

User Manual

Hybrid 20KW PV Inverter

Version: 1.1

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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.

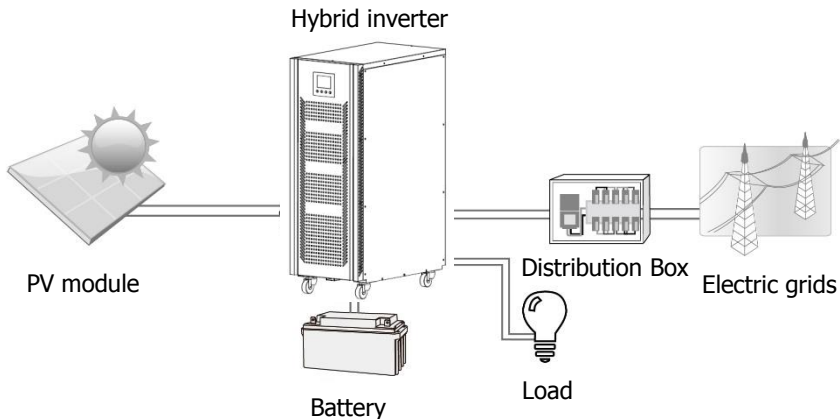


Figure 1 Basic hybrid PV System Overview

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.

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.

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:



Software CD



Manual

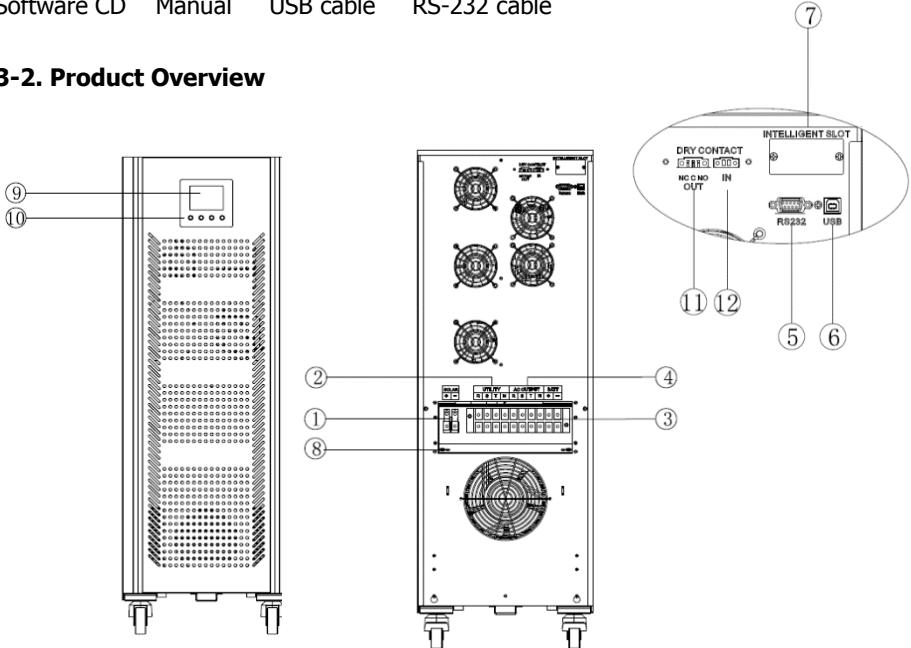


USB cable



RS-232 cable

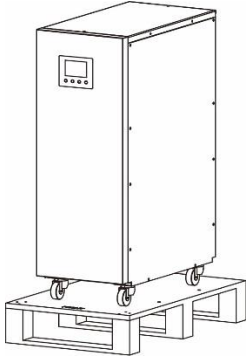
3-2. Product Overview



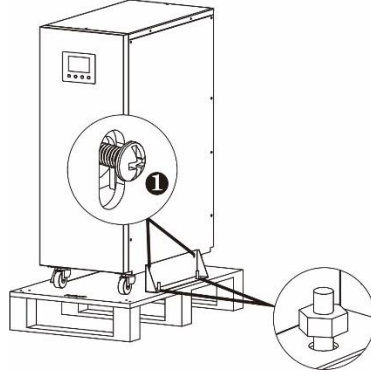
- | | |
|---|---|
| 1) PV connectors | 8) Grounding |
| 2) AC Grid connectors | 9) LCD display panel (Please check section 13 for detailed LCD operation) |
| 3) Battery connectors | 10) Operation buttons |
| 4) AC output connectors (Load connection) | 11) Dry contact for output (reserved) |
| 5) RS-232 communication port | 12) Dry contact for input (reserved) |
| 6) USB communication port | |
| 7) Intelligent slot | |

4. Installation

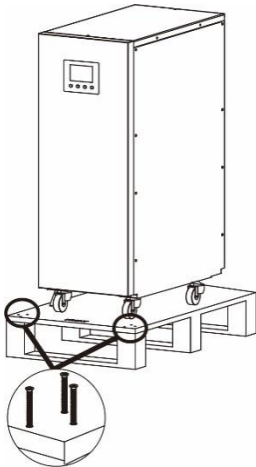
Then, follow below steps to remove the UPS from the carton and pallet.



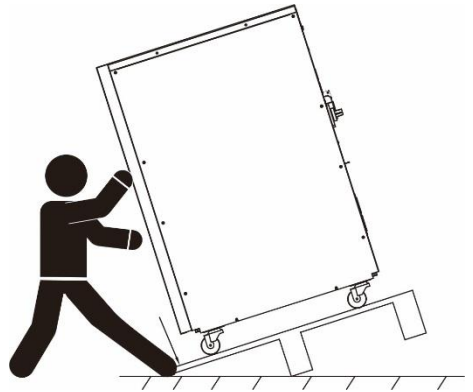
Step 1: Remove carton and foams



Step 2: Remove fixing plates on the two sides of the inverter as shown in the chart. After removing fixing plates, please put #① screws back to inverter.



Step 3: Take off front foot of the pallet by removing screws as shown in chart.

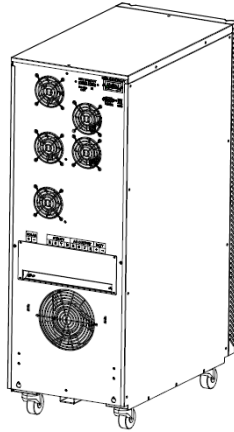


Step 4: Then, lean the pallet to remove the inverter from the pallet.

NOTE: Before installation, please inspect the unit. Be sure that nothing inside the package is damaged during transportation. Do not turn on the unit and notify the carrier and dealer immediately if there is any damage or lacking of some parts. Please keep the original package in a safe place for future use.

4-1. Preparation

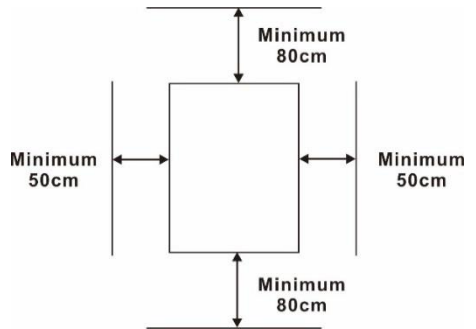
Before connecting all wirings, please take off three covers by removing 4PCS screws as shown



4-2. Unit Installation

Consider the following points before selecting where to install:

- It's requested to have a clearance of approx. 80 cm to the front and back of the unit and approx. 50 cm to the side.
- Dusty conditions on the unit may impair the performance of this inverter.
- The ambient temperature should be between 0°C and 55°C to ensure optimal operation.
- For proper operation, please use appropriate cables.



5. Grid (Utility) Connection

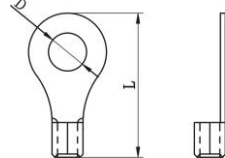
5-1. Preparation

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

NOTE 2: 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

Ring terminal:



Model	Typical Amperage	Cable Size	Ring Terminal			Torque Value
			Cable mm ²	Dimensions		
				D (mm)	L (mm)	
20KW	40A	8AWG	8	5.3	23.8	2.0~2.4Nm

5-2. Connecting to the AC Utility

1. Before making AC input connection, be sure to open DC protector or disconnector first.
2. Remove the terminal screws.
3. Insert the ring terminal of AC input wires flatly into AC input connector according to polarities indicated on terminal block and tighten the terminal screws. Be sure to connect PE protective conductor (⊕) first.

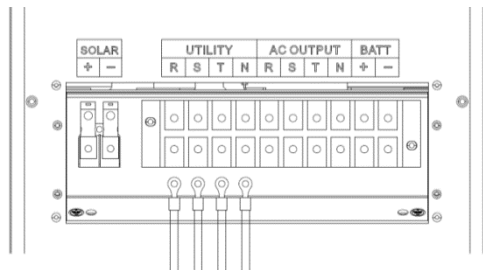
⊕ → **Ground (yellow-green)**

R Phase → **LINE (black)**

S Phase → **LINE (gray)**

T Phase → **LINE (brown)**

N → **Neutral (blue)**



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.

NOTE 1: Please use 1000VDC/20A circuit breaker.

NOTE 2: The overvoltage category of the PV input is II.

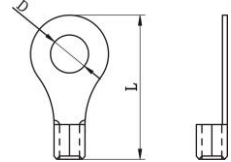
Please follow below steps to implement PV module connection:

WARNING: Because this inverter is non-isolated, only three types of PV modules are acceptable: single crystalline, 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.

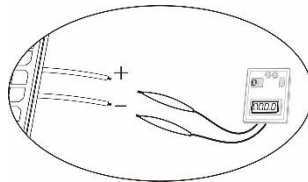
WARNING! It's very important for system safety and efficient operation to use appropriate cable for PV module connection. To reduce risk of injury, please use the proper recommended cable size as below.

Ring terminal:



Model	Typical Amperage	Cable Size	Ring Terminal			Torque Value
			Cable mm ²	Dimensions		
				D (mm)	L (mm)	
20KW	60A	6AWG	14	5.3	29.2	2.0~2.4Nm

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.

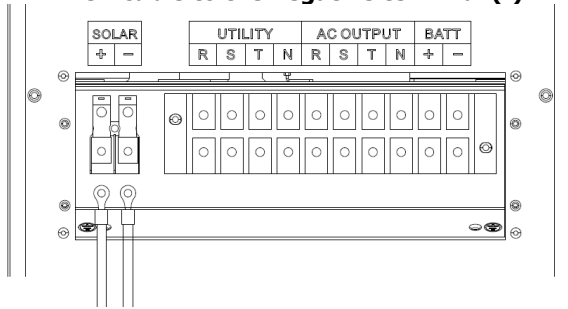


CAUTION: Exceeding the maximum input voltage can destroy the unit!! Check the system before wire connection.

Step 2: Insert the ring terminal of PV wires flatly into PV connector according to polarities indicated on terminal block and tighten the terminal screws.

RED cable to the positive terminal (+)

BLACK cable to the negative terminal (-)



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)	SOLAR INPUT 1	SOLAR INPUT 2	Q'ty of panels	Total Input Power
	(Min in serial: 11pcs; Max. in serial: 18pcs)			
- 250Wp - Vmp: 36.7Vdc - Imp: 6.818A - Voc: 44Vdc - Isc: 7.636A - Cells: 72	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.

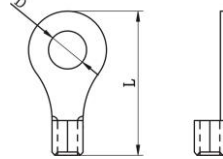
NOTE 1: Please only use sealed lead acid battery, vented and Gel battery. Please check maximum charging voltage and current when first using this inverter. If using Lithium iron or Nicd battery, please consult with installer for the details.

NOTE 2: Please use 60VDC/300A circuit breaker.

NOTE 3: The overvoltage category of the battery input is II.

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.

Ring terminal:



Model	Typical Amperage	Cable Size	Ring Terminal			Torque Value
			Cable mm ²	Dimensions		
				D (mm)	L (mm)	
20KW	50A	8AWG	8	5.3	23.8	2.0~2.4Nm

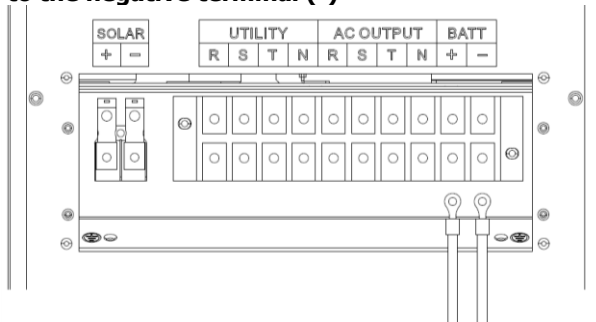
Please follow below steps to implement battery connection:

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

Step 2: Insert the ring terminal of battery wires flatly into battery connector according to polarities indicated on terminal block and tighten the terminal screws.

RED cable to the positive terminal (+)

BLACK cable to the negative terminal (-)



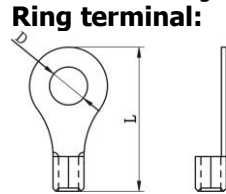
WARNING! Wrong connections will damage the unit permanently.

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.



Model	Typical Amperage	Cable Size	Ring Terminal			Torque Value
			Cable mm ²	Dimensions		
				D (mm)	L (mm)	
20KW	40A	8AWG	8	5.3	23.8	2.0~2.4Nm

8-2. Connecting to the AC output

1. Before making AC output connection, be sure to open DC protector or disconnecter first.
2. Remove the terminal screws.
3. Insert the ring terminal of AC input wires flatly into AC input connector according to polarities indicated on terminal block and tighten the terminal screws. Be sure to connect PE protective conductor (⊕) first.

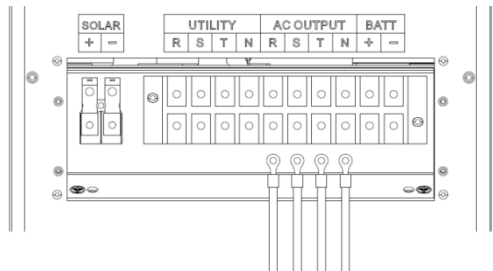
⊕ → **Ground (yellow-green)**

R Phase → **LINE (black)**

S Phase → **LINE (gray)**

T Phase → **LINE (brown)**

N → **Neutral (blue)**

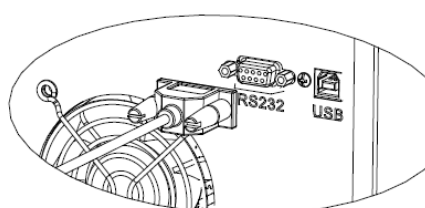
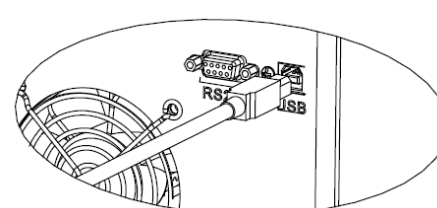
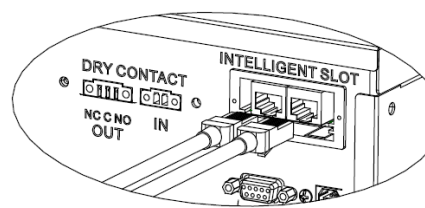


CAUTION: It's only allowed to connect load to "AC Output Connector". Do NOT connect the utility to "AC Output Connector".

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

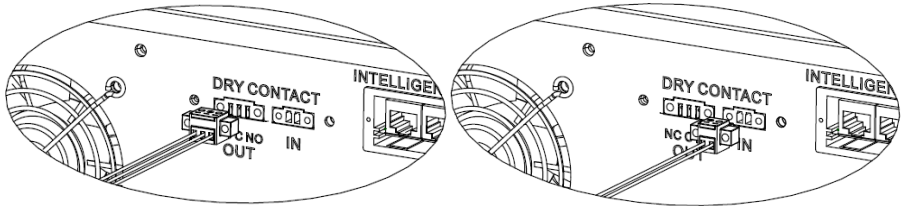
The inverter is equipped with several communication ports and it is also equipped with a slot for alternative communication interfaces in order to communicate with a PC with corresponding software. This intelligent slot is suitable to install with SNMP card and Modbus card. Follow below procedure to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

11. Commissioning

Step 1: Check the following requirements before commissioning:

- 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), battery 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.

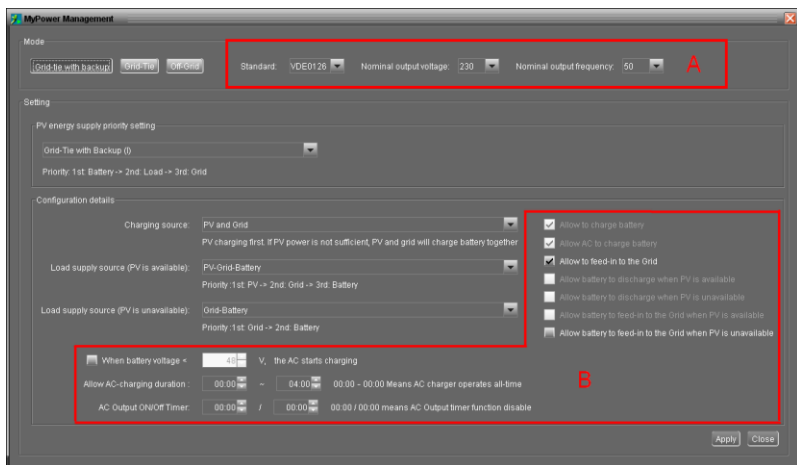
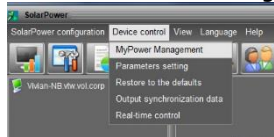
12. Initial Setup

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

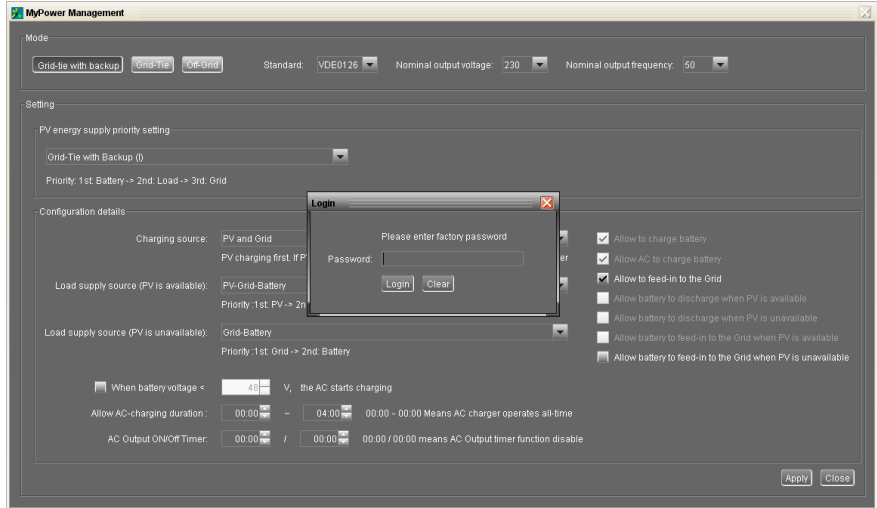
There are three operation modes: Grid-tie with backup, Grid-Tie and Off-Grid.

- 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.

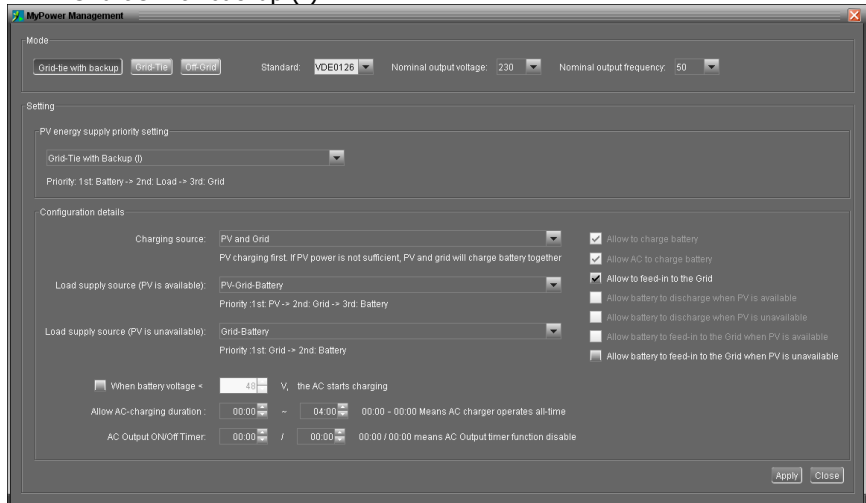
Allow battery to discharge when PV is unavailable: This option is automatically determined by setting in "Load supply source (PV is unavailable)". When "Battery" is higher priority than "Grid" in Load supply source (PV is unavailable), this option is default selected. Under Grid-tie mode, this option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

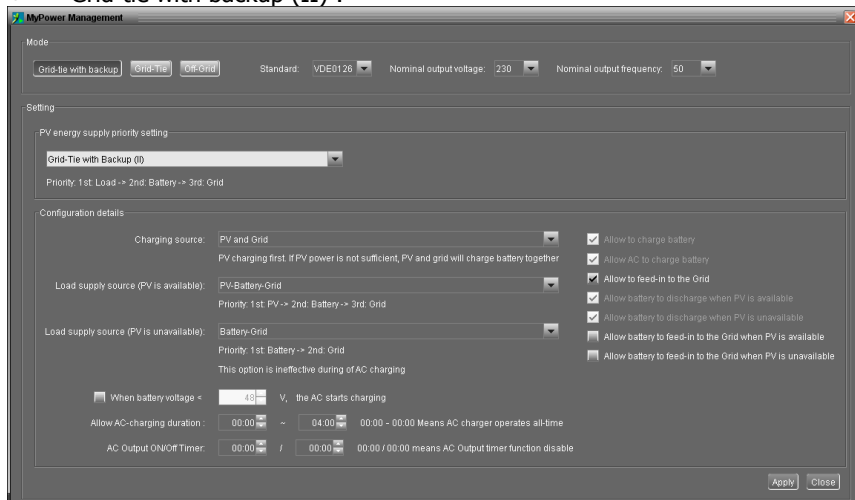
Grid will provide power to the load at first. If grid is not available, battery power will provide power backup.

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.

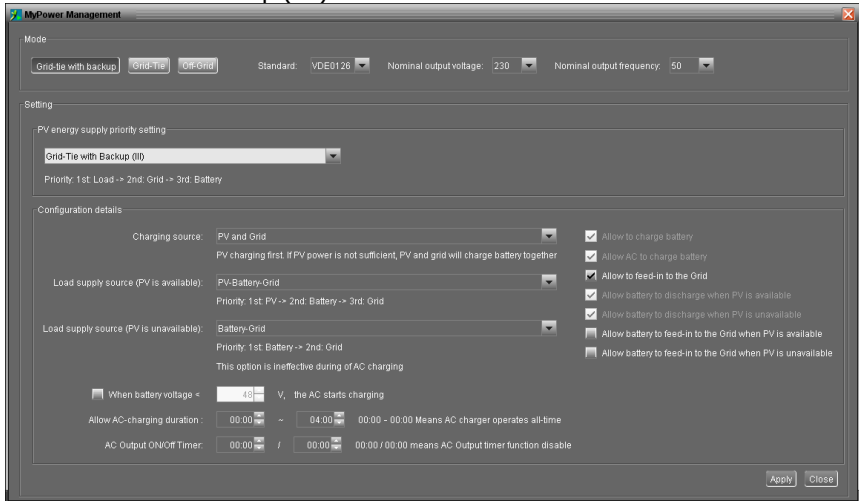
When PV power is not available:

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.

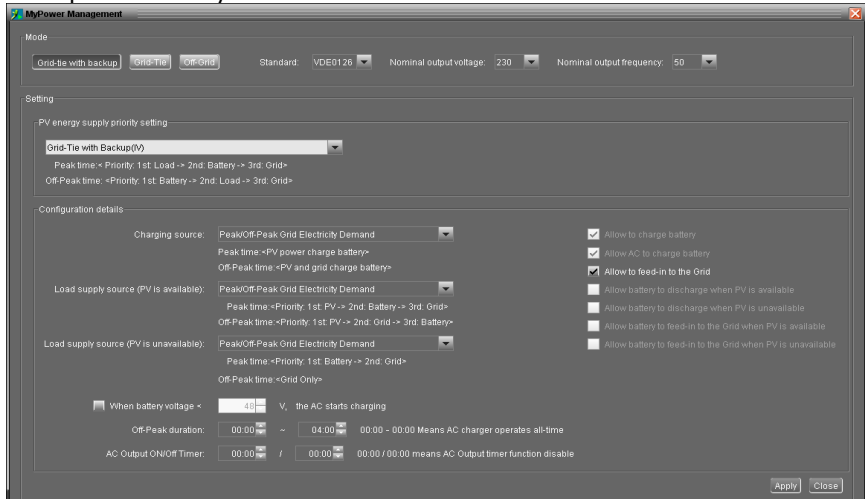
When PV power is not available:

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

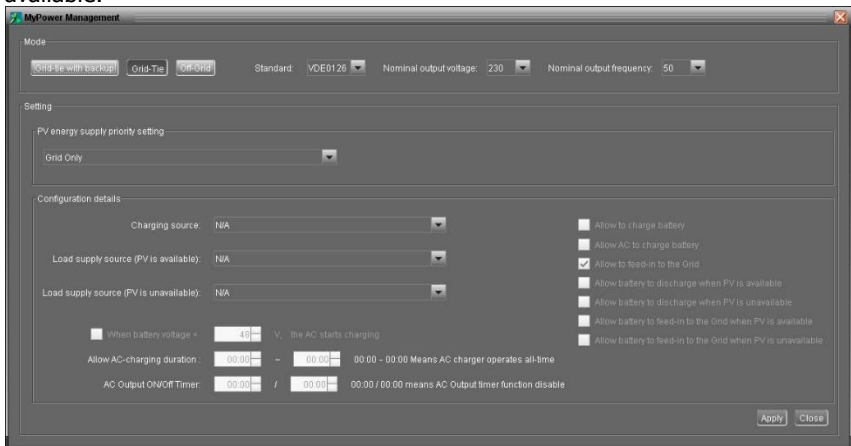
PV power will charge battery first during off-peak time. If it's not sufficient, grid will charge battery.

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.

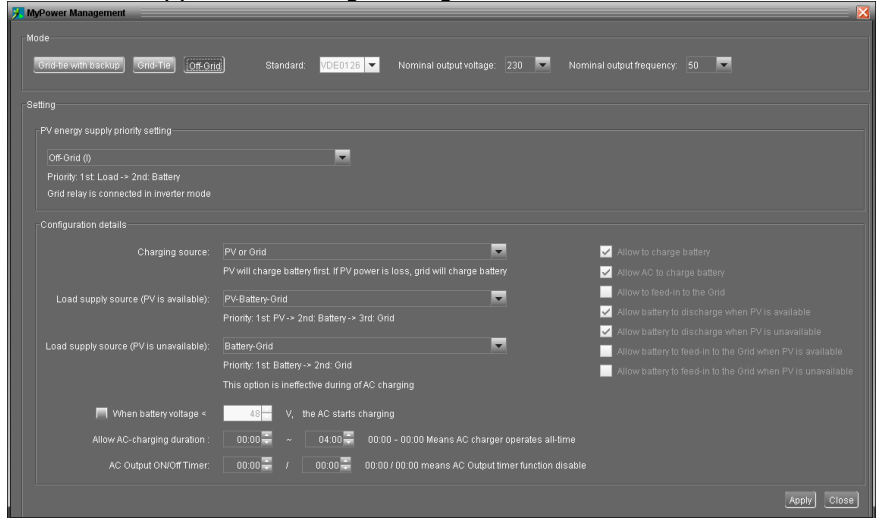
Grid-Tie

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

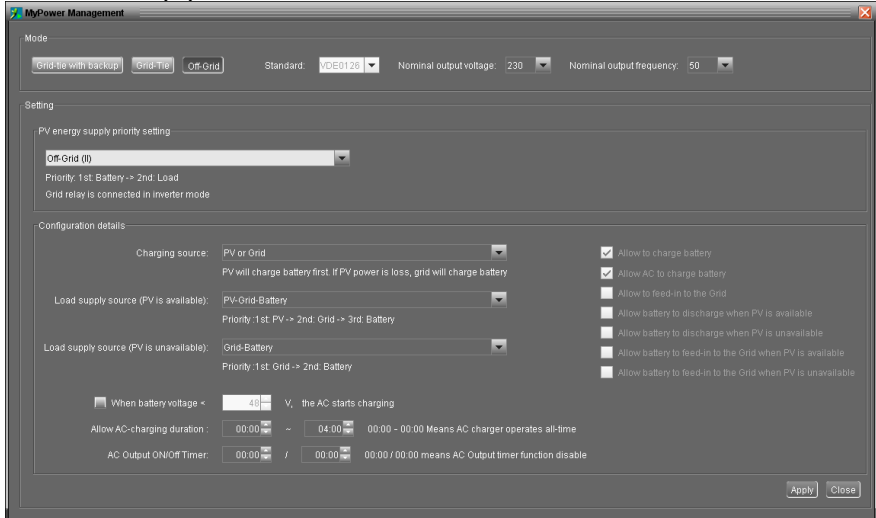
provide power backup.

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

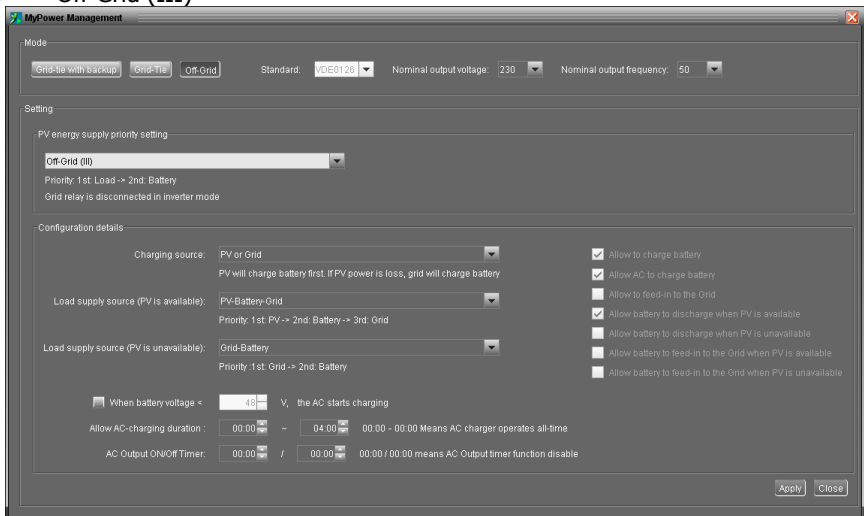
PV power will provide power to the load first. If it's not sufficient, grid will provide power to the load. If grid is not available at the same time, battery power will back up.

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.

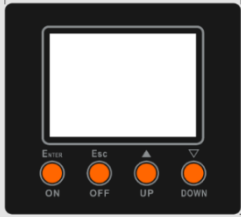
When PV power is not available:

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.

13. Operation

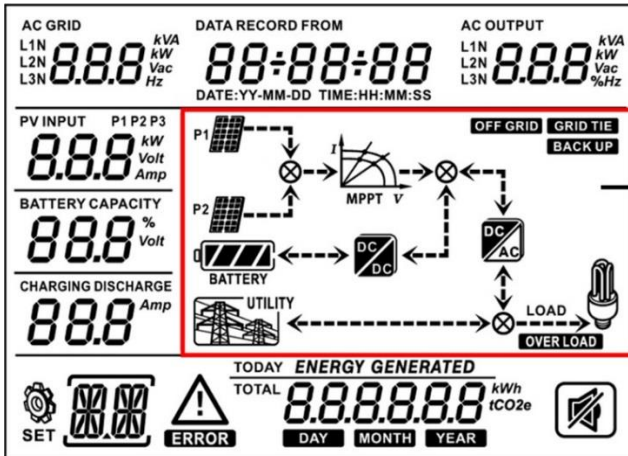
13-1. Interface



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.

13-2. 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
AC GRID L1N L2N 8.8.8 Vac L3N Hz	Indicates AC input voltage or frequency. Vac: voltage, Hz: frequency, L1N/L2N/L3N: Line phase
AC OUTPUT L1N L2N 8.8.8 kVA L3N %Hz	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
PV INPUT P1 P2 8.8.8 kW Volt	Indicates PV input voltage or power. Volt: voltage, KW: power, P1: PV input 1, P2: PV input 2
BATTERY CAPACITY 8.8.8 % Volt	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.

13-3. 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.

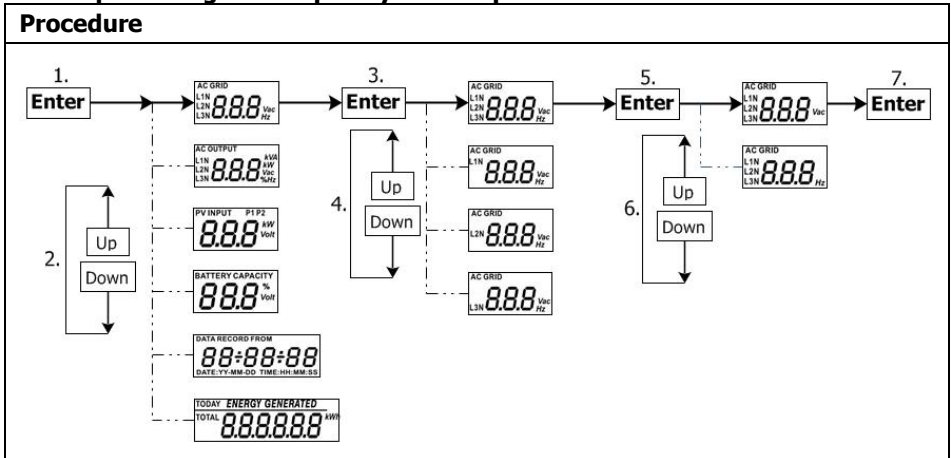
13-4. Query Menu Operation

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.

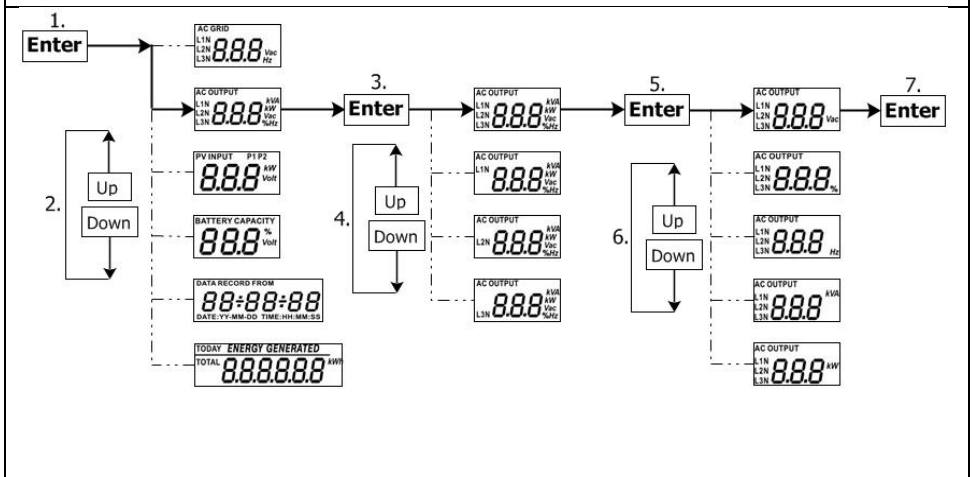
Setting Display Procedure

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



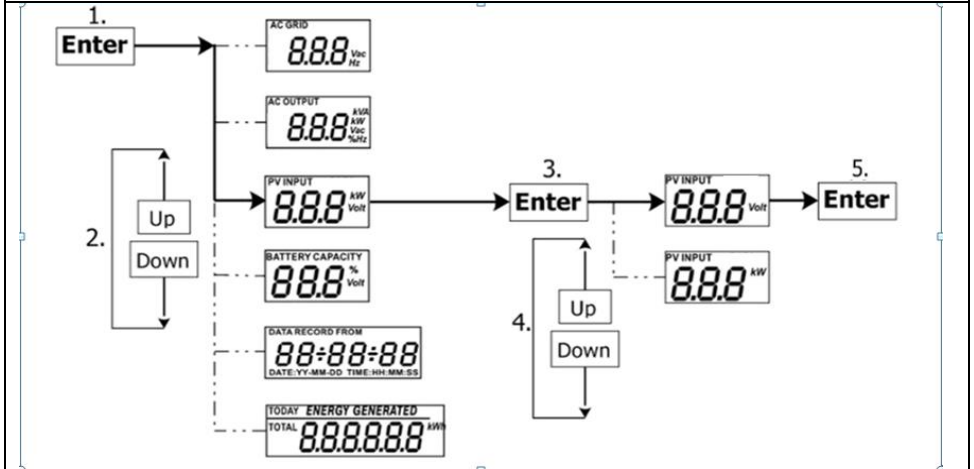
● Frequency, voltage, power or percentage of AC output

Procedure

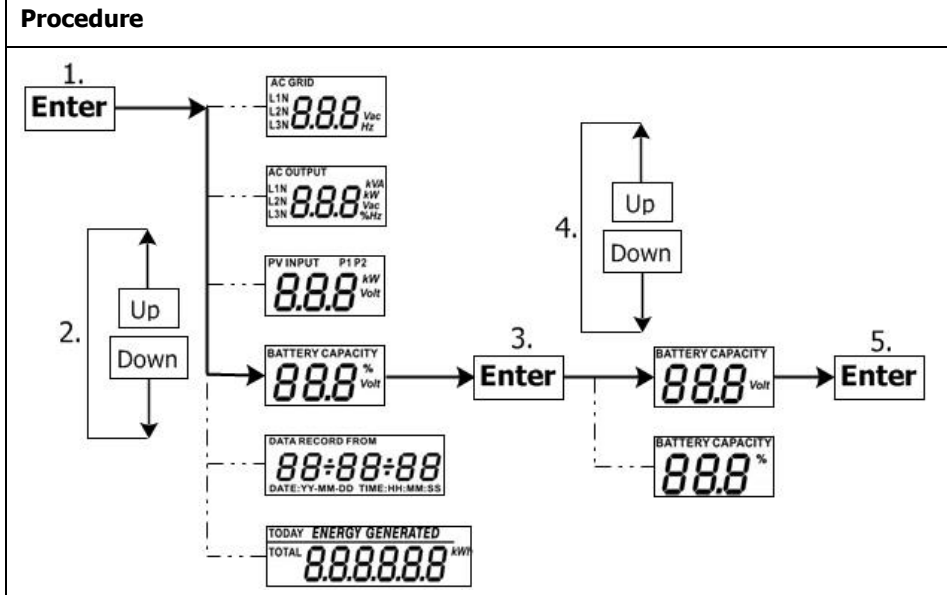


Input voltage or power of PV input.

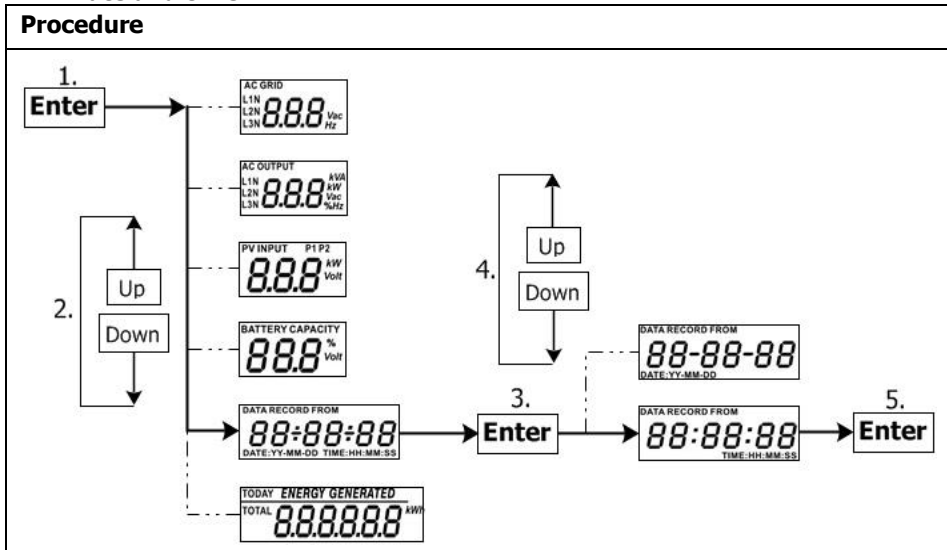
Procedure



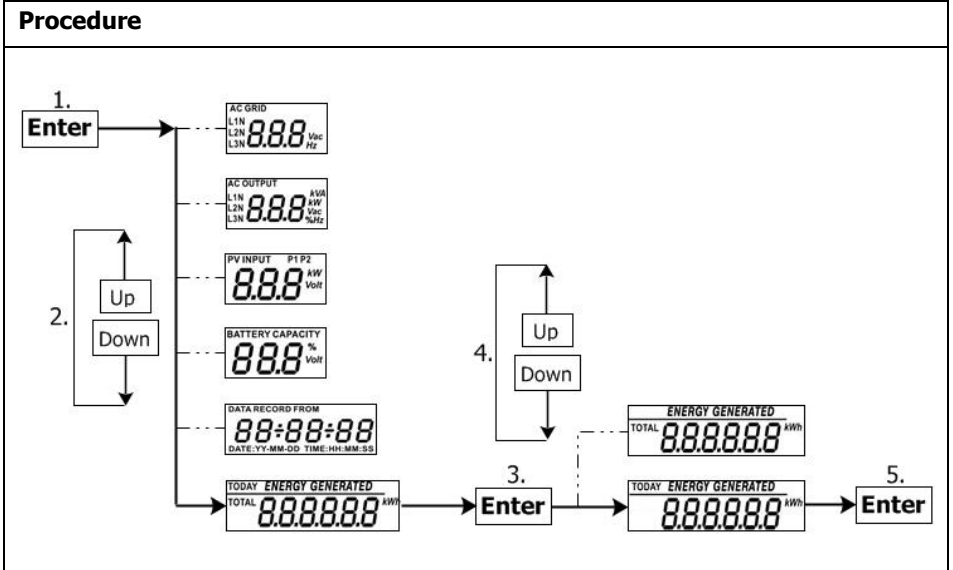
● **Battery voltage or percentage.**



● **Date and time.**



● **Today or total energy generated.**



13-5. 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
	<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>

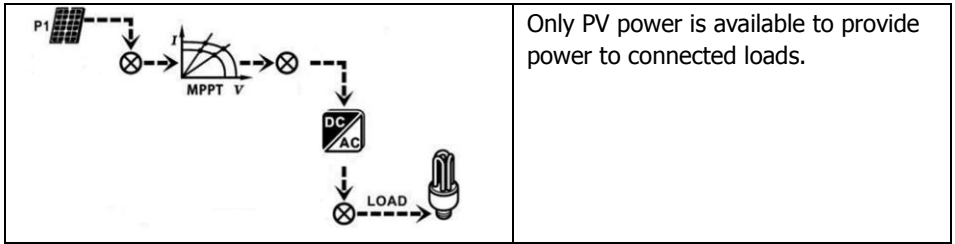
	<p>PV power is generated, but not sufficient enough to charge battery by itself. PV power and the utility are charging battery at the same time. And the utility is also supplying power to the connected load.</p>
	<p>This inverter is disabled to generate power to the loads via AC output. PV power is sufficient to charge battery first. Remaining PV power will feed in back to grid.</p>
	<p>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.</p>
	<p>This inverter is disabled to generate power to the loads via AC output. PV power is feeding power back to the grid.</p>

<p>The diagram shows a PV panel (P1) connected to an MPPT controller. The MPPT controller's output is connected to a DC/AC inverter. The inverter's output is connected to a load (represented by a light bulb) and also to a utility grid. Dashed arrows indicate the flow of power: from the PV panel to the MPPT controller, then to the DC/AC inverter, then to the load and the utility grid.</p>	<p>PV power is sufficient to provide power to loads and feed power back to the grid.</p>
<p>The diagram shows a PV panel (P1) connected to an MPPT controller. The MPPT controller's output is connected to a DC/AC inverter. The inverter's output is connected to a load (represented by a light bulb) and also to a utility grid. Dashed arrows indicate the flow of power: from the PV panel to the MPPT controller, then to the DC/AC inverter, then to the load. Additionally, a dashed arrow shows power flowing from the utility grid to the load.</p>	<p>PV power and utility are providing power to the connected loads because of insufficient PV power.</p>

Inverter mode without grid connected

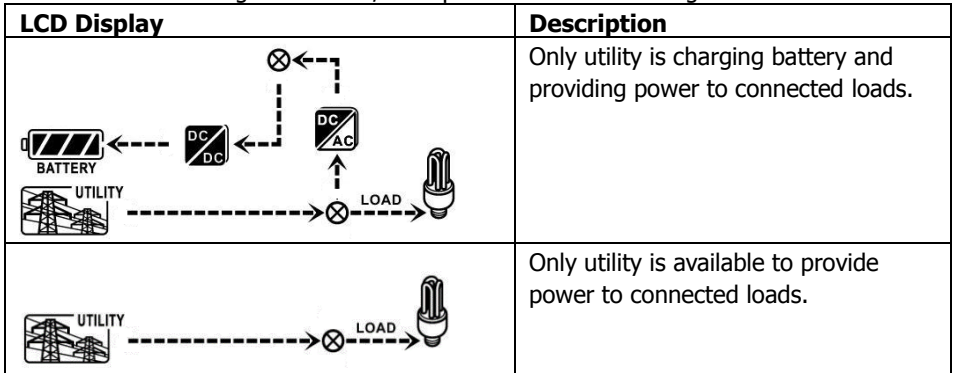
This inverter is working with DC/INV operation and not connecting to the grid.

LCD Display	Description
<p>The diagram shows a PV panel (P1) connected to an MPPT controller. The MPPT controller's output is connected to a DC/DC converter, which is connected to a battery. The MPPT controller's output is also connected to a DC/AC inverter. The inverter's output is connected to a load (represented by a light bulb). Dashed arrows indicate the flow of power: from the PV panel to the MPPT controller, then to the DC/DC converter and the DC/AC inverter, then to the battery and the load.</p>	<p>PV power is sufficient to charge battery and provide power to the connected loads.</p>
<p>The diagram shows a PV panel (P1) connected to an MPPT controller. The MPPT controller's output is connected to a DC/DC converter, which is connected to a battery. The MPPT controller's output is also connected to a DC/AC inverter. The inverter's output is connected to a load (represented by a light bulb). Dashed arrows indicate the flow of power: from the PV panel to the MPPT controller, then to the DC/DC converter and the DC/AC inverter, then to the battery and the load. Additionally, a dashed arrow shows power flowing from the battery to the DC/AC inverter.</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>The diagram shows a battery connected to a DC/DC converter, which is connected to a DC/AC inverter. The inverter's output is connected to a load (represented by a light bulb). Dashed arrows indicate the flow of power: from the battery to the DC/DC converter, then to the DC/AC inverter, then to the load.</p>	<p>Only battery power is available to provide power to connected loads.</p>



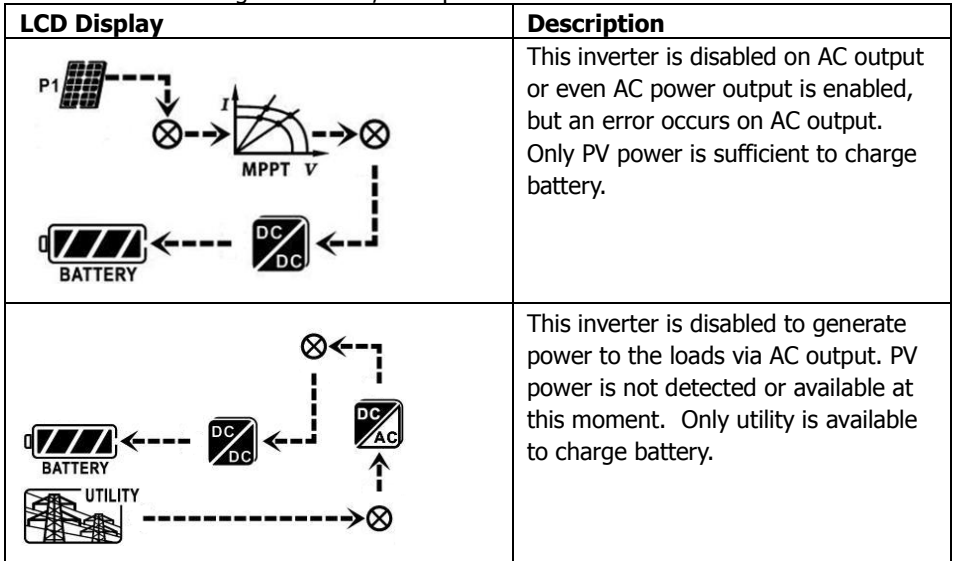
Bypass mode




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



Standby mode :

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



  	<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>
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14. Charging Management

Charging Parameter	Default Value	Note
Charging current	10A	It can be adjusted via software from 1Amp to 50Amp.
Floating charging voltage (default)	448.0Vdc	It can be adjusted via software from 384Vac to 480Vdc.
Max. absorption charging voltage (default)	432.0Vdc	It can be adjusted via software from 384Vac to 480Vdc.
Battery overcharge protection	512.0Vdc	
<p>Charging process based on default setting.</p> <p>3 stages:</p> <p>First stage- max. charging voltage increases to 448V.</p> <p>Second stage- charging voltage will maintain at 448V until charging current is down to 2 Amp.</p> <p>Third stage- go to floating charging at 432V.</p>		

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 user manual of external battery pack from battery manufacturer.

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 200 Ah battery, then, maximum charging current is $200 \times 0.2 = 40$ (A). Please use at least 50Ah battery because the default value of charging current is 10A. If using AGM/Gel or other types of battery, please consult with installer for the details.

15. 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.















16. Trouble Shooting

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

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

16-1. 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.
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.
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.

16-2. Fault Reference Codes

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

Code	Fault Event	Possible cause	Solution
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.
06	R SCR Close Fault	Internal components failed.	Please contact your installer.
07	S SCR Close Fault		
08	T SCR Close Fault		
09	Solar Power abnor	Solar input voltage is too high	1. Please check if solar input voltage is higher than 950V. 2. Please contact your installer.
11	Solar IP Curr over	Surge	1. Restart the inverter. 2. If the error message still remains, please contact your installer.
17	Mcu&Dsp com loss	Firmware version not compatible	please contact your installer.
18	Mcu&Dsp ver error		
22	Bat volt over	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.

24	R SCR Open Fault	Internal components failed.	Please contact your installer.
25	S SCR Open Fault		
26	T SCR Open Fault		
32	Battery curr over	Load fluctuates	1. Restart the inverter. 2. If the error message still remains, please contact your installer.
33	Inv Volt Low	Internal components failed.	1. Restart the inverter. 2. If the error message still remains, please contact your installer.
34	Inv Volt High		
36	OP Circuit Fault	Grid connects to output terminal	Don't connect the grid to the output terminal.
40	Inv R Short	Output short circuited	1. Check if wiring is connected well and remove abnormal load. 2. If the error message still remains, please contact your installer.
41	Inv S Short		
42	Inv T Short		
43	Inv R/S short		
44	Inv S/T short		
45	Inv T/R short		
46	Trans Temp Over		
47	DCDC Temp Over		
48	Inv Temp Over		
49	Inv1 Temp Over		
53	Bat Curr CT	Internal components failed.	Please contact your installer.
54	R INV Curr CT		
55	S INV Curr CT		
56	T INV Curr CT		
57	R OP Volt CT		
58	S OP Volt CT		
59	T OP Volt CT		
61	R Inv Cur FW Over	Surge	1. Restart the inverter. 2. If the error message still remains, please contact your installer.
62	S Inv Cur FW Over		
63	T Inv Cur FW Over		

17. Specifications

MODEL	20KW
RATED POWER	20000 W
PV INPUT (DC)	
Maximum DC Power	30000 W
Nominal DC Voltage	720 VDC
Maximum DC Voltage	950 VDC
Working DC Voltage Range	500VDC ~ 950 VDC
Start-up Voltage / Initial Feeding Voltage	500 VDC / 550 VDC
MPP Voltage Range / Full Load MPP Voltage Range	550 VDC ~ 900 VDC / 625 VDC ~ 900 VDC
Maximum Input Current	48 A
Isc PV (absolute maximum)	52 A
Max. inverter back feed current to the array	0 A
GRID OUTPUT (AC)	
Nominal Output Voltage	230 VAC (P-N) / 400 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	29 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	20000VA/20000W
Maximum AC Input Current	40 A
Inrush Input Current	40 A / 1ms
BATTERY MODE OUTPUT (AC)	
Nominal Output Voltage	230 VAC (P-N) / 400 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)	
DC Voltage Range	336 – 512 VDC
Nominal DC Voltage	384 VDC
Maximum Battery Discharging Current	50 A
Maximum Charging Current	50 A

GENERAL	
PHYSICAL	
Dimension, D X W X H (mm)	559x 320x 909
Net Weight (kg)	120
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.