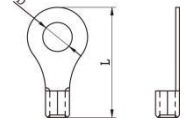
NOTE: For proper air circulation to dissipate heat, it's necessary to allow a clearance of approx. 20 cm to the side and approx. 50 cm above and below the unit. Be sure to install each unit in the same level.

Wiring Connection

The cable size of each inverter is shown as below:

Recommended battery cable and terminal size for each inverter:

Ring terminal:



Wire Size	Ring Terminal			Torque value
	Cable mm ²	Dimensions		
		D (mm)	L (mm)	
3/0AWG	85	8.4	56	7~12 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:

AWG no.	Conductor cross-section	Torque
8-6 AWG	10~16 mm ²	1.4~1.6Nm

You need to connect the cables of each inverter together. Take the battery cables for example. You need to use a connector or bus-bar as a joint to connect the battery cables together, and then connect to the battery terminal. The cable size used from joint



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

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

CAUTION!! Please install a breaker at the battery side. This will ensure the inverter can be securely disconnected during maintenance and fully protected from overcurrent of battery.

Recommended breaker specification of battery for each inverter:

One unit*
250A/60VDC

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

Recommended battery capacity

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

CAUTION! Please follow the battery charging current and voltage from battery spec to choose the suitable battery. The wrong charging parameters will reduce the battery lifecycle sharply.

Approximate back-up time table

Load (W)	Backup Time @ 48Vdc 400Ah (min)	Backup Time @ 48Vdc 600Ah (min)	Backup Time @ 48Vdc 800Ah (min)	Backup Time @ 48Vdc 1000Ah (min)	Backup Time @ 48Vdc 1200Ah (min)
20000	54	84	108	144	168
30000	36	54	72	96	108
40000	24	42	54	72	84
50000	21	33	45	54	66
60000	18	30	36	48	60

PV Connection

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

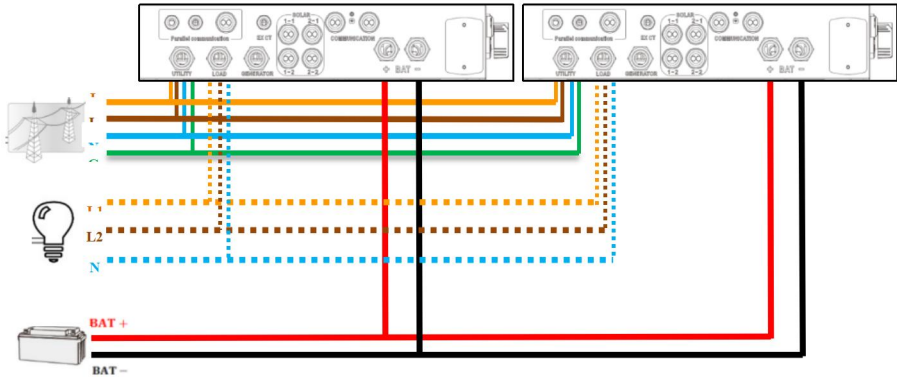
CAUTION: Each inverter should connect to PV modules separately.



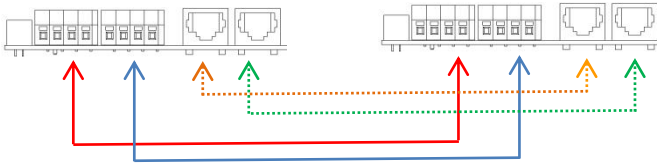
Inverters Configuration

Two inverters in parallel:

Power Connection

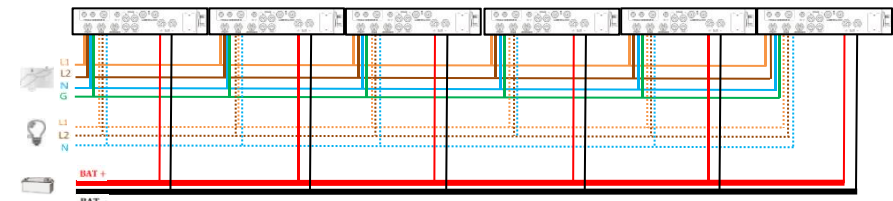


Communication Connection

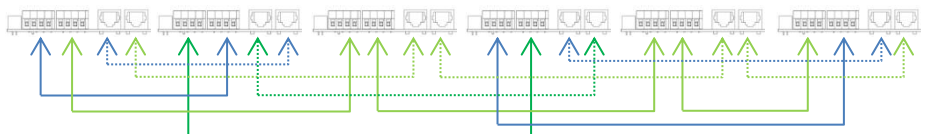


Six inverters in parallel:

Power Connection



Communication Connection





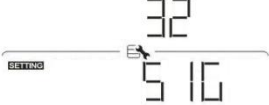

Setting and LCD Display

Setting Program:

The parallel function setting can be set up through LCD setting #32.

- Through LCD operation

In LCD program 32, you may select single or parallel.

32	Parallel for output	<p>Single: This inverter is operated in Single system.(default)</p> 	<p>Parallel: This inverter is operated in parallel system.</p> 
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Commissioning

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 wire of each unit is connected together.

Step 2: Turn on each unit and set "enable parallel for output" on SolarPower or SolarPower Pro. And then, shut down all units.

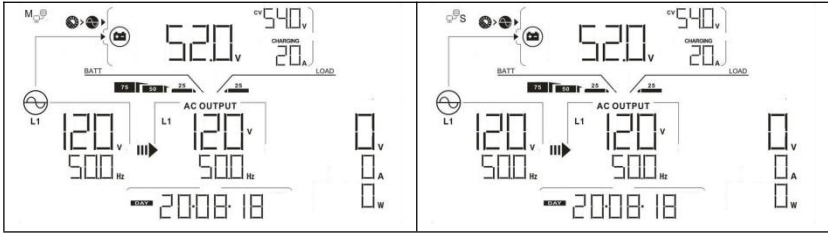
Step 3: Turn on each unit.

LCD display in Master unit	LCD display in Slave unit
	

NOTE: Master and slave units are randomly defined. Warning 02 is AC GRID voltage low.

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

LCD display in Master unit	LCD display in Slave unit
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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.

Trouble shooting

Situation		Solution
Fault Code	Fault Event Description	
60	Current feedback into the inverter is detected.	<ol style="list-style-type: none"> Restart the inverter. Check if L1/L2/N cables are not connected with wrong sequence in all inverters. Make sure the sharing cables are connected in all inverters. If the problem remains, please contact your installer.
61	Relay board driver loss	<ol style="list-style-type: none"> Disconnect all of power source. Only connect AC input and press Enter key to let it working in bypass mode.
62	Relay board communication loss	<ol style="list-style-type: none"> Check if the problem happens again or not and feed back the result to your installer.
71	The firmware version of each inverter is not the same.	<ol style="list-style-type: none"> Update all inverter firmware to the same version. After updating, if the problem still remains, please contact your installer.
72	The output current of each inverter is different.	<ol style="list-style-type: none"> Check if sharing cables are connected well and restart the inverter. If the problem remains, please contact your installer.
80	CAN data loss	<ol style="list-style-type: none"> Check if communication cables are connected well and restart the inverter. If the problem remains, please contact your installer.
81	Host data loss	
82	Synchronization data loss	

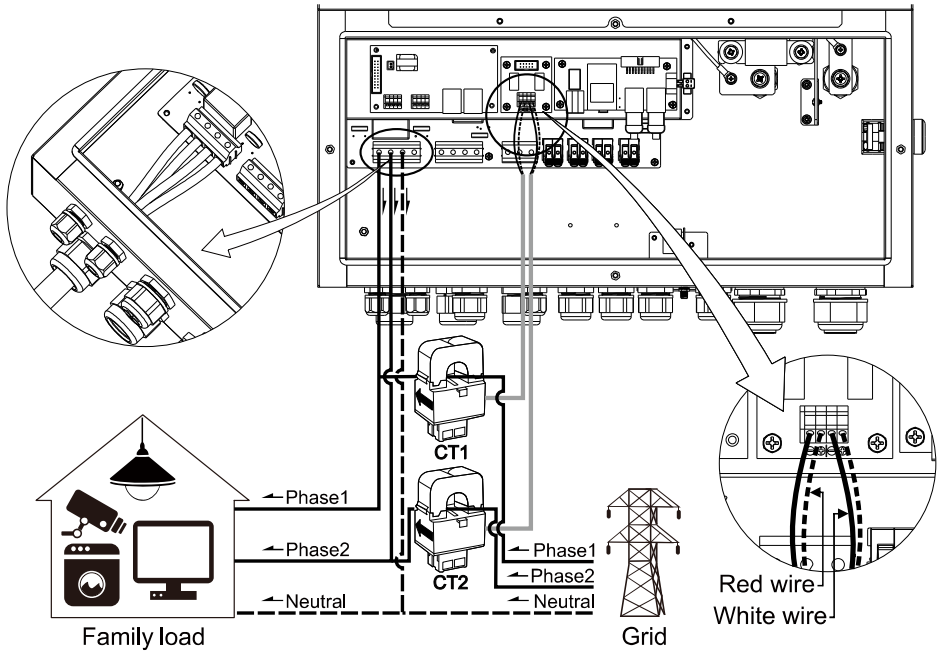


Appendix II: The CT Operation Guide

With CT connected, hybrid inverter can be easily integrated into the existing household system. It's to arrange self-consumption via CT to control power generation and battery charging of the inverter.

1. Single commissioning

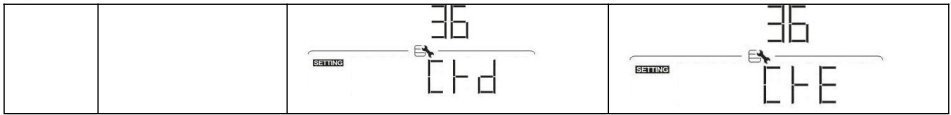
Step 1. Power off the inverter and connect the CT circuit according to the wiring diagram below.



Step 2: Power on the inverter, wake up the LCD and modify LCD setting. Enter LCD program #13 and set up as any Grid-tie with backup mode. The CT will not be enable if not setting to grid-tie with backup.

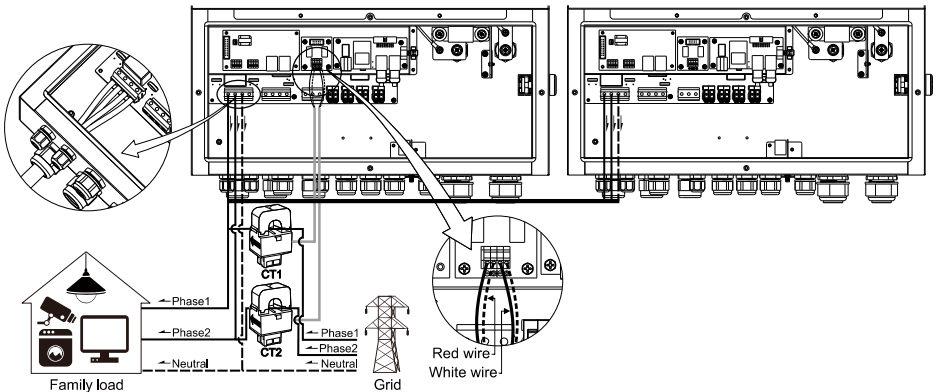
Step 3: Enter LCD setting on the inverter with CT sensor connected and change program #36 to "enable".

36	External CT function	Disable (default)	Enable
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2. Parallel commissioning

Step 1. Power off the inverter and connect the CT sensor according to the wiring diagram below. For other parallel circuits, please follow Appendix I.



Step 2: Power on all inverters, wake up the LCD and modify the Settings. Enter LCD program #13 and set up as any Grid-tie with backup mode. The CT will not be enabled if not setting to grid-tie with backup.

Step 3: Enter LCD setting on the inverter with CT sensor connected and change program #36 to "enable".

36	External CT function	Disable (default)	Enable

IMPORTANT ATTENTION :

If applying CT function during parallel operation, it only needs one inverter from parallel system connected to CT sensor. Be sure to enable LCD program #36 external CT function on the one inverter with CT connected and set up "Disable" on

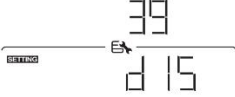
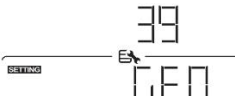


the remaining inverters. Otherwise, it will cause CT function not working during parallel operation.

Appendix III: The Generator Operation Guide

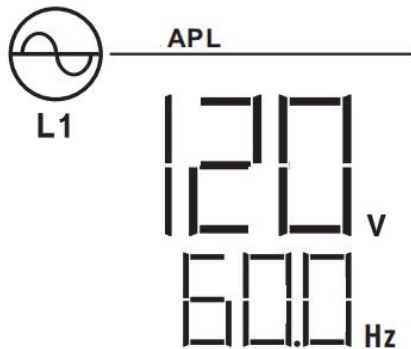
Through the generator port, the inverter can realize multiple groups of redundant backup power supply. In the absence of grid or solar power, users have the option of using a generator to charge the battery and power the load. Follow below steps to activate this function.

Step 1. Turn on the inverter and enable generator port function in LCD program #39 (Select "GEN").

39	Generator port Function	Disable(default) 	If selected, the input of generator port will be disabled.
		Enable 	If selected, generator port will be activated.

After setting, " **APL** " icon will flash on LCD display.

Step 2: You need to turn on the AC output of the inverter. The generator can only be used in battery mode. Once generator port function is activated and power input of generator enter the inverter, " **APL** " icon will be illuminated and input voltage/input frequency will show on the LCD display.



Note:



1. When the generator is in use, the inverter will force the battery to charge.
2. When the generator is in use, the maximum charging current of the inverter will be limited to 100A, and the user can choose a lower charging current by setting LCD program #05.
3. The generator will be used when the power grid is lost. If the power grid is restored, the generator will stop being used.