User Manual

OPTI-Solar

Solar Hybrid 3Phase PV Inverter

SP10000 Premium

Version: 1.2

Table Of Contents

1. Introduction 1
2. Important Safety Warning 2
3. Unpacking & Overview 4
   - 3-1. Packing List 4
   - 3-2. Product Overview 4
4. Installation 5
   - 4-1. Selecting Mounting Location 5
   - 4-2. Mounting Unit 5
5. Grid (Utility) Connection 7
   - 5-1. Preparation 7
   - 5-2. Connecting to the AC Utility 7
6. PV Module (DC) Connection 9
7. Battery Connection 13
8. Load (AC Output) Connection 14
   - 8-1. Preparation 14
   - 8-2. Connecting to the AC output 14
9. Communication 16
10. Dry Contact Signal 17
    - 10-1. Electric Parameter 17
    - 10-2. Function Description 17
11. Relay Control Port 19
    - 11-1. Interface Configuration 19
    - 11-2. Function Description 19
    - 11-3. Application 20
12. Application with Energy Meter 21
13. Commissioning 22
14. Initial Setup 23
15. Operation 35
    - 15-1. Interface 35
    - 15-2. LCD Information Define 35
    - 15-3. Button Definition 36
    - 15-4. Query Menu Operation 37
    - 15-5. Operation Mode & Display 40
16. Charging Management 44
17. Maintenance & Cleaning 46
18. Trouble Shooting 47
    - 18-1. Warning List 47
    - 18-2. Fault Reference Codes 48
19. Specifications 50

Appendix I: Parallel Installation Guide 52

1. Introduction

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

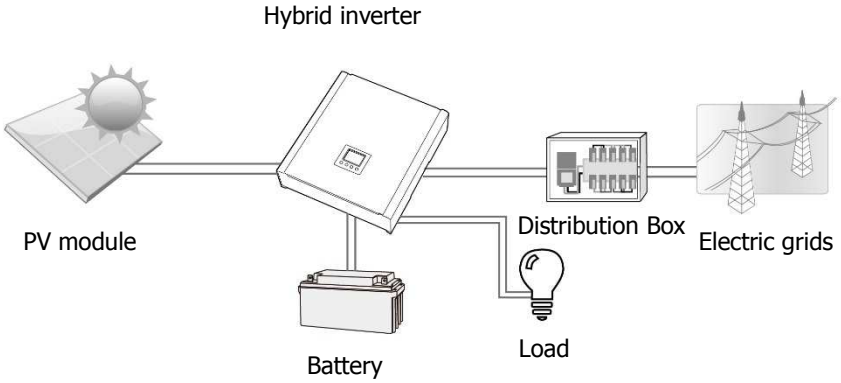


Figure 1 Basic hybrid PV System Overview

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.

Note: By following the EEG standard, every inverter sold to German area is not allowed to charge battery from Utility. The relevant function is automatically disabled by the software.

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.



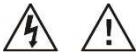
WARNING! Normally grounded conductors may be ungrounded and energized when a ground fault is indicated.



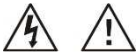
WARNING! This inverter is heavy. It should be lifted by at least two persons.



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.



CAUTION! Do not connect the PV voltage over 900Vdc & Current over 18.6A

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

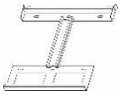
3-1. Packing List

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


PV connectors


AC connector


Mounting plate


Fixing screws


Software CD

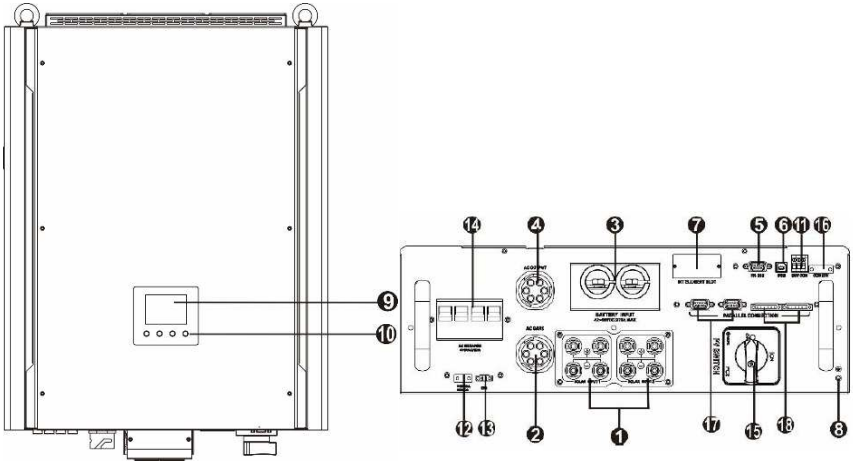

Manual


USB cable


RS-232 cable


Relay control port

3-2. Product Overview



1) PV connectors
2) AC Grid connectors
3) Battery connectors
4) AC output connectors (Load connection)
5) RS-232 communication port
6) USB communication port
7) Intelligent slot
8) Grounding
9) LCD display panel (Please check section 10 for detailed LCD operation)
10) Operation buttons
11) Dry contact
12) Battery thermal sensor
13) EPO
14) AC circuit breaker
15) DC Switch
16) Relay control port
17) Parallel communication port
18) Current sharing port

4. Installation

4-1. Selecting Mounting Location

Consider the following points before selecting where to install:

- Do not mount the inverter on flammable construction materials.
- Mount on a solid surface
- This inverter can make noises during operation which may be perceived as a nuisance in a living area.
- Install this inverter at eye level in order to allow the LCD display to be read at all times.
- 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.
- Dusty conditions on the unit may impair the performance of this inverter.
- The ambient temperature should be between 0°C and 40°C and relative humidity should be between 5% and 85% to ensure optimal operation.
- The recommended installation position is to be adhered to vertical.
- For proper operation of this inverter, please use appropriate cables for grid connection.
- The pollution degree of the inverter is PD2. Select an appropriate mounting location. Install the solar inverter in a protected area that is dry, free of excessive dust and has adequate air flow. Do NOT operate it where the temperature and humidity is beyond the specific limits. (Please check the specs for the limitations.)
- Installation position shall not prevent access to the disconnection means.
- This inverter is designed with IP20 for indoor applications only.
- Regularly clean the fan filter.

4-2. Mounting Unit

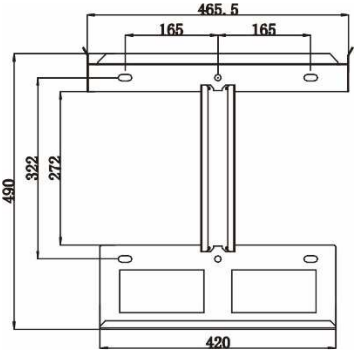
WARNING!! Remember that this inverter is heavy! Please be carefully when lifting out from the package.

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

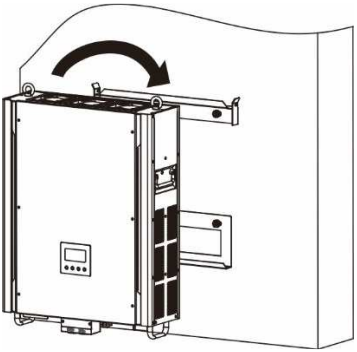
The inverter only can be used in a CLOSED ELECTRICAL OPERATING AREA. Only service person can enter into this area.

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

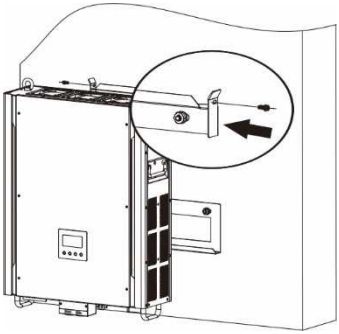
1. Drill six holes in the marked locations with supplied six screws. The reference tightening torque is 35 N.m.



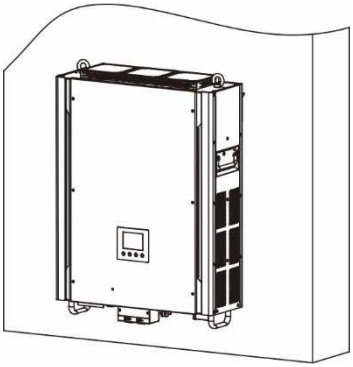
2. Raise the inverter and place it over the mounting plate.



3. Fix the inverter in position by screwing the supplied two screws (M4*12) located on the top two sides of the inverter.



4. Check if the inverter is firmly secured.



5. Grid (Utility) Connection

5-1. Preparation

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

NOTE2: The inverter is built in a 63A/400V breaker to protect the inverter from AC power damage.

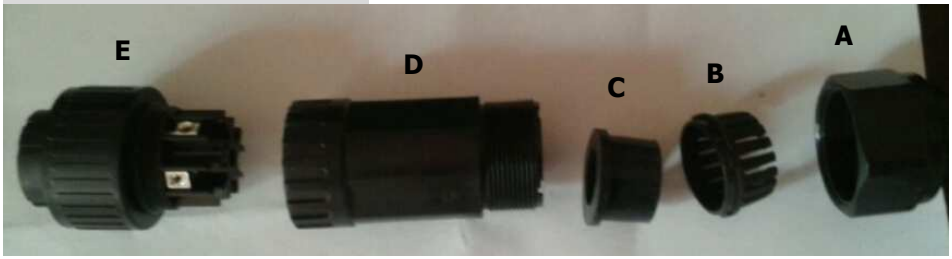
WARNING! It's very important for system safety and efficient operation to use appropriate cable for grid (utility) connection. To reduce risk of injury, please use the proper recommended cable size as below.

Suggested cable requirement for AC wire

Nominal Grid Voltage	230VAC per phase
Conductor cross-section (mm^2)	10-16
AWG no.	8-6

5-2. Connecting to the AC Utility

Overview of AC Connection Socket



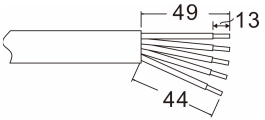
Component	Description
A	Pressure dome
B	Clip
C	Sealing nut
D	Protective element
E	Socket element

Step 1: Check the grid voltage and frequency with an AC voltmeter. It should be the same to "VAC" value on the product label.

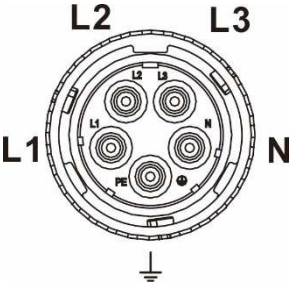
Step 2: Turn off the circuit breaker.

Step 3: Remove insulation sleeve 13 mm for five conductors.

Step 4: Thread the five cables through pressure dome (A), clip (B), sealing nut (C) and protective element (D) in sequence.

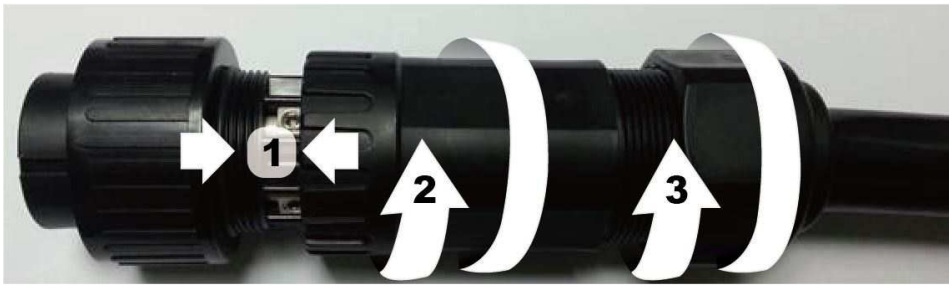


Step 5: Thread five cables through socket element (E) according to polarities indicated on it and tighten the screws to fix wires after connection.

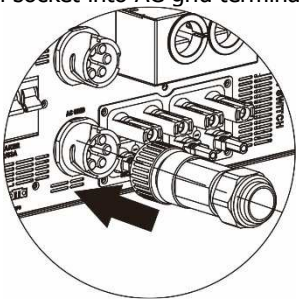


L1→ LINE 1 (Black)
L2→ LINE 2 (Grey)
L→ LINE 3 (Brown)
⏚→ Ground (Yellow-Green)
N→ Neutral (Blue)

The reference tightening torque is 1.5-2.5 N.m.
Step 6: Push protective dome (D) on to socket element (E) until both are locked tightly. Then, twist protective element (D) and pressure dome (A) so that all cables are firmly connected.



Step 7: Plug the AC connection socket into AC grid terminal of the inverter.



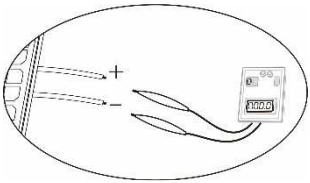
CAUTION: To prevent risk of electric shock, ensure the ground wire is properly earthed before operating this hybrid inverter no matter the grid is connected or not.

6. 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 three types of PV modules are acceptable: single crystalline and poly crystalline with class A-rated and CIGS modules. 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. When using CIGS modules, please be sure NOT grounding.
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 350VDC - 900VDC. This system is only applied with two strings of PV array. Please make sure that the maximum current load of each PV input connector is 18.6A.



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

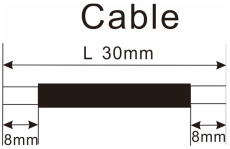
Step 2: Disconnect the circuit breaker and switch off the DC switch.

Step 3: Assemble provided PV connectors with PV modules by the following below steps.
Components for PV connectors and Tools:

Female connector housing	
Female terminal	
Male connector housing	
Male terminal	

Crimping tool and spanner	

Cable preparation and connector assembly process:



Strip one cable 8 mm on both end sides and be careful NOT to nick conductors.

Insert striped cable into female terminal and crimp female terminal as shown below charts.



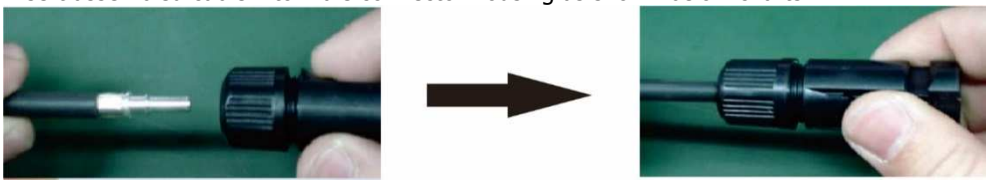
Insert assembled cable into female connector housing as shown below charts.



Insert striped cable into male terminal and crimp male terminal as shown below charts.



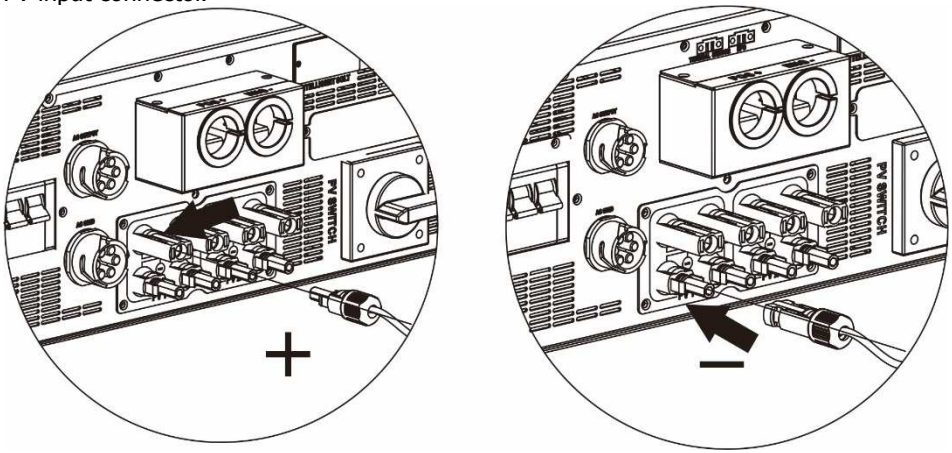
Insert assembled cable into male connector housing as shown below charts.



Then, use spanner to screw pressure dome tightly to female connector and male connector as shown below.



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

Solar Panel Spec. (reference) - 250Wp - Vmp: 36.7Vdc - Imp: 6.818A - Voc: 44Vdc - Isc: 7.636A - Cells: 72	**SOLAR INPUT 1**	**SOLAR INPUT 2**	**Q'ty of panels**	**Total Input Power**
	(Min in serial: 11pcs; Max. in serial: 18pcs)			
	11pcs in serial	x	11pcs	2750W
	x	11pcs in serial	11pcs	2750W
	11pcs in serial	11pcs in serial	22pcs	5500W
	11pcs in serial, 2 parallel	x	22pcs	5500W
	x	11pcs in serial, 2 parallel	22pcs	5500W
	18pcs in serial	18pcs in serial	36pcs	9000W
	14pcs in serial, 2 parallel	14pcs in serial	42pcs	10500W
	18pcs in serial, 2 parallel	18pcs in serial	54pcs	13500W
	15pcs in serial, 2 parallel	15pcs in serial, 2 parallel	60pcs	15000W

7. 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.

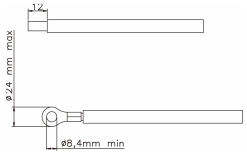
NOTE2: Please use 60VDC/300A circuit breaker.

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

Please follow below steps to implement battery connection:

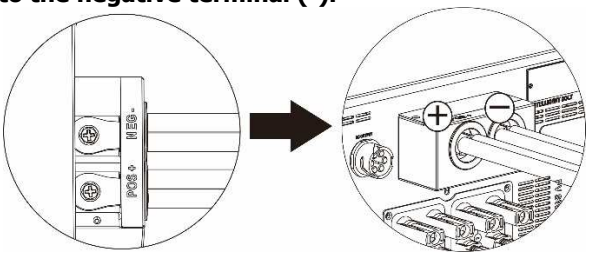
Step 1: Check the nominal voltage of batteries. The nominal input voltage for inverter is 48VDC.

Step 2: Use two battery cables. Remove insulation sleeve 12 mm and insert conductor into cable ring terminal. Refer to right chart.



Step 3: Remove battery cover and follow battery polarity guide printed near the battery terminal! Place the external battery cable ring terminal over the battery terminal.

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 2.04 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)

8. Load (AC Output) Connection

8-1. Preparation

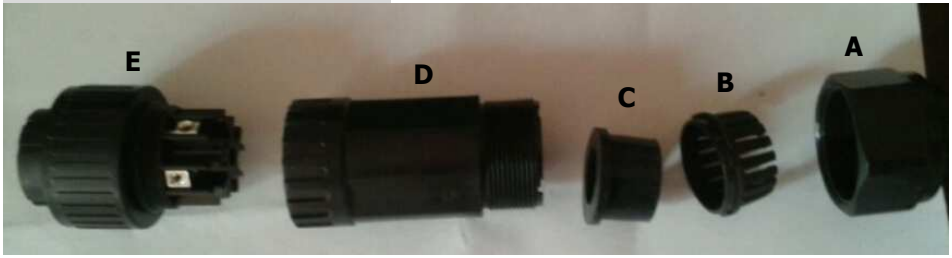
CAUTION: To prevent further supply to the load via the inverter during any mode of operation, an additional disconnection device should be placed on in the building wiring installation.

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	208/220/230/240 VAC per phase
Conductor cross-section (mm^2)	5.5-10
AWG no.	10-8

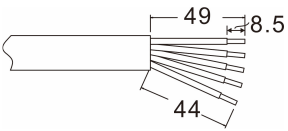
8-2. Connecting to the AC output

Overview of Load Connection Socket

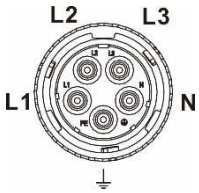


Component	Description
A	Pressure dome
B	Clip
C	Sealing nut
D	Protective element
E	Socket element

Step 1: Remove insulation sleeve 8.5 mm for five conductors.
Step 2: Thread the five cables through pressure dome (A), clip (B), sealing nut (C) and protective element (D) in sequence.



Step 3: Thread five cables through socket element (E) according to polarities indicated on it and tighten the screws to fix wires after connection.

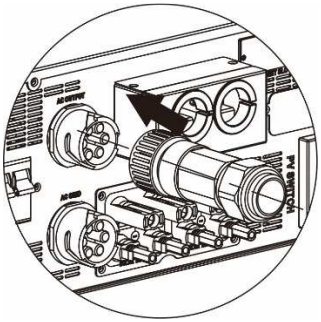


L1→ LINE 1 (Black)
L2→ LINE 2 (Grey)
L→ LINE 3 (Brown)
⏚→ Ground (Yellow-Green)
N→ Neutral (Blue)
The reference tightening torque is 1.0-1.5 N.m.

Step 4: Push protective dome (D) on to socket element (E) until both are locked tightly. Then, twist protective element (D) and pressure dome (A) so that all cables are firmly connected.



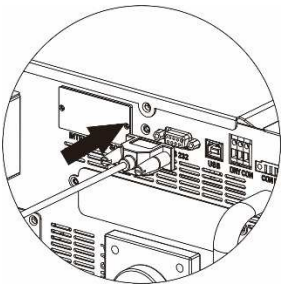
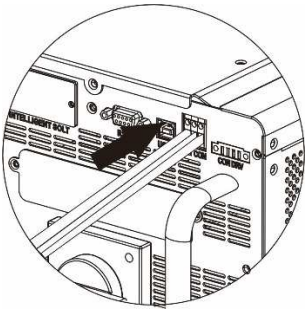
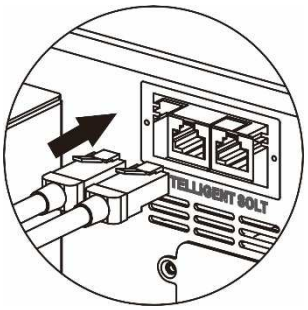
Step 5: Plug the socket into the terminal.



CAUTION: It's only allowed to connect load to "AC Output Connector". Do NOT connect the utility to "AC Output Connector".
CAUTION: Be sure to connect L terminal of load to L terminal of "AC Output Connector" and N terminal of load to N terminal of "AC Output Connector". The G terminal of "AC Output Connector" is connected to grounding of the load. Do NOT mis-connect.

9. Communication

The inverter is equipped with several communication ports and it is also equipped with a slot for alternative communication interfaces in order to communicate with a PC with corresponding software. This intelligent slot is suitable to install with SNMP card and Modbus card. Follow below procedure to connect communication wiring and install the software.

For RS232 port, you should use a DB9 cable as follows:	For USB port, you should use a USB cable as follows:
	
For Dry contact port, please remove insulation sleeve 8 mm for three conductors and insert three cables into ports	For SNMP or MODBUS card, you should use RJ45 cables as follows:
	

Please install monitoring software in your computer. Detailed information is listed in the next chapter. After software is installed, you may initial the monitoring software and extract data through communication port.

10. Dry Contact Signal

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

10-1. Electric Parameter

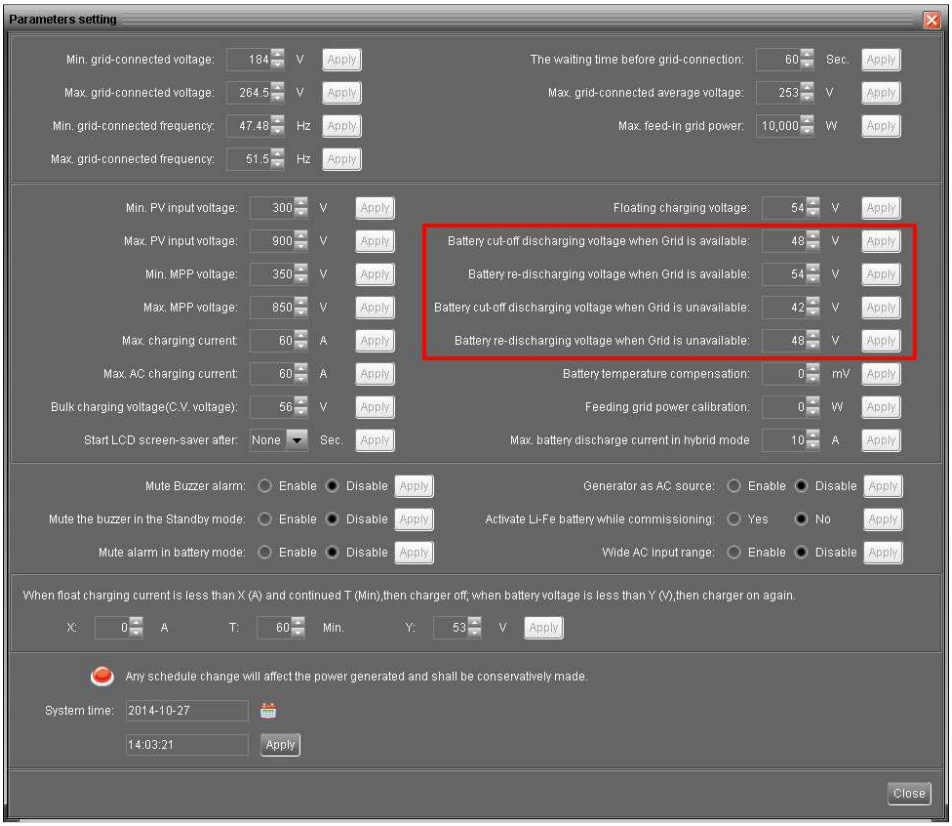
Parameter	Symbol	Max.	Unit
Relay DC voltage	Vdc	30	V
Relay DC current	Idc	1	A

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

10-2. Function Description

Unit Status	Condition	Dry contact port: 	
		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

You can set the related parameters in software. Refer to below chart:

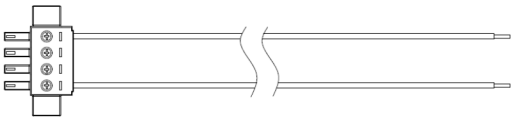

Parameters setting
Min. grid-connected voltage: 184 V Apply
Max. grid-connected voltage: 264.5 V Apply
Min. grid-connected frequency: 47.48 Hz Apply
Max. grid-connected frequency: 51.5 Hz Apply
The waiting time before grid-connection: 60 Sec. Apply
Max. grid-connected average voltage: 253 V Apply
Max. feed-in grid power: 10,000 W Apply
Min. PV input voltage: 300 V Apply
Max. PV input voltage: 900 V Apply
Min. MPP voltage: 350 V Apply
Max. MPP voltage: 850 V Apply
Max. charging current: 60 A Apply
Max. AC charging current: 60 A Apply
Bulk charging voltage(C.V. voltage): 56 V Apply
Start LCD screen-saver after: None Sec. Apply
Floating charging voltage: 54 V Apply
Battery cut-off discharging voltage when Grid is available: 48 V Apply
Battery re-discharging voltage when Grid is available: 54 V Apply
Battery cut-off discharging voltage when Grid is unavailable: 42 V Apply
Battery re-discharging voltage when Grid is unavailable: 48 V Apply
Battery temperature compensation: 0 mV Apply
Feeding grid power calibration: 0 W Apply
Max. battery discharge current in hybrid mode 10 A Apply
Mute Buzzer alarm: Enable Disable Apply
Mute the buzzer in the Standby mode: Enable Disable Apply
Mute alarm in battery mode: Enable Disable Apply
Generator as AC source: Enable Disable Apply
Activate Li-Fe battery while commissioning: Yes No Apply
Wide AC input range: Enable Disable Apply
When float charging current is less than X (A) and continued T (Min),then charger off; when battery voltage is less than Y (V),then charger on again.
X: 0 A T: 60 Min. Y: 53 V Apply
Any schedule change will affect the power generated and shall be conservatively made.
System time: 2014-10-27
14:03:21
Apply
Close

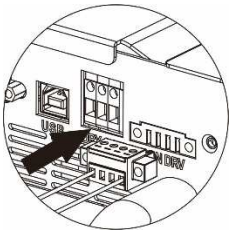
11. Relay Control Port

This port is available to provide a power source (230V/8A) to trigger external relay. This function is only valid for **Grid-tie with backup II** mode.

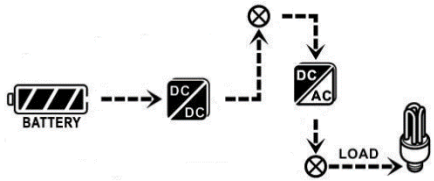
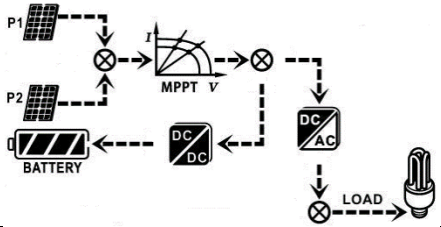
11-1. Interface Configuration

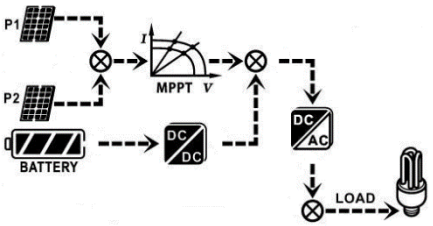
There are four pins on this port. However, only Pin 1 and Pin 4 are worktable. Please use supplied cables to connect Pin 1 and Pin 4 shown as below charts.





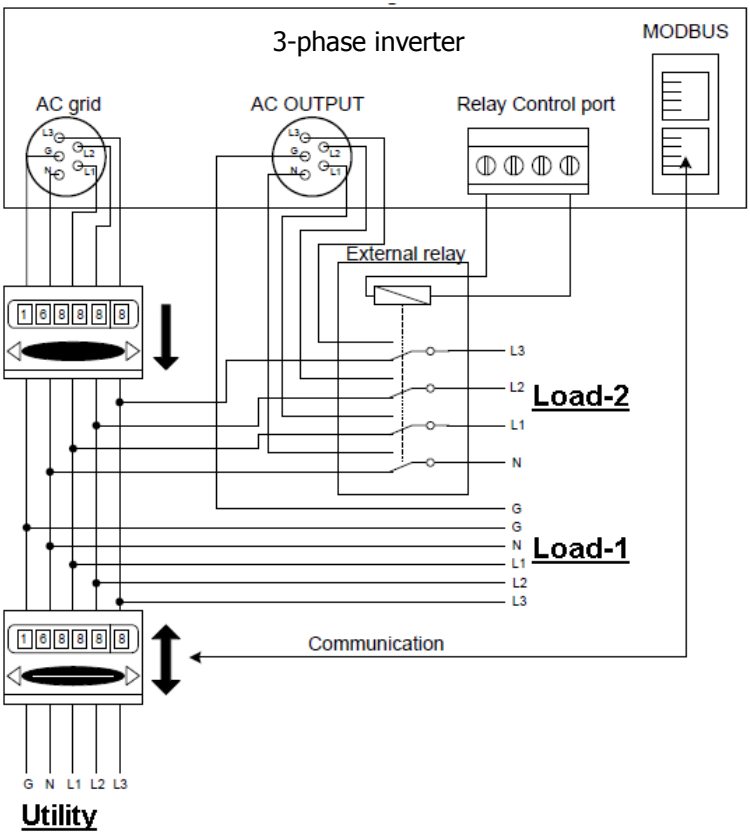
11-2. Function Description

Unit status	Condition	Output voltage from relay control port
Power Off	Unit is off and no output is powered.	0V
Power On	When the unit is working at inverter mode and grid is not available. **Condition 1:**  **Condition 2:** 	230V

Power on	**Condition 3:** 	230V
	When the unit is not working at inverter mode or grid is available.	0V

11-3. Application

Below chart is recommended circuit wiring.

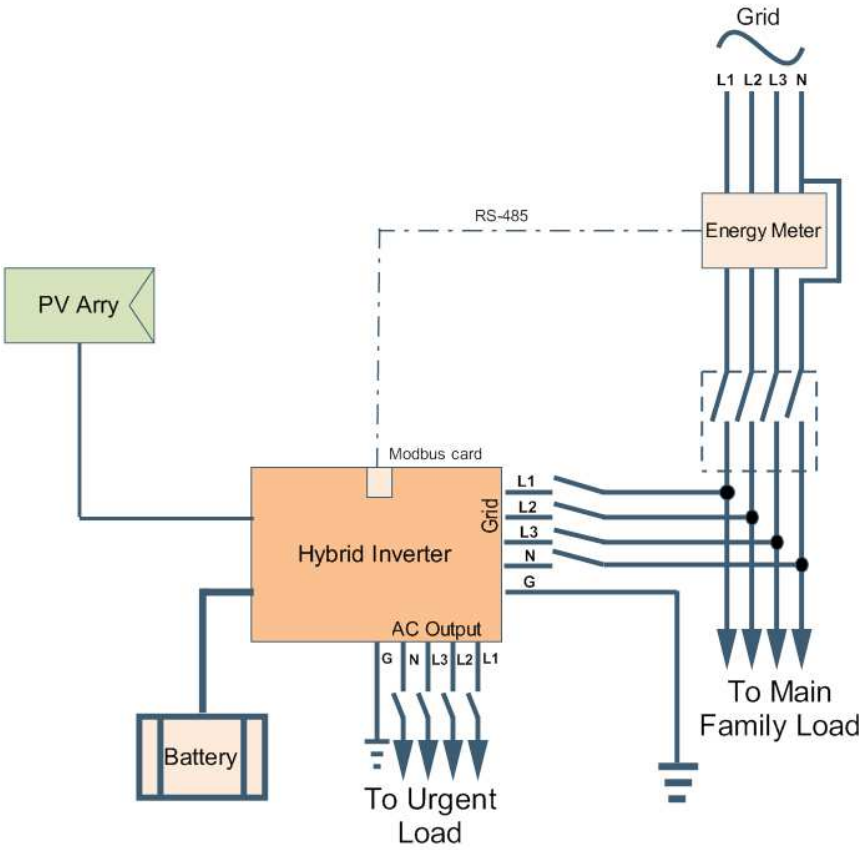


12. Application with Energy Meter

With Modbus card II and energy meter, hybrid inverter can be easily integrated into the existing household system. For details please refer to Modbus card II manual.

Note: this application is only valid for **Grid-Tie with Backup II** mode.

Equipped with Modbus card II, hybrid inverter is connected to energy meter with RS485 communication port. It's to arrange self-consumption via Modbus card to control power generation and battery charging of the inverter.



13. Commissioning

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.

Step 3: Please insert CD into your computer and install monitoring software in your PC. Follow below steps to install software.

1. Follow the on-screen instructions to install the software.
2. When your computer restarts, the monitoring software will appear as shortcut icon located in the system tray, near the clock.

NOTE: If using modbus card as communication interface, please install bundled software. Check local dealer for the details.

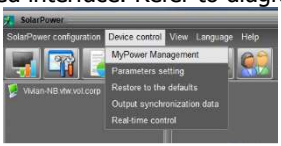
14. Initial Setup

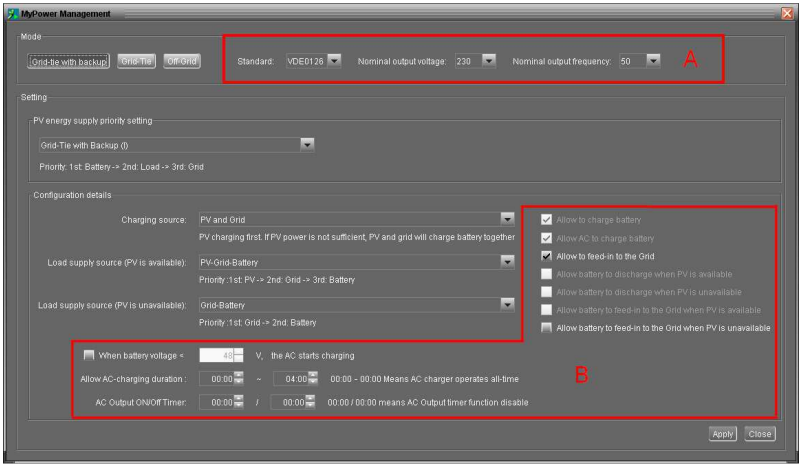
Before inverter operation, it's required to set up "Operation Mode" via software. Please strictly follow below steps to set up. For more details, please check software manual.

Step 1: After turning on the inverter and installing the software, please click "Open Monitor" to enter main screen of this software.

Step 2: Log in into software first by entering default password "administrator".

Step 3: Select Device Control>>MyPower Management. It is to set up inverter operation mode and personalized interface. Refer to diagram below.





Mode

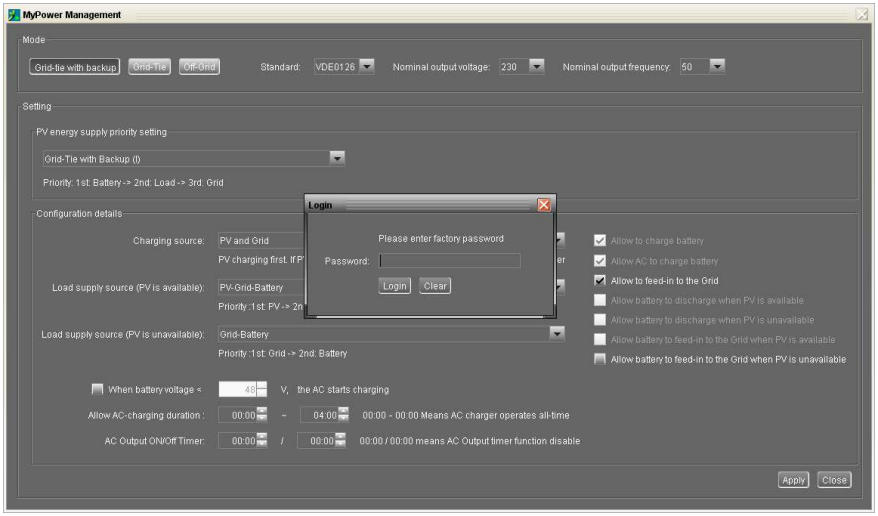
There are three operation modes: Grid-tie with backup, Grid-Tie and Off-Grid.

- Grid-tie with backup: PV power can feed-in back to grid, provide power to the load and charge battery. There are four options available in this mode: Grid-tie with backup I, II, III and IV. In this mode, users can configure *PV power supply priority, charging source priority and load supply source priority.* However, when Grid-tie with backup IV option is selected in PV energy supply priority, the inverter is only operated between two working logics based on defined peak time and off-peak time of electricity. Only peak time and off-peak time of electricity are able to set up for optimized electricity usage.
- Grid-Tie: PV power only can feed-in back to grid.
- Off-Grid: PV power only provides power to the load and charge battery. No feed-in back to grid is allowed.

SECTION A:

Standard: It will list local grid standard. It's requested to have factory password to make any modifications. Please check local dealer only when this standard change is requested.

CAUTION: Wrong setting could cause the unit damage or not working.



Nominal Output Voltage: 230V.

Nominal Output Frequency: 50HZ.

SECTION B:

This section contents may be different based on different selected types of operations.

Allow AC charging duration: It's a period time to allow AC (grid) to charge battery. When the duration is set up as 0:00-00:00, it means no time limitation for AC to charge battery.

AC output ON/Off Timer: Set up on/off time for AC output of inverter. If setting it as 00:00/00:00, this function is disabled.

Allow to charge battery: This option is automatically determined by setting in "Charging source". It's not allowed to modify here. When "NONE" is selected in charging source section, this option becomes unchecked as grey text.
Allow AC to charge battery: This option is automatically determined by setting in "Charging source". It's not allowed to modify here. When "Grid and PV" or "Grid or PV" is selected in charging source section, this option is default selected. Under Grid-tie mode, this option is invalid.

Allow to feed-in to the Grid: This option is only valid under Grid-tie and Grid-tie with backup modes. Users can decide if this inverter can feed-in to the grid.

Allow battery to discharge when PV is available: This option is automatically determined by setting in "Load supply source (PV is available)". When "Battery" is higher priority than "Grid" in Load supply source (PV is available), this option is default selected. Under Grid-tie, this option is invalid.

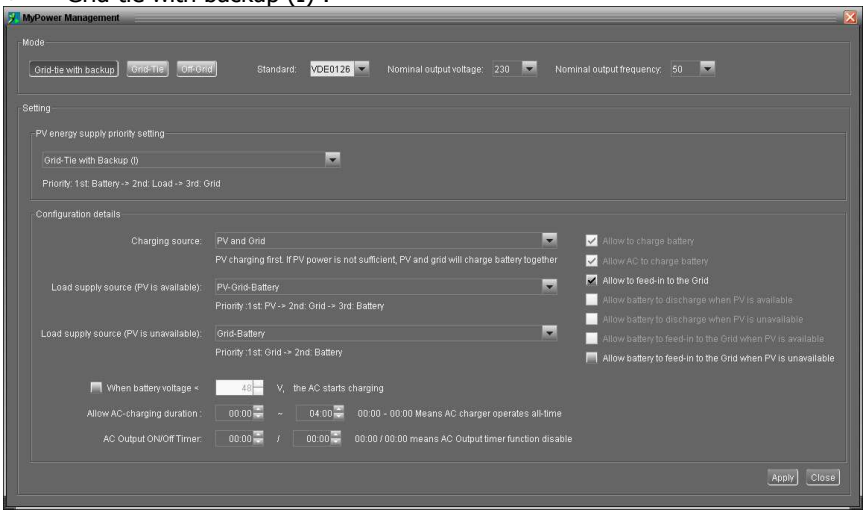
Allow battery to discharge when PV is unavailable: This option is automatically determined by setting in "Load supply source (PV is unavailable)". When "Battery" is higher priority than "Grid" in Load supply source (PV is unavailable), this option is default selected. Under Grid-tie mode, this option is invalid.

Allow battery to feed-in to the Grid when PV is available: This option is only valid in Grid-tie with backup II or Grid-tie with backup III modes.

Allow battery to feed-in to the Grid when PV is unavailable: This option is only valid in all options of Grid-tie with backup mode.

Grid-tie with backup

- Grid-tie with backup (I) :



PV energy supply priority setting: 1st Battery, 2nd Load and 3rd 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.
Battery charging source:

1. PV and Grid (Default)

It's allowed to charge battery from PV power first. If it's not sufficient, grid will charge battery.

2. PV only

It is only allow PV power to charge battery.

3. None

It is not allowed to charge battery no matter it's from PV power or grid.

Load supply source:

When PV power is available: 1st PV, 2nd Grid, 3rd Battery

If battery is not fully charged, PV power will charge battery first. And remaining PV power will provide power to the load. 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.

When PV power is not available:

1. 1st Grid, 2nd Battery (Default)

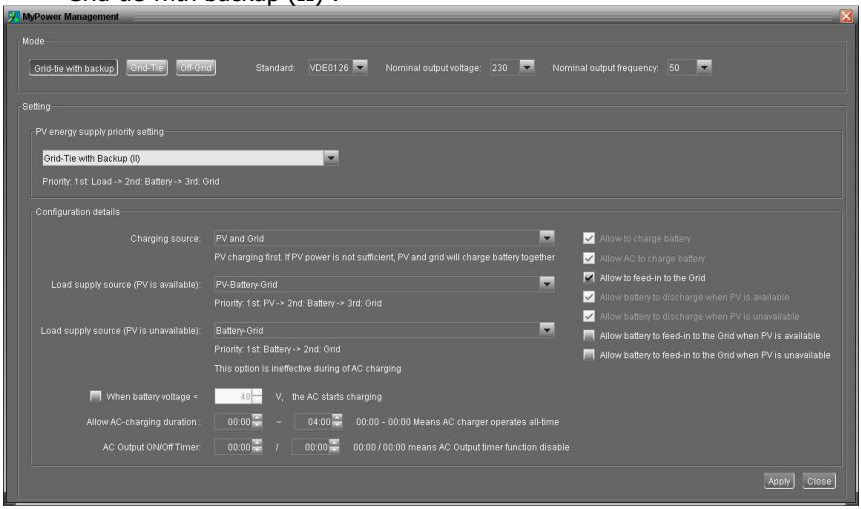
Grid will provide power to the load at first. If grid is not available, battery power will provide power backup.

2. 1st Battery, 2nd Grid

Battery power will provide power to the load at first. If battery power is running out, grid will back up the load.

NOTE: This option will become ineffective during AC charging time and the priority will automatically become 1st Grid and 2nd Battery order. Otherwise, it will cause battery damage.

- Grid-tie with backup (II) :



PV energy supply priority setting: 1st Load, 2nd Battery and 3rd 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.

Battery charging source:

1. PV and Grid

It's allowed to charge battery from PV power first. If it's not sufficient, grid will charge battery.

2. PV only

It is only allow PV power to charge battery.

3. None

It is not allowed to charge battery no matter it's PV power or grid.

Load supply source:

When PV power is available:

1. 1st PV, 2nd Battery, 3rd 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.

2. 1st PV, 2nd Grid, 3rd Battery

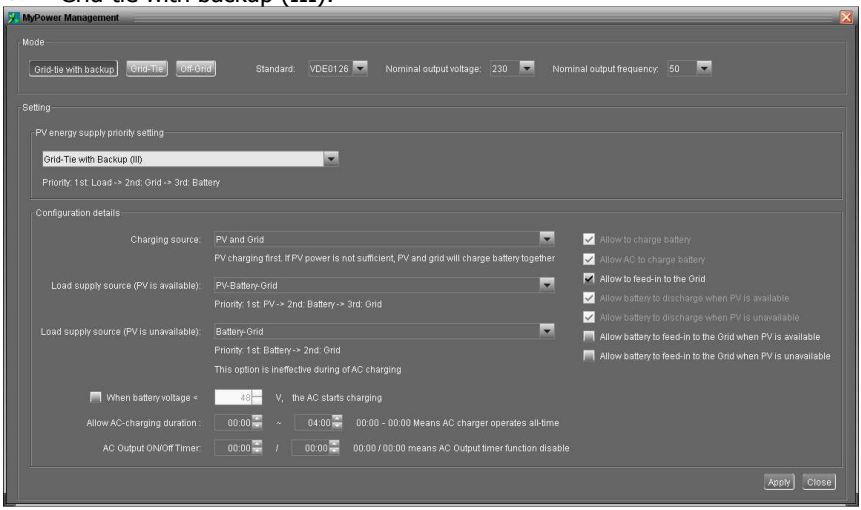
PV power will provide power to the load first. If it's not sufficient, grid will provide power to the load. If grid is not available at the same time, battery power will back up.

When PV power is not available:

1. 1st Grid, 2nd Battery: Grid will provide power to the load at first. If grid is not available, battery power will provide power backup.
2. 1st Battery, 2nd Grid: Battery power will provide power to the load at first. If battery power is running out, grid will back up the load

NOTE: This option will become ineffective during AC charging time and the priority will automatically become 1st Grid and 2nd Battery order. Otherwise, it will cause battery damage.

- Grid-tie with backup (III):



PV energy supply priority setting: 1st Load, 2nd Grid and 3rd 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.

NOTE: The max. feed-in grid power setting is available in parameter setting. Please refer to software manual.

Battery charging source:

1. PV and Grid: It's allowed to charge battery from PV power first. If it's not sufficient, grid will charge battery.
2. PV only: It is only allow PV power to charge battery.
3. None: It is not allowed to charge battery no matter it's PV power or grid.

Load supply source:

When PV power is available:

1. 1st PV, 2nd Battery, 3rd 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.

2. 1st PV, 2nd Grid, 3rd Battery

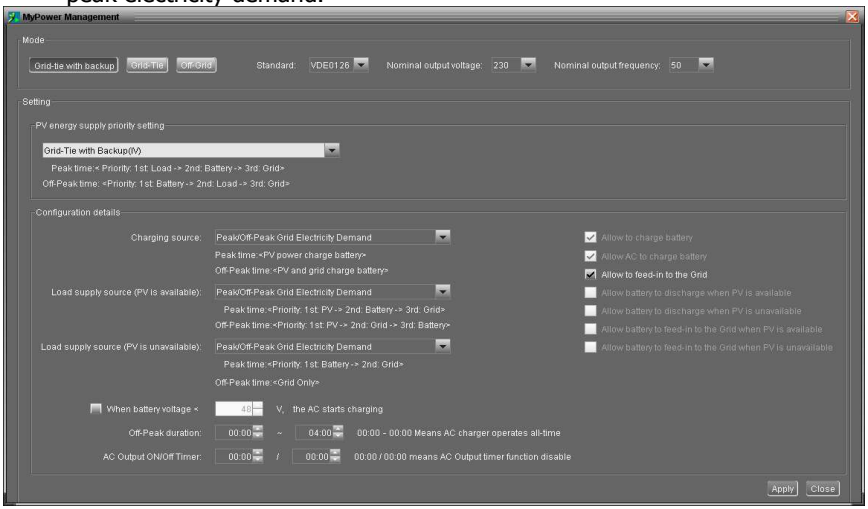
PV power will provide power to the load first. If it's not sufficient, grid will provide power to the load. If grid is not available at the same time, battery power will back up.

When PV power is not available:

1. 1st Grid, 2nd Battery: Grid will provide power to the load at first. If grid is not available, battery power will provide power backup.
2. 1st Battery, 2nd Grid: Battery power will provide power to the load at first. If

battery power is running out, grid will back up the load.
NOTE: This option will become ineffective during AC charging time and the priority will automatically become 1st Grid and 2nd Battery order. Otherwise, it will cause battery damage.

- Grid-tie with backup (IV): Users are only allowed to set up peak time and off-peak electricity demand.

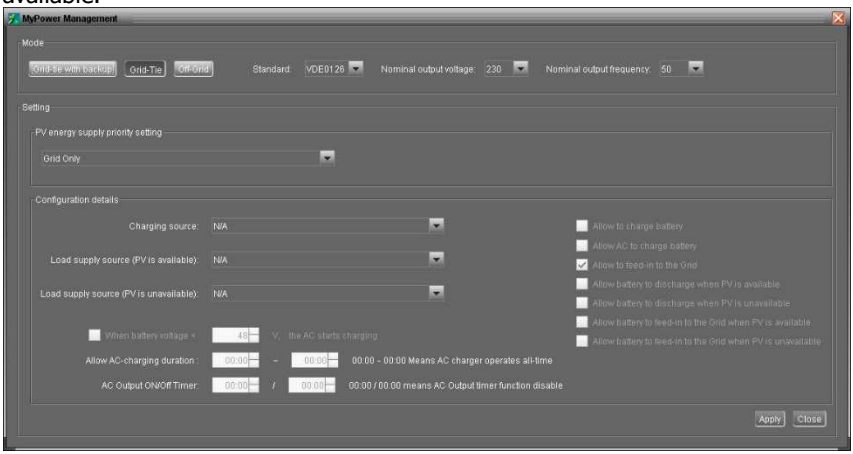


Working logic under peak time:
PV energy supply priority: 1st Load, 2nd Battery and 3rd Grid
PV power will provide power to the load first. If PV power is sufficient, it will charge battery next. If there is remaining PV power left, it will feed-in to the grid. Feed-in to the grid is default disabled.
Battery charging source: PV only
Only after PV power fully supports the load, the remaining PV power is allowed to charge battery during peak time.
Load supply source: 1st PV, 2nd Battery, 3rd Grid
PV power will provide power to the load first. If PV power is not sufficient, battery power will back up the load. If battery power is not available, grid will provide the load. When PV power is not available, battery power will supply the load first. If battery power is running out, grid will back up the load.

Working logic under off-peak time:
PV energy supply priority: 1st Battery, 2nd Load and 3rd Grid
PV power will charge battery first. If PV power is sufficient, it will provide power to the loads. The remaining PV power will feed to the grid.
NOTE: The max. feed-in grid power setting is available in parameter setting. Please refer to software manual.

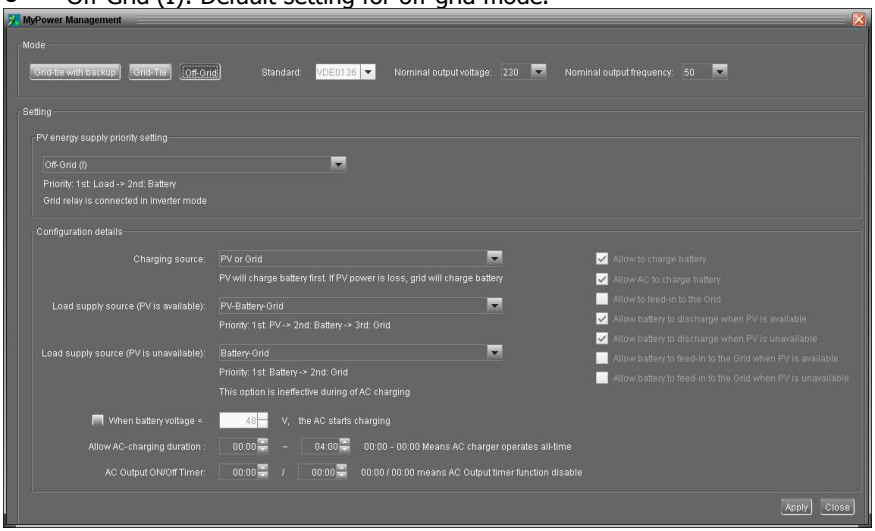
Battery charging source: PV and grid charge battery
PV power will charge battery first during off-peak time. If it's not sufficient, grid will charge battery.
Load supply source: 1st PV, 2nd Grid, 3rd Battery
When battery is fully charged, remaining PV power will provide power to the load first. If PV power is not sufficient, grid will back up the load. If grid power is not available, battery power will provide power to the load.

Grid-Tie
Under this operation mode, PV power only feeds-in to the grid. No priority setting is available.



Off-Grid

- Off-Grid (I): Default setting for off-grid mode.



PV energy supply priority setting: 1st Load, 2nd 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 connected in Inverter mode. That means the transfer time from inverter mode to battery mode will be less than 15ms. Besides, it will avoid overload fault because grid can supply load when connected load is over 10KW.

Battery charging source:

1. PV or Grid: 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. (Default)
2. PV only: It is only allow PV power to charge battery.
3. None: It is not allowed to charge battery no matter it's PV power or grid.

Load supply source:

When PV power is available:

1. 1st PV, 2nd Battery, 3rd Grid (Default)

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.

2. 1st PV, 2nd Grid, 3rd 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.

When PV power is not available:

1. 1st Grid, 2nd Battery

Grid will provide power to the load at first. If grid is not available, battery power will

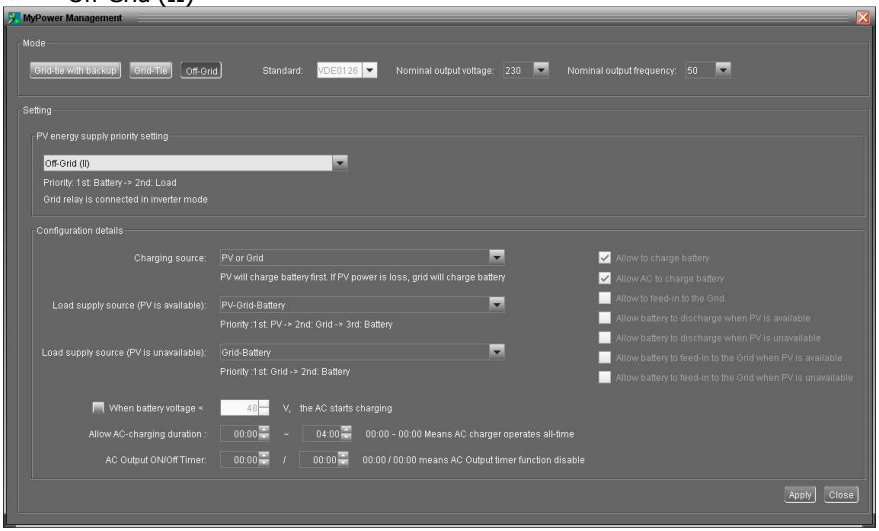
provide power backup.

2. 1st Battery, 2nd Grid (Default)

Battery power will provide power to the load at first. If battery power is running out, grid will back up the load.

NOTE: This option will become ineffective during AC charging time and the priority will automatically become 1st Grid and 2nd Battery order. Otherwise, it will cause battery damage.

- Off-Grid (II)



PV energy supply priority setting: 1st Battery, 2nd 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 in Inverter mode. That means the transfer time from inverter mode to battery mode will be less than 15ms. Besides, it will avoid overload fault because grid can supply load when connected load is over 10KW.

Battery charging source:

1. PV or Grid: 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.
2. PV only: It is only allow PV power to charge battery.
3. None: It is not allowed to charge battery no matter it's PV power or grid.

NOTE: It's allowed to set up AC charging duration.

Load supply source:

When PV power is available: 1st PV, 2nd Grid, 3rd Battery

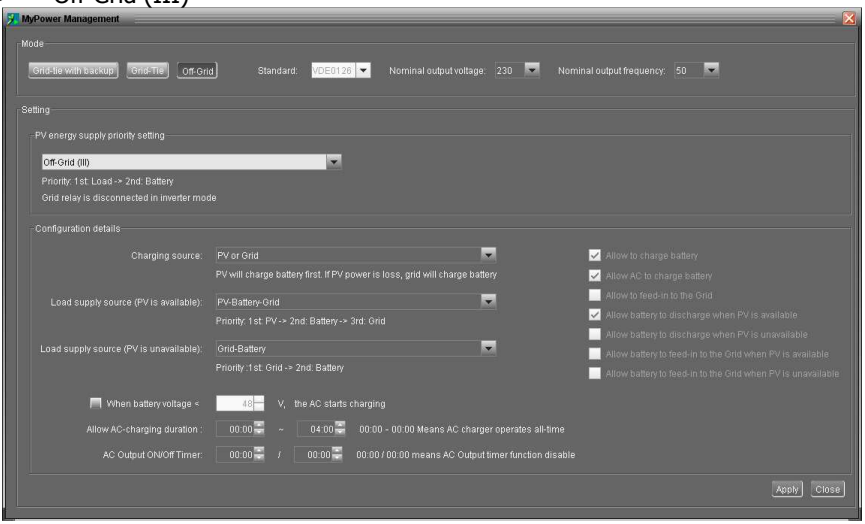
PV power will provide power to the load first. If it's not sufficient, grid will provide power to the load. If grid is not available at the same time, battery power will back up.

When PV power is not available:

1. 1st Grid, 2nd Battery: Grid will provide power to the load at first. If grid is not available, battery power will provide power backup.
2. 1st Battery, 2nd Grid: Battery power will provide power to the load at first. If battery power is running out, grid will back up the load.

NOTE: This option will become ineffective during AC charging time and the priority will automatically become 1st Grid and 2nd Battery order. Otherwise, it will cause battery damage.

- Off-Grid (III)



PV energy supply priority setting: 1st Load, 2nd 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 in Inverter mode. That means the transfer time from inverter mode to battery mode will be about 15ms. If connected load is over 10KW and grid is available, this inverter will allow grid to provide power to the loads and PV power to charge battery. Otherwise, this inverter will activate fault protection.

Battery charging source:

1. PV or Grid: 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.
2. PV only: It is only allow PV power to charge battery.
3. None: It is not allowed to charge battery no matter it's PV power or grid.

NOTE: It's allowed to set up AC charging duration.

Load supply source:

When PV power is available: 1st PV, 2nd Battery, 3rd Grid

PV power will provide power to the load first. If it's not sufficient, battery power will back up the load. Only after battery power is running, Grid will back up the load.

When PV power is not available:

1. 1st Grid, 2nd Battery: Grid will provide power to the load at first. If grid is not available, battery power will provide power backup.
2. 1st Battery, 2nd Grid: Battery power will provide power to the load at first. If battery power is running out, grid will back up the load.

NOTE: This option will become ineffective during AC charging time and the priority will automatically become 1st Grid and 2nd Battery order. Otherwise, it will cause battery damage.

15. Operation

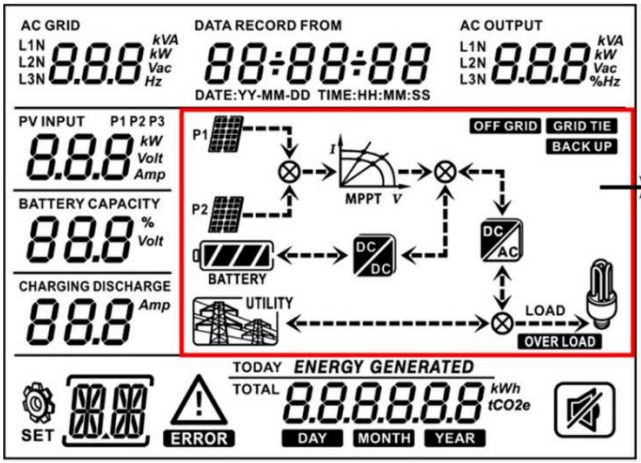
15-1. Interface



This display is operated by four buttons.

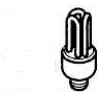
NOTICE: To accurately monitor and calculate the energy generation, please calibrate the timer of this unit via software every one month. For the detailed calibration, please check the user manual of bundled software.

15-2. LCD Information Define



Real-time operation status
Section 12-5 describes all operation conditions when the inverter is set up at "Grid-tie with backup (I)" mode.

Display	Function
	Indicates AC input voltage or frequency. Vac: voltage, Hz: frequency, L1N/L2N/L3N: Line phase
	Indicates AC output power, voltage, frequency, or load percentage. KVA: apparent power, KW: active power, Vac: Voltage, %: Load percentage, Hz: frequency, L1N/L2N/L3N: AC output phase
	Indicates PV input voltage or power. Volt: voltage, KW: power, P1: PV input 1, P2: PV input 2
	Indicates battery voltage or percentage. Volt: voltage, %: percentage

	Indicates charging current to battery or discharging current from battery.
	Indicates that the warning occurs.
	Indicates that the fault occurs.
	Indicates fault code or warning code.
	Indicates date and time, or the date and time users set for querying energy generation.
	Indicates solar panels. Icon flashing indicates PV input voltage or is out of range.
	Indicates utility. Icon flashing indicates utility voltage or frequency is out of range.
	Indicates battery condition. And the lattice of the icon indicates battery capacity.
	Icon  flashing indicates battery is not allowed to discharge.
	Icon  flashing indicates the battery voltage is too low.
	Indicates AC output for loads is enabled and inverter is providing power to the connected loads.
	Indicates AC output for loads is enabled but there is no power provided from inverter. At this time, no battery and the utility are available. Only PV power exists but is not able to provide power to the connected loads.
	Indicates overload.
	Indicates PV energy generated.

15-3. Button Definition

Button	Operation	Function
ENTER/ON	Short press.	Enter query menu.
		If it's in query menu, press this button to confirm selection or entry.
	Press and hold the button for approximately 1 second when the utility is detected or 3 seconds without the utility.	This inverter is able to provide power to connected loads via AC output connector.

ESC/OFF	Short press.	Return to previous menu.
	Press and hold the button until the buzzer continuously sounds.	Turn off power to the loads.
Up	Short press.	Select last selection or increase value.
Down	Short press.	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 pressing any button. When an error occurs, the buzzer will continuously sound. You may press any button to mute it.

15-4. Query Menu Operation

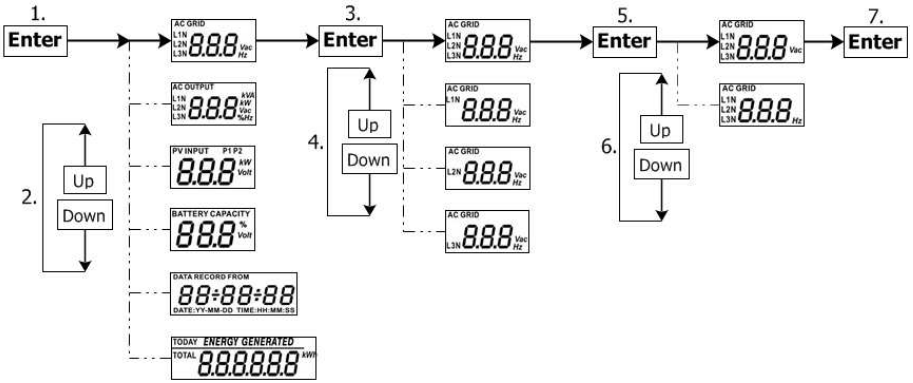
The display shows current contents that have been set. The displayed contents can be changed in query menu via button operation. Press 'Enter' button to enter query menu. There are seven query selections:

- 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.
- Date and time.
- Today or total energy generated.
- Mode of query energy generated.

Setting Display Procedure

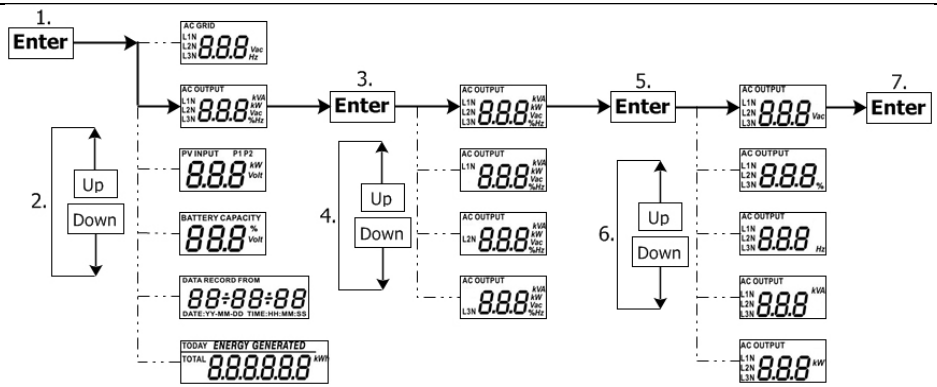
- **Input voltage or frequency of AC input**

Procedure



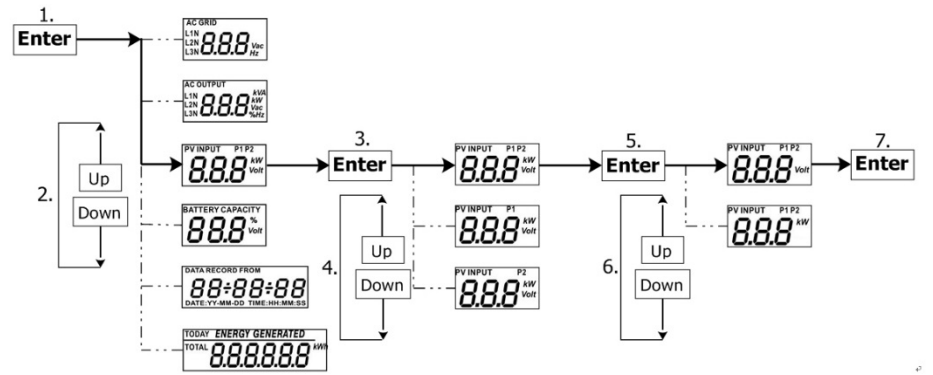
- **Frequency, voltage, power or percentage of AC output**

Procedure



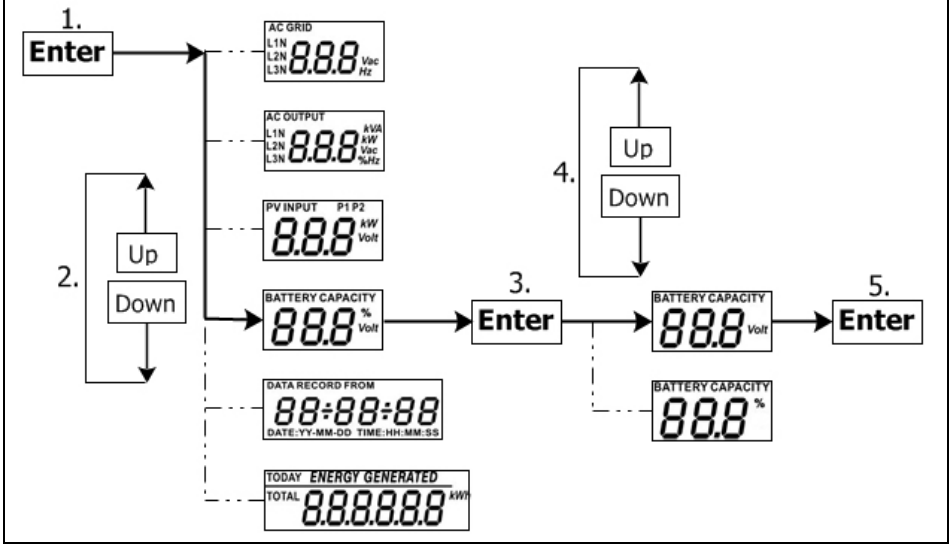
Input voltage or power of PV input.

Procedure



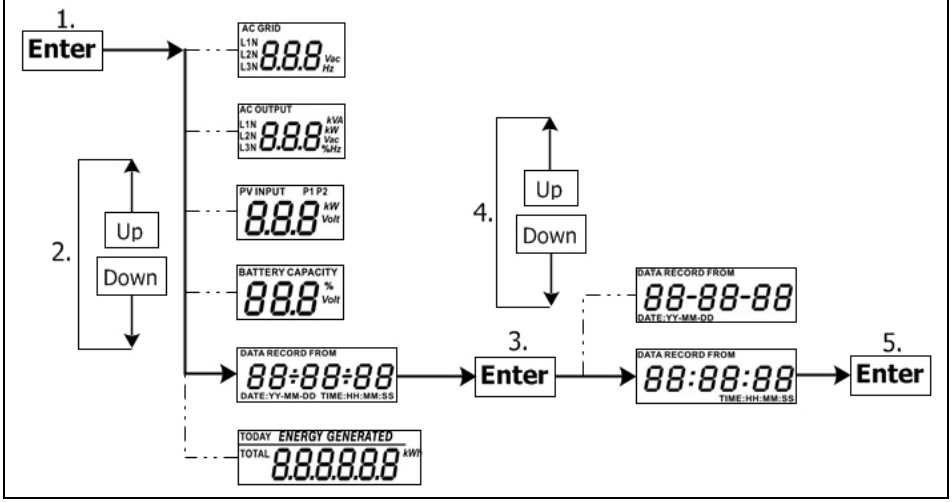
- **Battery voltage or percentage.**

Procedure



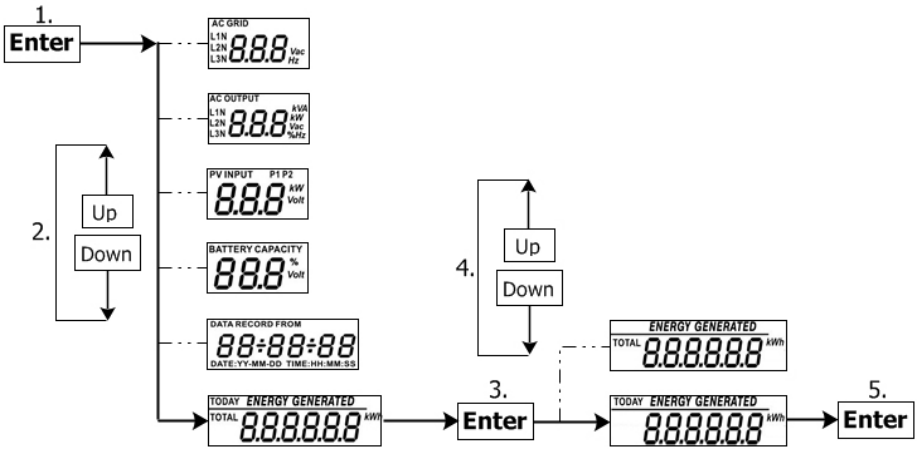
- **Date and time.**

Procedure



- **Today or total energy generated.**

Procedure

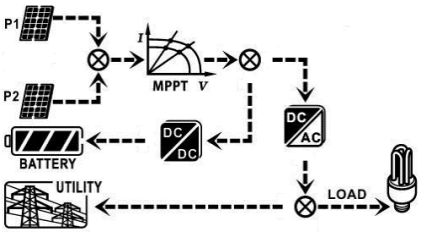
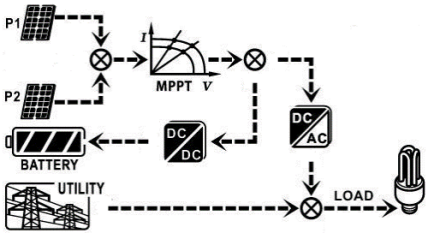


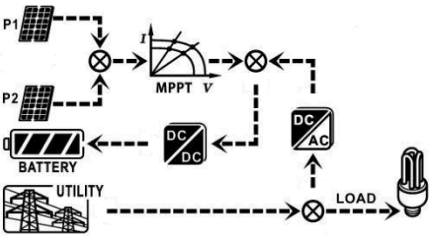
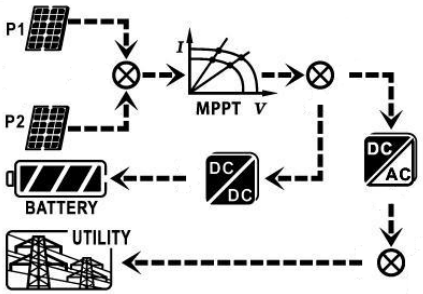
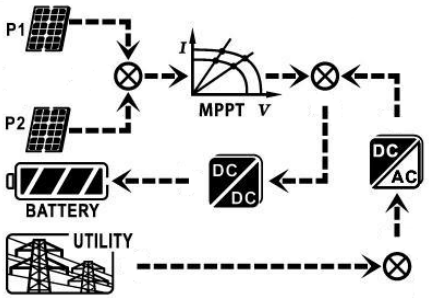
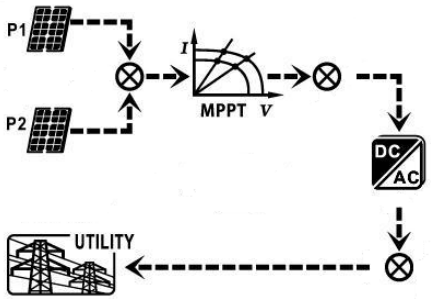
15-5. Operation Mode & Display

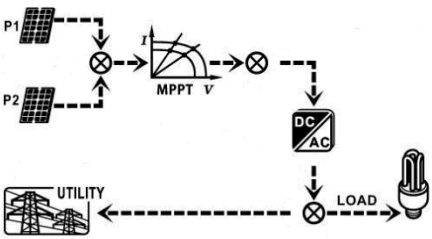
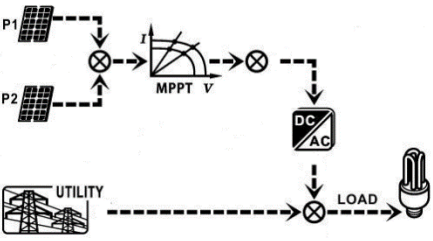
Below is only contained LCD display for **grid-tie with backup mode (I)**. If you need to know other operation mode with LCD display, please check with installer.

Inverter mode with grid connected

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

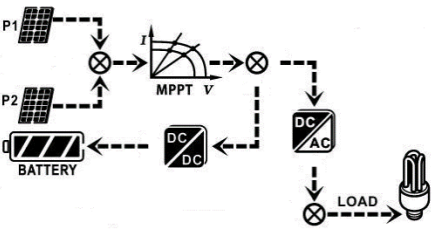
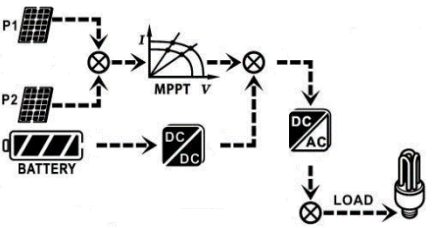
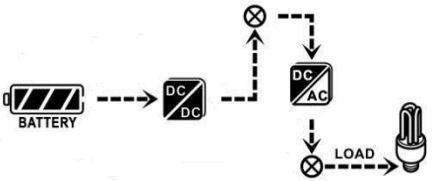
LCD Display	Description
	PV power is sufficient to charge battery, provide power to loads, and then feed in to the grid.
	PV power is sufficient to charge the battery first. However, remaining PV power is not sufficient to back up the load. Therefore, remaining PV power and the utility are supplying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

	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.
	This inverter is disabled to generate power to the loads via AC output. PV power is sufficient to charge battery first. Remaining PV power will feed in back to grid.
	This inverter is disabled to generate power to the loads via AC output. PV power and utility are charging battery at the same time because of insufficient PV power.
	This inverter is disabled to generate power to the loads via AC output. PV power is feeding power back to the grid.

	PV power is sufficient to provide power to loads and feed power back to the grid.
	PV power and utility are providing power to the connected loads because of insufficient PV power.

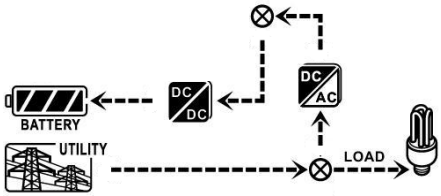
Inverter mode without grid connected

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

LCD Display	Description
	PV power is sufficient to charge battery and provide power to the connected loads.
	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.
	Only battery power is available to provide power to connected loads.

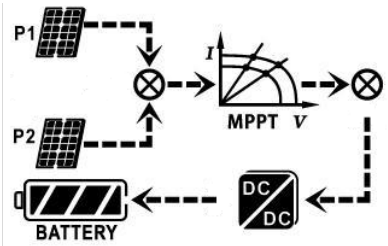
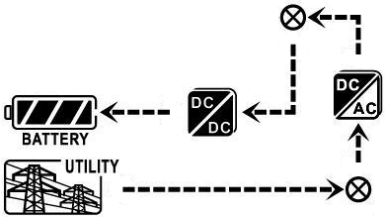
Bypass mode

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

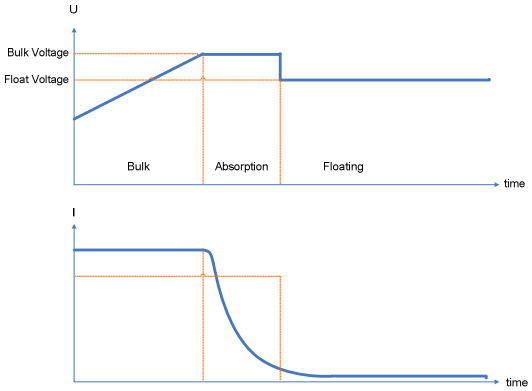
LCD Display	Description
	Only utility is charging battery and providing power to connected loads.
	Only utility is available to provide power to connected loads.

Standby mode :

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

LCD Display	Description
	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.
	This inverter is disabled to generate power to the loads via AC output. PV power is not detected or available at this moment. Only utility is available to charge battery.
	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.

16. Charging Management

Charging Parameter	Default Value	Note
Charging current	60A	It can be adjusted via software from 10Amp to 200Amp.
Floating charging voltage (default)	54.0 Vdc	It can be adjusted via software from 50Vac to 60Vdc.
Max. absorption charging voltage (default)	56.0 Vdc	It can be adjusted via software from 50Vac to 60Vdc.
Battery overcharge protection	62.0 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.		

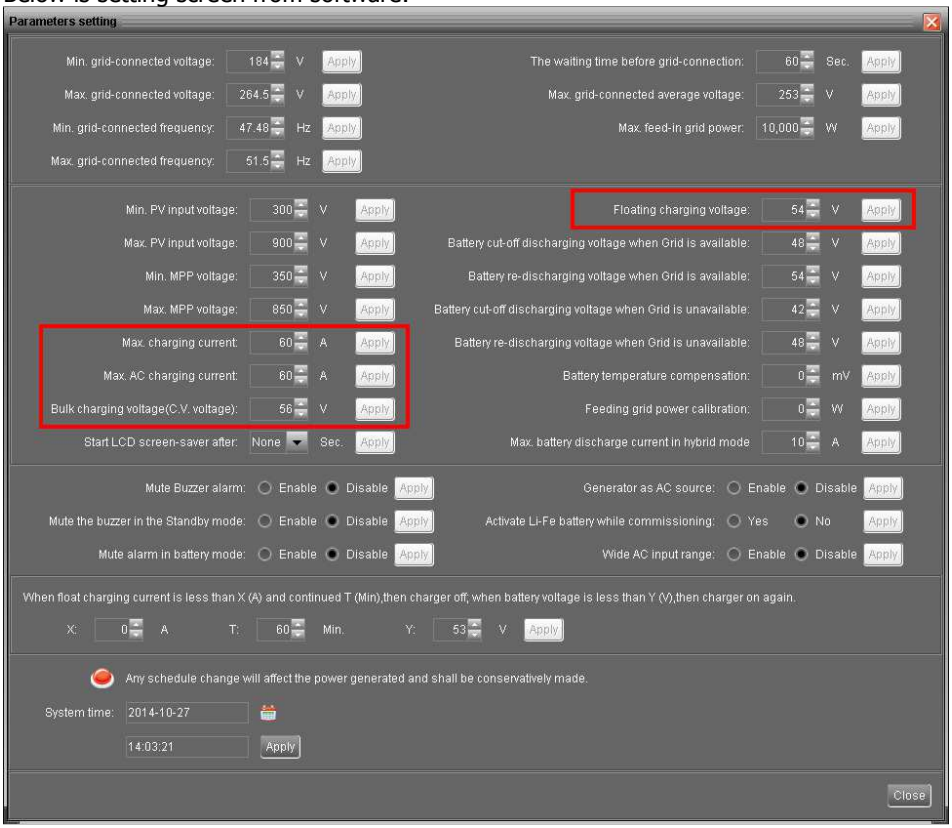
This inverter can connect to battery types of sealed lead acid battery, vented battery, gel battery and lithium battery. The detail installation and maintenance explanations of the external battery pack are provided in the manufacturer's external battery pack of manual.

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

The maximum charging current = Battery capacity (Ah) x 0.2

For example, if you are using 300 Ah battery, then, maximum charging current is 300 x 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.

Below is setting screen from software:



17. 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.

18. Trouble Shooting

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

NOTE: The warning and fault information can be recorded by remote monitoring software.

18-1. Warning List

There are 17 situations defined as warnings. When a warning situation occurs, ⚠ icon will flash and  will display 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.

18-2. Fault Reference Codes

When a fault occurs, the icon ERROR 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 850V.	1. Please check if solar input voltage is higher than 850V. 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 excceds the limit.	1. Check the wire and panels which may cause the leakage. 2. If the error message still remains, please contact your installer.
13	PV ISO fault	The resistance between PV and ground is too low.	
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.
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	INV DC voltage over	Load 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 ouput terminal.
38	Short circuited on PV input	Short circuited on PV input	Please contact your installer.

19. Specifications

MODEL	**SP10K Premium**
RATED POWER	10000 W
PV INPUT (DC)	
Maximum DC Power	14850 W
Nominal DC Voltage	720 VDC
Maximum DC Voltage	900 VDC
Working DC Voltage Range	300 VDC ~ 900 VDC
Start-up Voltage / Initial Feeding Voltage	320 VDC / 350 VDC
MPP Voltage Range / Full Load MPP Voltage Range	350 VDC ~ 850 VDC / 400 VDC ~ 800 VDC
Maximum Input Current	2*18.6 A
Isc PV (absolute maximum)	25 A
Max. inverter back feed current to the array	0 A
GRID OUTPUT (AC)	
Nominal Output Voltage	220 VAC (P-N) / 380 VAC (P-P)
Output Voltage Range	184 - 265 VAC per phase
Output Frequency Range	47.5 ~ 51.5 Hz or 59.3~ 60.5Hz
Nominal Output Current	14.5 A per phase
Inrush Current/Duration	17 A per phase / 20ms
Maximum Output Fault Current/Duration	51 A per phase / 1ms
Maximum output Overcurrent Protection	51 A per phase
Power Factor Range	0.9 lead – 0.9 lag
AC INPUT	
AC Start-up Voltage	120-140 VAC per phase
Auto Restart Voltage	180 VAC per phase
Acceptable Input Voltage Range	170 - 280 VAC per phase
Nominal Frequency	50 Hz / 60 Hz
AC Input Power	10000VA/10000W
Maximum AC Input Current	40 A
Inrush Input Current	40 A / 1ms
BATTERY MODE OUTPUT (AC)	
Nominal Output Voltage	220 VAC (P-N) / 380 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 – 60 VDC
Nominal DC Voltage	48 VDC
Maximum Battery Discharging Current	275 A
Maximum Charging Current	200 A

GENERAL	
PHYSICAL	
Dimension, D X W X H (mm)	622 x 500 x 167.2
Net Weight (kgs)	45
INTERACE	
Communication Port	RS-232/USB
Intelligent Slot	Optional SNMP, Modbus and AS-400 cards available
ENVIRONMENT	
Protective Class	I
Ingress Protection Rating	IP20
Humidity	0 ~ 90% RH (No condensing)
Operating Temperature	-10 to 55°C (Power derating above 50°C)
Altitude	Max. 2000m*

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

Appendix I: Parallel Installation Guide

1. Introduction

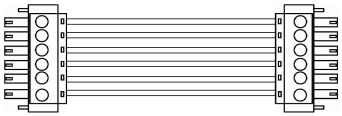
This inverter can be used in parallel with maximum 3 units. The supported maximum output power is 30KW/30KVA.

2. Parallel cable

You will find the following items in the package:

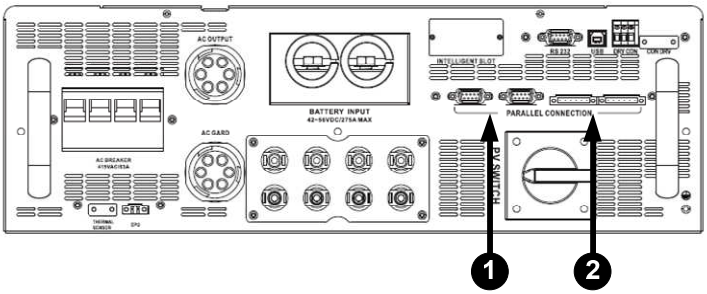


Parallel communication cable



Current sharing cable

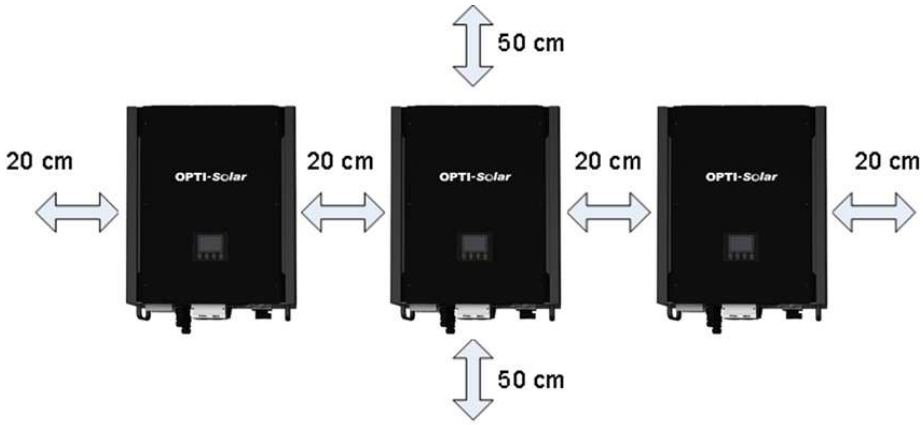
3. Overview



1. Parallel communication port
2. Current sharing port

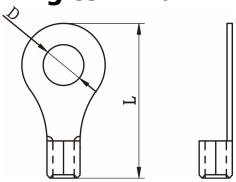
4. Mounting the Unit

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.

Ring terminal:



5. Wiring Connection

The cable size of each inverter is shown as below:

Recommended battery cable and terminal size for each inverter:

Model	Wire Size	Ring Terminal			Torque value
		Cable mm^2	Dimensions		
			D (mm)	L (mm)	
SP10K Premium	3/0	85	8.4	54.2	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:

Model	AWG no.	Conductor cross-section	Torque
SP10K Premium	10~8 AWG	5.5~10 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:

Model	One unit*
SP10K Premium	300A/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
Battery Capacity	800AH	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 800Ah (min)	Backup Time @ 48Vdc 1200Ah (min)
5,000	240	360
10,000	112	168
15,000	60	90
20,000	40	60
25,000	20	30
30,000	13	20

PV Connection

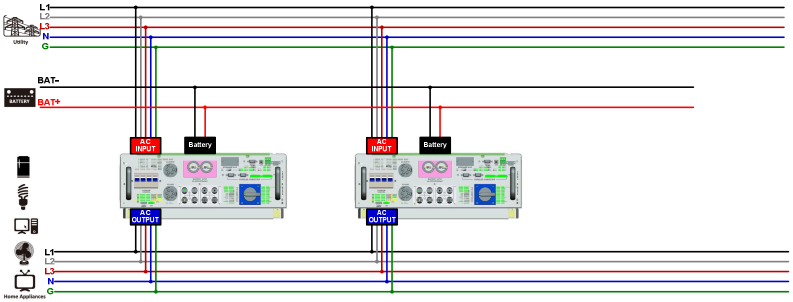
Please refer to user manual of single unit for PV Connection.

CAUTION: Each inverter should connect to PV modules separately.

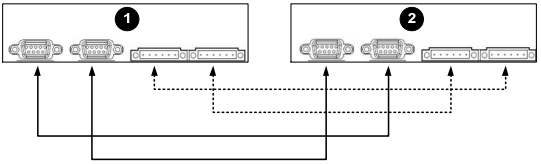
6. Inverters Configuration

Two inverters in parallel:

Power Connection

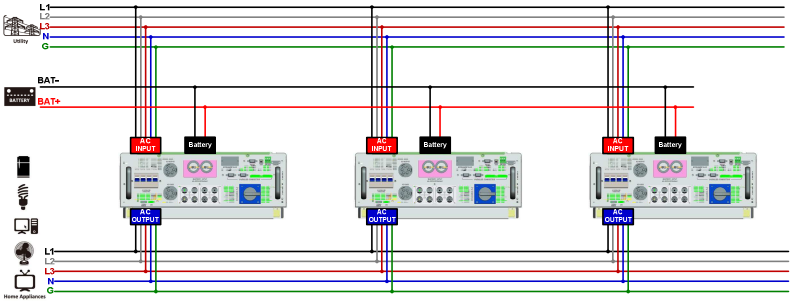


Communication Connection

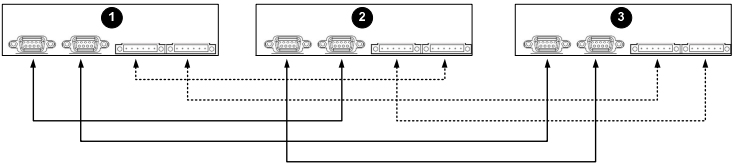


Three inverters in parallel:

Power Connection



Communication Connection



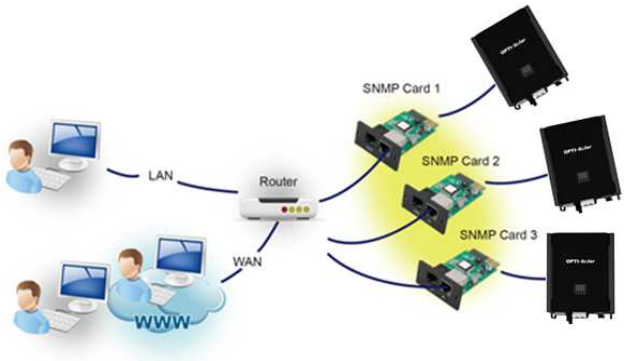
7. Setting and LCD Display

Setting Program:

The parallel function setting is only available by SolarPower. Please install SolarPower in your PC first.
For setting, you can set the inverter one by one through RS232 or USB port. But we suggest to use SNMP or Modbus card to combine the system as a centralized monitoring system. Then, you can use “SYNC” function to set all the inverters at the same time. If using SNMP or Modbus card to set up program, the bundled software is SolarPower Pro.

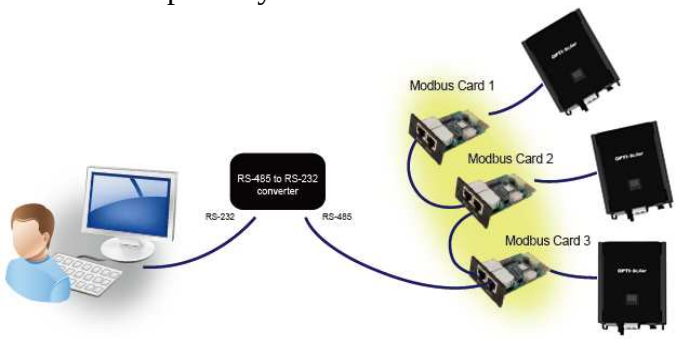
- Use SNMP card to synchronize the parameters:

Each inverter should be installed one SNMP card. Make sure all of the SNMP cards are connected to the router as a LAN.



- Use Modbus card to synchronize the parameters:

Each inverter should be installed one Modbus card. Make sure all of the Modbus cards are connected to each other and one of the Modbus cards is connected to the computer by RS-485/RS232 converter.



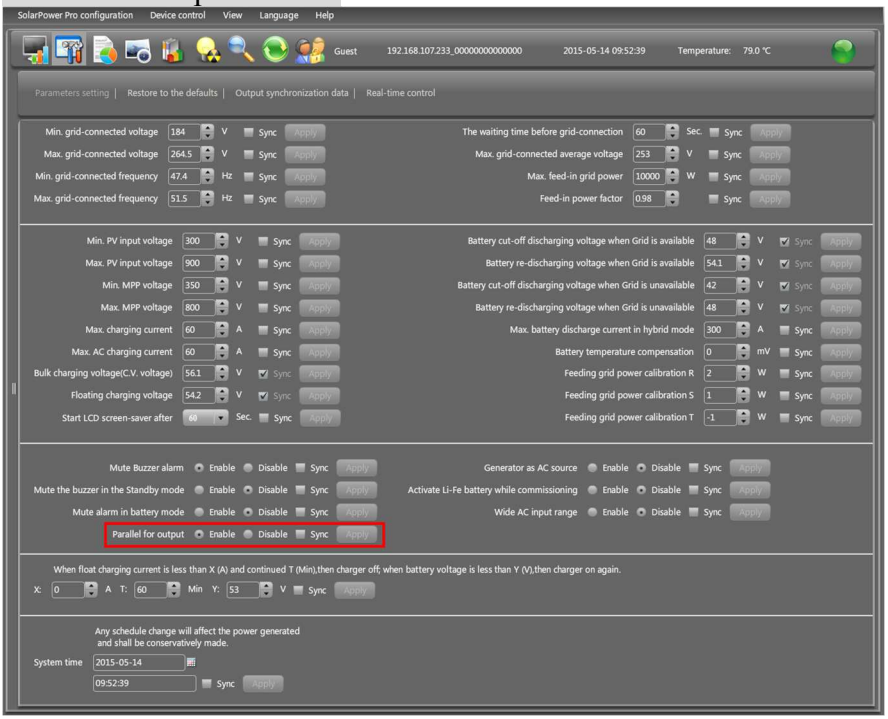
Launch SolarPowerPro in computer and select Device Control >> Parameter Setting >> Parallel output. Two options: Enable or Disable. If you want to use parallel function, please choose “Enable” and press “Apply” button. Then, “Sync” button will be shown is the screen.

Please be sure to click “Sync” button before clicking “Apply” button.

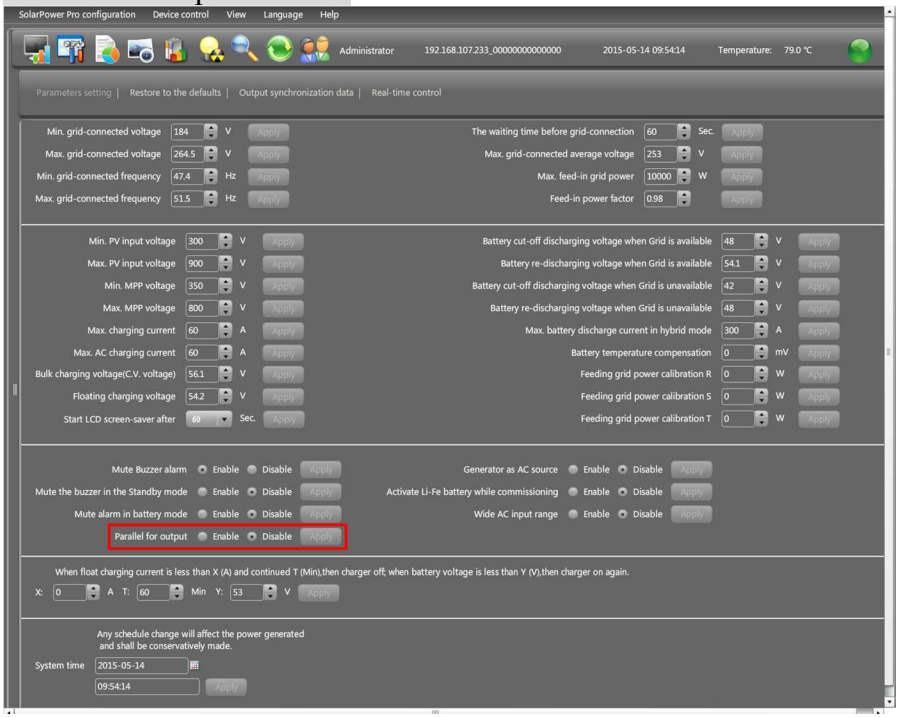
There is a “Sync” button in each parameter setting. When “Sync” is clicked and “Apply” is pressed, this new setting will be applied to all inverters. If not, this setting is only effected in current inverter you choose.

Note: Without centralized monitoring system, “Sync” function is not effective. Then, you have to set up the inverter one by one through serial communication port.

Parallel for output: Enable



Parallel for output: Disable



Fault code display:

Fault Code	Fault Event	Icon on
37	Over current on Neutral wire	
60	Power feedback protection	
61	Relay board driver loss	
62	Relay board communication loss	
71	Firmware version inconsistent	
72	Current sharing fault	
80	CAN fault	
81	Host loss	
82	Synchronization loss	

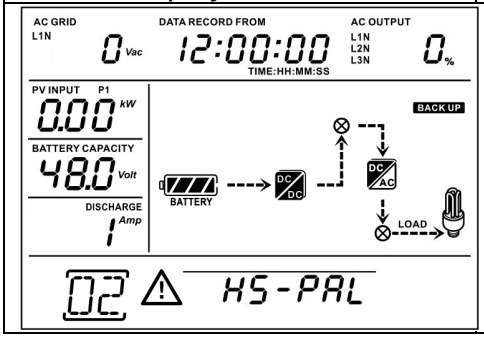
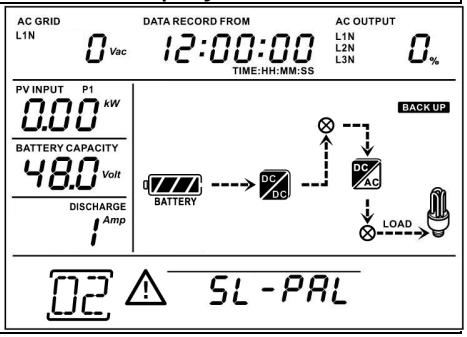
8. Commissioning

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.

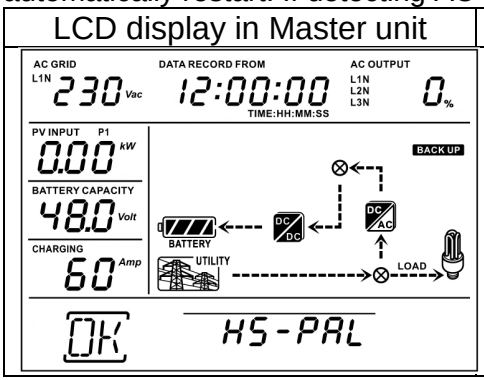
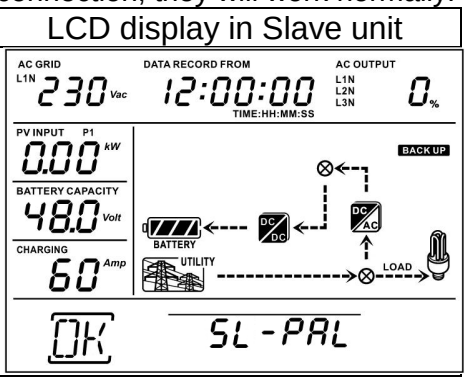
Step 2: Turn on each unit and set “enable parallel for output” on SolarPower or SolarPower Pro. And then, shut down all units.

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
	

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.

9. Trouble shooting

Situation		Solution
Fault Code	Fault Event Description	
37	Over current on Neutral wire	1. Remove excessive loads. 2. Restart the inverter. 3. If the problem remains, please contact your installer.
60	Current feedback into the inverter is detected.	4. Restart the inverter. 5. Check if L1/L2/L3/N cables are not connected with wrong sequence in all inverters. 6. Make sure the sharing cables are connected in all inverters. 7. If the problem remains, please contact your installer.
61	Relay board driver loss,	1. Disconnect all of power source. 2. Only connect AC input and press Enter key to let it working in bypass mode. 3. Check if the problem happens again or not and feed back the result to your installer.
62	Relay board communication loss,	
71	The firmware version of each inverter is not the same.	1. Update all inverter firmware to the same version. 2. 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	