User Manual

MPP Solar™

2724LV-MR (3KVA)

INVERTER / CHARGER

Version: 1.1

Table Of Contents

ABOUT THIS MANUAL

Purpose

This manual describes the assembly, installation, operation and troubleshooting of this unit. Please read this manual carefully before installations and operations. Keep this manual for future reference.

Scope

This manual provides safety and installation guidelines as well as information on tools and wiring.

SAFETY INSTRUCTIONS

⚠ **WARNING: This chapter contains important safety and operating instructions. Read and keep this manual for future reference.**

1. Before using the unit, read all instructions and cautionary markings on the unit, the batteries and all appropriate sections of this manual.
2. **CAUTION** --To reduce risk of injury, charge only deep-cycle lead acid type rechargeable batteries. Other types of batteries may burst, causing personal injury and damage.
3. Do not disassemble the unit. Take it to a qualified service center when service or repair is required. Incorrect re-assembly may result in a risk of electric shock or fire.
4. To reduce risk of electric shock, disconnect all wirings before attempting any maintenance or cleaning. Turning off the unit will not reduce this risk.
5. **CAUTION** – Only qualified personnel can install this device with battery.
6. **NEVER** charge a frozen battery.
7. For optimum operation of this inverter/charger, please follow required spec to select appropriate cable size. It's very important to correctly operate this inverter/charger.
8. Be very cautious when working with metal tools on or around batteries. A potential risk exists to drop a tool to spark or short circuit batteries or other electrical parts and could cause an explosion.
9. Please strictly follow installation procedure when you want to disconnect AC or DC terminals. Please refer to INSTALLATION section of this manual for the details.
10. Fuses (150A, 32VDC) are provided as over-current protection for the battery supply.
11. GROUNDING INSTRUCTIONS -This inverter/charger should be connected to a permanent grounded wiring system. Be sure to comply with local requirements and regulation to install this inverter.
12. NEVER cause AC output and DC input short circuited. Do NOT connect to the mains when DC input short circuits.
13. **Warning!!** Only qualified service persons are able to service this device. If errors still persist after following troubleshooting table, please send this inverter/charger back to local dealer or service center for maintenance.

INTRODUCTION

This is a multi-function inverter/charger, combining functions of inverter, AVR, solar charger and battery charger to offer uninterruptible power for office and home appliances. Its comprehensive LCD display offers user-configurable and easy-accessible button operation such as battery charging current, AC/solar charger priority, and acceptable input voltage based on different applications.

Features

- Pure sine wave inverter
- Built-in solar charge controller
- Built in boost and buck AVR for voltage regulation
- Configurable home appliances and personal computers via LCD setting
- Configurable battery charging current based on applications via LCD setting
- Configurable AC/Solar Charger priority via LCD setting
- Compatible to mains voltage or generator power
- Auto restart while AC is recovering
- Overload/ Over temperature/ short circuit protection
- Smart battery charger design for optimized battery performance
- Cold start function
- Built-in 5V/3A USB charger port

Basic System Architecture

The following illustration shows basic application for this inverter/charger. It also includes following devices to have a complete running system:
- Generator or Utility.
- PV modules (option)

Consult with your system integrator for other possible system architectures depending on your requirements.

This inverter can power all kinds of appliances in home or office environment, including motor-type appliances such as tube light, fan, refrigerator and air conditioner.
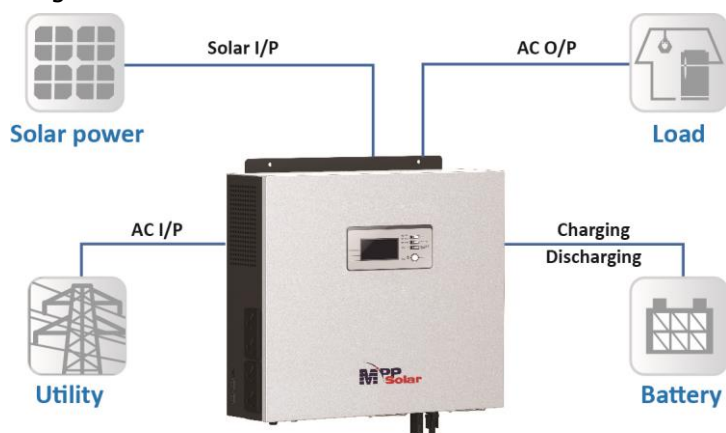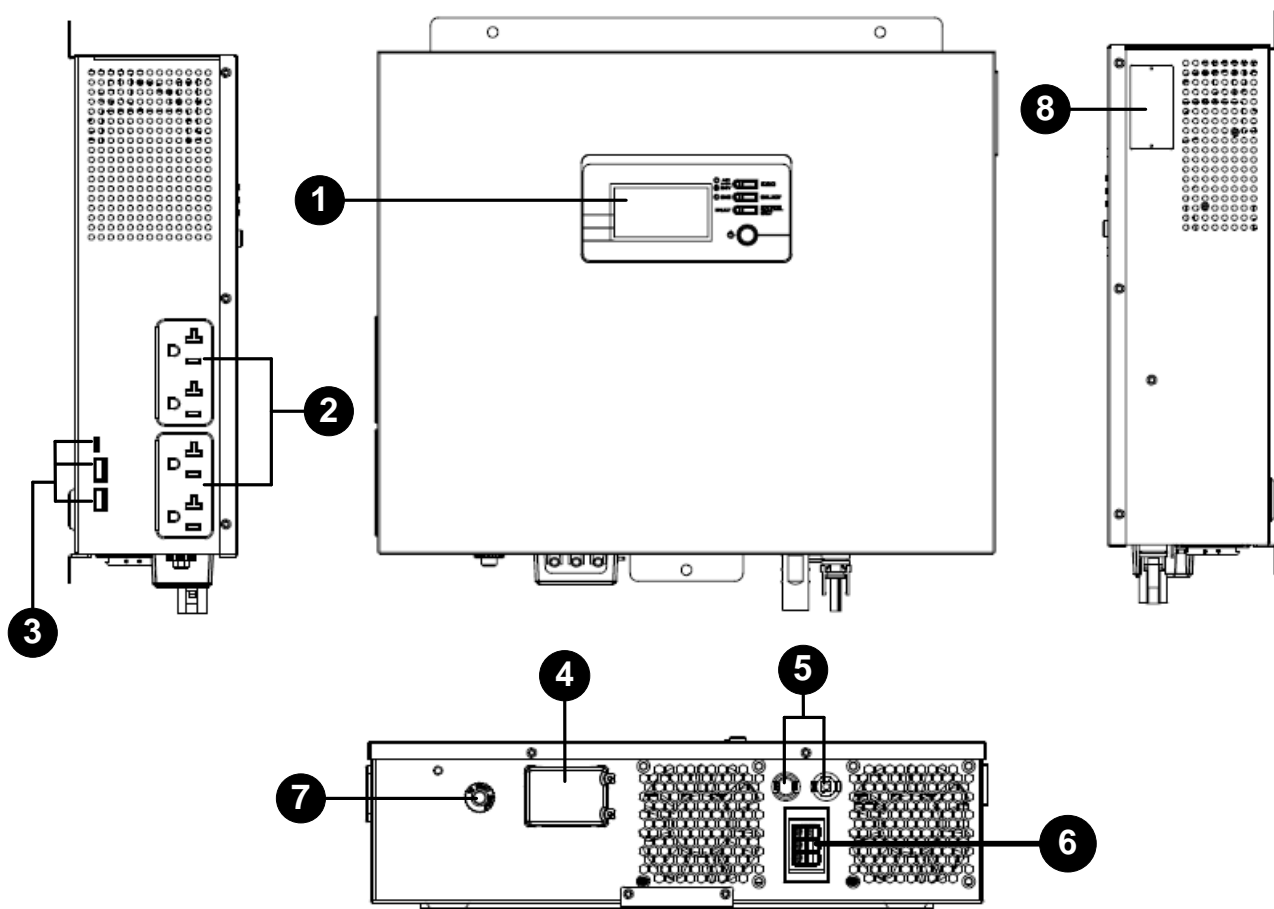

Figure 1 Hybrid Power System

Product Overview

1. Operation panel
2. Output sockets
3. USB charger ports
4. AC input
5. PV input
6. Battery connectors
7. Circuit breaker
8. USB and RS232 communication ports

INSTALLATION

Unpacking and Inspection

Before installation, please inspect the unit. Be sure that nothing inside the package is damaged. You should have received the following items inside of package:

- The unit x 1
- User manual x 1
- Software CD x 1
- Battery cable x 1
- PV connectors x 1
- Communication cable x 2

Installation

Wall mounted

Consider the following points before selecting where to install:

- Do not mount the inverter on flammable construction materials.
- Mount on a solid surface
- Install this inverter at eye level in order to allow the LCD display to be read at all times.
- The ambient temperature should be between 0°C and 55°C to ensure optimal operation.
- The recommended installation position is to be adhered to the wall vertically.
- 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.

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

Please follow the steps as below to finish the installation.

- Drill three holes in the marked locations on a solid surface as shown in below chart. The reference tightening torque is 3 Nm.
- Mounting the unit by screwing three screws. It's recommended to use M5 or M6 screws.
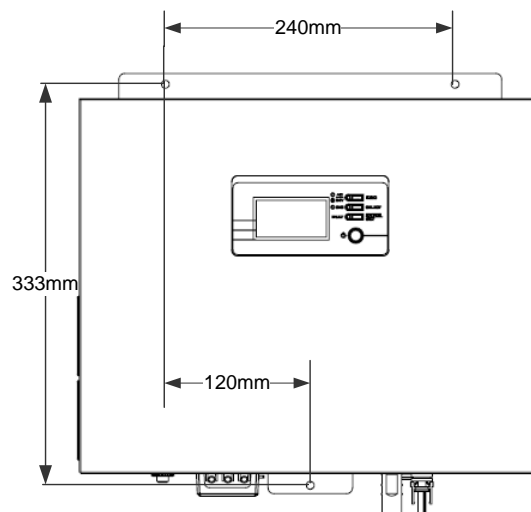
Battery Connection

CAUTION: For safety operation and regulation compliance, it's requested to install a separate DC over-current protector or disconnect device between battery and inverter. It may not be requested to have a disconnect device in some applications. However, it's still requested to have over-current protection (typical 120A) installed.
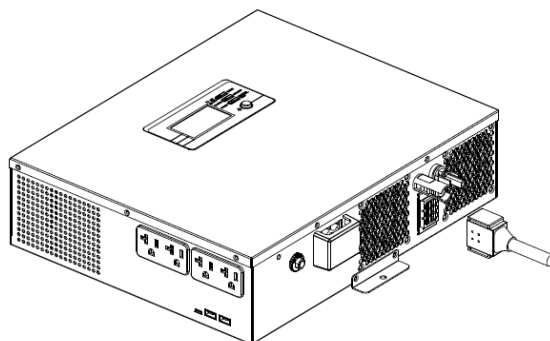
WARNING! All wiring connection must be performed by a qualified personnel.

Please follow below steps to implement battery connection:

1. This inverter supports 24VDC system. Connect all battery packs as below chart. It's suggested to connect at least 100Ah capacity battery.
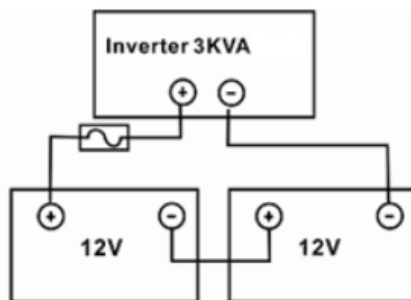
2. Plug battery cable into the battery connectors of the unit. Make sure polarity at both the battery and the inverter/charge is correctly connected.

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

⚠	**CAUTION!!** Before making the final DC connection or closing DC breaker/disconnector, be sure positive (+) must be connected to positive (+) and negative (-) must be connected to negative (-).

AC Input/Output Connection

CAUTION!! Before connecting to AC input power source, please install a **separate** AC breaker between inverter and AC input power source. This will ensure the inverter can be securely disconnected during maintenance and fully protected from over current of AC input. The recommended spec of AC breaker is 40A.

WARNING!! When using sockets as the output, please make sure that the current of each socket is less than 20A, in case of electric hazard.

WARNING! All wiring must be performed by qualified person.

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

Suggested cable requirement for AC wires

Model	Gauge	Torque Value
3KVA	10 AWG	1.2~ 1.6 Nm

Please follow below steps to implement AC input/output connection:
1. Before making AC input/output connection, be sure to open DC protector or disconnect first.
2. Remove insulation sleeve 10mm for three conductors.
3. Insert AC input wires according to polarities indicated on terminal block and tighten the terminal screws. Be sure to connect PE protective conductor (⏚) first. Make sure the wires are securely connected.

> ⏚→**Ground (yellow-green)**
>
> L→**LINE (brown or black)**
>
> N→**Neutral (blue)**
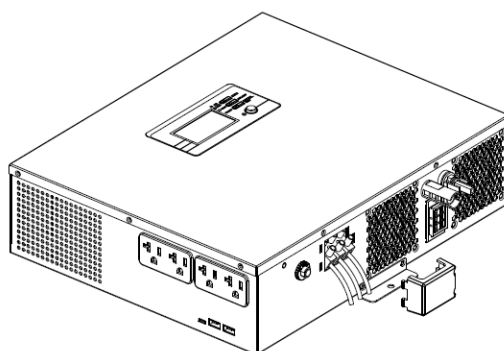
⚠	**WARNING:**
	Be sure that AC power source is disconnected before attempting to fix the wire to the unit.

4. Simply connect devices to the output sockets.

> **CAUTION:** Appliances such as air conditioner are required at least 2~3 minutes to restart because it's required to have enough time to balance refrigerant gas inside of circuits.   If a power shortage occurs and recovers in a short time, it will cause damage to your connected appliances. To prevent this kind of damage, please check manufacturer of air conditioner if it's equipped with time-delay function before installation. Otherwise, this inverter/charger will trig overload fault and cut off output to protect your appliance but sometimes it still causes internal damage to the air conditioner.

PV Connection

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

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

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

Model	Typical Amperage	Cable Size	Torque
3KVA	25A	12 AWG	1.4~1.6 Nm

PV Module Selection:

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

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

Max. PV Array Open Circuit Voltage	60VDC
Recommended PV Array MPPT Voltage Range: Vmp*	30~50VDC
Max. charging current	25A

Note: * Vmp: panel max power point voltage.

The PV charging efficiency is maximized while PV system voltage is close to Best Vmp.

Maximum PV module numbers in Series: Vmpp of PV module * X pcs ≒ Best Vmp of Inverter or Vmp range

PV module numbers in Parallel: Max. charging current of inverter / Impp

Total PV module numbers = maximum PV module numbers in series * PV module numbers in parallel

After considering Voc of PV module not exceed 60Vdc and max. Vmpp of PV module close to 60Vdc or within 30Vdc ~ 50Vdc, we can choose PV module with below specification.

Maximum Power (Pmax)	250W	Max. PV module numbers in series
Max. Power Voltage Vmpp(V)	30.9V	1 ➔ 30.9x 1 ≒ 30 ~ 50
Max. Power Current Impp(A)	8.42A	PV module numbers in parallel
Open Circuit Voltage Voc(V)	37.7V	3 ➔ 25 A / 8.42
Short Circuit Current Isc(A)	8.89A	Total PV module numbers 1 x 3 = 3

Maximum PV module numbers in Series: 1
PV module numbers in Parallel: 3
Total PV module numbers: 1 x 3 = 3

Please follow below steps to implement PV module connection:

1. Check the input voltage of PV array modules. The acceptable input voltage of the inverter is 60VDC (with rated load). Please make sure that the maximum current of each PV input connector is 13A.
2. Disconnect the circuit breaker.
3. Assemble provided PV connectors with PV modules by appropriate crimping tool and spanner. Prepare the cable and assemble connector as following 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.
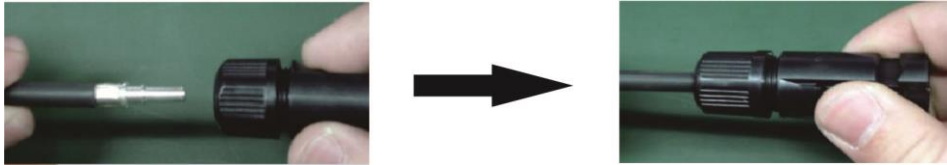
Insert assembled cable into female connector housing as shown below.
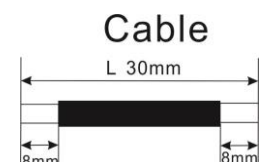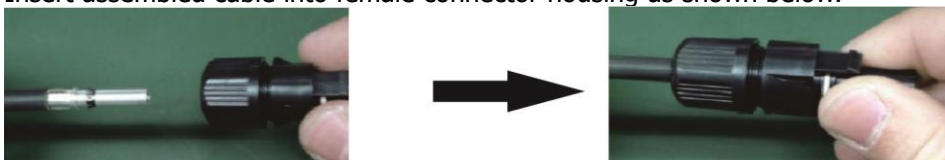
Insert striped cable into male terminal and crimp male terminal as shown below.

Insert assembled cable into male connector housing as shown below.

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

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.
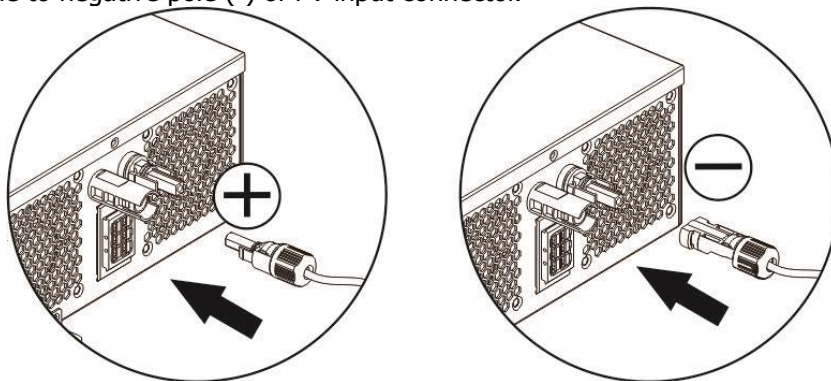
5. Make sure all PV connectors are firmly connected.

Communication Connection

This inverter is equipped with intelligent slot perfect to install with communication card such as SNMP or Modbus. When installing with SNMP or Modbus card in the inverter, it will provide advanced communication and monitoring options.

After communication cable is connected well, insert bundled CD into a computer and follow on-screen instruction to install the monitoring software. For the detailed software operation, please check user manual of software inside of CD.

OPERATION

Power ON/OFF
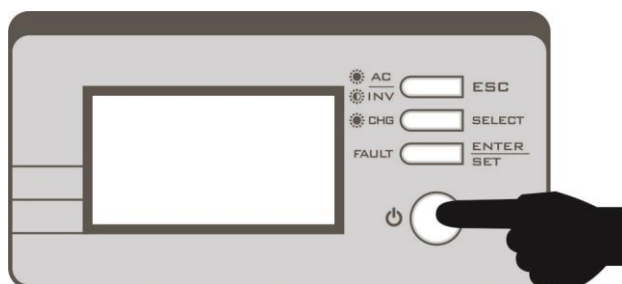
Once the unit has been properly installed and the batteries are connected well, simply press On/Off switch to turn on the unit.

Operation and Display Panel

The operation and display panel, shown in below chart, is on the front panel of the inverter. It includes three LED indicators, three function keys and a LCD display, indicating the operating status and input/output power information.
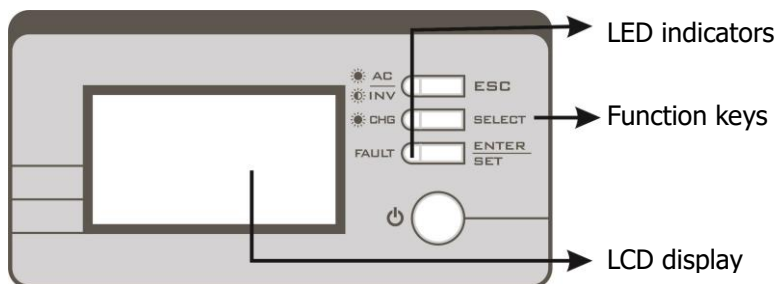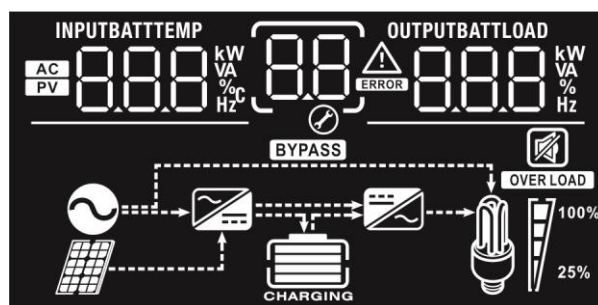
LED Indicators

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

Function Keys

Function Key	Description
ESC	To exit setting mode
SELECT	To go to next page or next selection
ENTER	To confirm the selection in setting mode or enter setting mode

LCD Display Icons

Icon	Function description
Input Source Information	
AC	Indicates the AC input.
PV	Indicates the PV input
INPUTBATT 8.8.8 kW VA %°C Hz	Indicate input voltage, input frequency, PV voltage, charger current (if PV in charging for 3K models), charger power, battery voltage.
Configuration Program and Fault Information	
88 ⊘	Indicates the setting programs.
88 ⚠ ERROR	Indicates the warning and fault codes. Warning: 88 ⚠ flashing with warning code. Fault: 88 ERROR lighting with fault code
Output Information	
OUTPUTBATTLOAD 8.8.8 kW VA % Hz	Indicate output voltage, output frequency, load percent, load in VA, load in Watt and discharging current.
Battery Information	
CHARGING	Indicates battery level by 0-24%, 25-49%, 50-74% and 75-100% in battery mode and charging status in line mode.

In AC mode, it will present battery charging status.

Status	Battery voltage	LCD Display
Constant Current mode / Constant Voltage mode	<2V/cell	4 bars will flash in turns.
	2 ~ 2.083V/cell	Bottom bar will be on and the other three bars will flash in turns.
	2.083 ~ 2.167V/cell	Bottom two bars will be on and the other two bars will flash in turns.
	> 2.167 V/cell	Bottom three bars will be on and the top bar will flash.
Floating mode. Batteries are fully charged.		4 bars will be on.

In battery mode, it will present battery capacity.

Load Percentage	Battery Voltage	LCD Display
Load >50%	< 1.85V/cell	
	1.85V/cell ~ 1.933V/cell	
	1.933V/cell ~ 2.017V/cell	
	> 2.017V/cell	
Load < 50%	< 1.892V/cell	
	1.892V/cell ~ 1.975V/cell	
	1.975V/cell ~ 2.058V/cell	
	> 2.058V/cell	

Load Information

OVER LOAD	Indicates overload.

	Indicates the load level by 0-24%, 25-49%, 50-74% and 75-100%.			
	0%~24%	25%~49%	50%~74%	75%~100%

Mode Operation Information

	Indicates unit connects to the mains.
	Indicates unit connects to the PV panel.
BYPASS	Indicates load is supplied by utility power.
	Indicates the utility charger circuit is working.
	Indicates the DC/AC inverter circuit is working.

Mute Operation

	Indicates unit alarm is disabled.

LCD Setting

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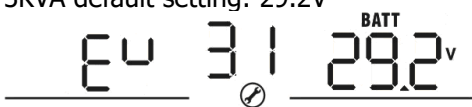
Setting Programs:

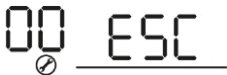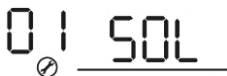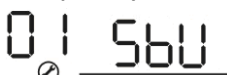| Program	Description	Selectable option	
00	Exit setting mode	Escape 00 ESC	
01	Output source priority: To configure load power source priority	Solar first 01 SOL	Solar energy provides power to the loads as first priority. If solar energy is not sufficient to power all connected loads, battery energy will supply power the loads at the same time. Utility provides power to the loads only when any one condition happens: - Solar energy is not available - Battery voltage drops to either low-level warning voltage or the setting point in program 12.
		Utility first (default) 01 UtI	Utility will provide power to the loads as first priority. Solar and battery energy will provide power to the loads only when utility power is not available.
		SBU priority 01 SbU	Solar energy provides power to the loads as first priority. If solar energy is not sufficient to power all connected loads, battery energy will supply power to the loads at the same time. Utility provides power to the loads only when battery voltage drops to either low-level warning voltage or the setting point in program 12.
02	Maximum charging current: To configure total charging current for solar and utility chargers. (Max. charging current = utility charging current + solar charging current)	15A 02 15 ᴬ	25A (default) 02 25 ᴬ
03	AC input voltage range	Appliances (default) 03 APL	If selected, the transfer time is within 20ms between battery mode and line mode

		UPS `03 UPS`	If selected, the transfer time is within 10ms between battery mode and line mode
05	Battery type	AGM (default) `05 AGn`	Flooded `05 FLd`
		User-Defined `05 USE`	If "User-Defined" is selected, battery charge voltage and low DC cut-off voltage can be set up in program 26, 27 and 29.
06	Auto restart when overload occurs	Restart disable (default) `06 LHd`	Restart enable `06 LHE`
07	Auto restart when over temperature occurs	Restart disable (default) `07 tHd`	Restart enable `07 tHE`
09	Output frequency	50Hz `09 50 Hz`	60Hz (default) `09 60 Hz`
11	Maximum utility charging current	15A(default) `11 15A`	25A `11 25A`
12	Setting voltage point back to utility source when selecting "SBU priority" or "Solar first" in program 01.	22.0V `12 BATT 22.0 V`	22.5V `12 BATT 22.5 V`
		23.0V (default) `12 BATT 23.0 V`	23.5V `12 BATT 23.5 V`
		24.0V `12 BATT 24.0 V`	24.5V `12 BATT 24.5 V`
		25.0V `12 BATT 25.0 V`	25.5V `12 BATT 25.5 V`
13	Setting voltage point back to battery mode when selecting "SBU priority" or "Solar first" in program 01.	Battery fully charged `13 BATT FUL`	24V `13 BATT 24.0 V`
		24.5V `13 BATT 24.5 V`	25V `13 BATT 25.0 V`

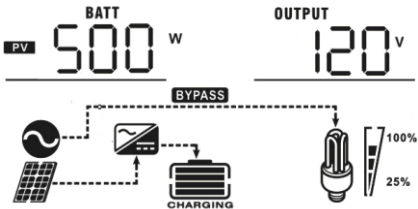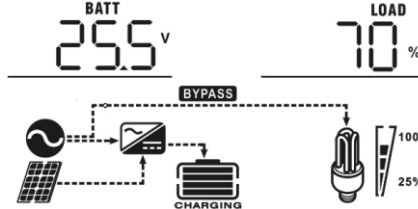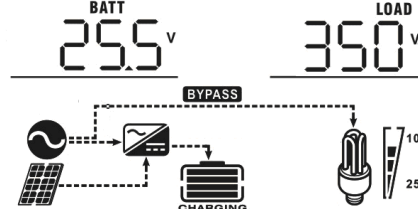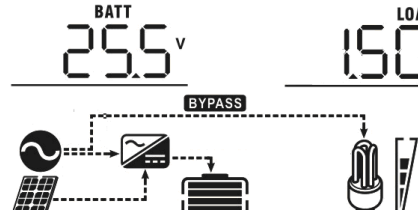|		25.5V	26V
		13 25.5ᵥ BATT	**13** 26.0ᵥ BATT
		26.5V	27V (default)
		13 26.5ᵥ BATT	**13** 27.0ᵥ BATT
		27.5V	28V
		13 27.5ᵥ BATT	**13** 28.0ᵥ BATT
		28.5V	29V
		13 28.5ᵥ BATT	**13** 29.0ᵥ BATT
16	Charger source priority: To configure charger source priority	If this inverter/charger is working in Line, Standby or Fault mode, charger source can be programmed as below:	
		Solar first **16** CSO	Solar energy will charge battery as first priority. Utility will charge battery only when solar energy is not available.
		Utility first **16** CUt	Utility will charge battery as first priority. Solar energy will charge battery only when utility power is not available.
		Solar and Utility **16** SNU	Solar energy and utility will charge battery at the same time.
		Only Solar **16** OSO	Solar energy will be the only charger source no matter utility is available or not.
		If this inverter/charger is working in Battery mode or Power saving mode, only solar energy can charge battery. Solar energy will charge battery if it's available and sufficient.	
18	Alarm control	Alarm on (default) **18** bON	Alarm off **18** bOF
19	Auto return to default display screen	Return to default display screen (default) **19** ESP	If selected, no matter how users switch display screen, it will automatically return to default display screen (Input voltage /output voltage) after no button is pressed for 1 minute.
		Stay at latest screen **19** � HEP	If selected, the display screen will stay at latest screen user finally switches.
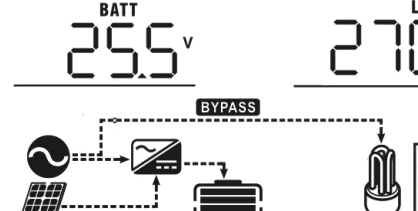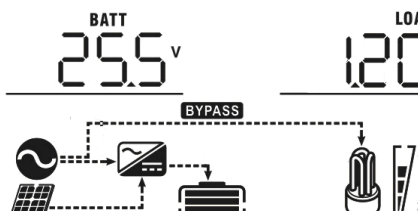
20	Backlight control	Backlight on (default) 20 LON	Backlight off 20 LOF
22	Beeps while primary source is interrupted	Alarm on (default) 22 AON	Alarm off 22 AOF
23	Overload bypass: When enabled, the unit will transfer to line mode if overload occurs in battery mode.	Bypass disable (default) 23 bYd	Bypass enable 23 bYE
25	Record Fault code	Record enable (default) 25 FEN	Record disable 25 FdS

26	Bulk charging voltage (C.V voltage)	24V model default setting: 28.2V CU 26 28.2ᵥ BATT
		If self-defined is selected in program 5, this program can be set up. Setting range is from 24.0V to 29.2V for 24V model. Increment of each click is 0.1V.

27	Floating charging voltage	24V model default to 27.0V FLU 27 27.0ᵥ BATT
		If self-defined is selected in program 5, this program can be set up. Setting range is from 24.0V to 29.2V for 24V model. Increment of each click is 0.1V.

29	Low DC cut-off voltage	24V model default setting: 21.0V COU 29 21.0ᵥ BATT
		If self-defined is selected in program 5, this program can be set up. Setting range is from 20.0V to 24.0V for 24V model. Increment of each click is 0.1V. Low DC cut-off voltage will be fixed to setting value no matter what percentage of load is connected.

30	Battery equalization	Battery equalization 30 EEN	Battery equalization disable (default) 30 EdS
		If "Flooded" or "User-defined" is selected in program 5, this program can be set up.	

31	Battery equalization voltage	3KVA default setting: 29.2V EU 31 29.2ᵥ BATT
		Setting range is from 25.0V to 30V for 3KVA model. Increment of each click is 0.1V.

33	Battery equalized time	60min (default) **33 60**	Setting range is from 5min to 900min. Increment of each click is 5min.
34	Battery equalized timeout	120min (default) **34 120**	Setting range is from 5min to 900 min. Increment of each click is 5 min.
35	Equalization interval	30days (default) **35 30d**	Setting range is from 0 to 90 days. Increment of each click is 1 day
36	Equalization activated immediately	Enable **36 AEN** — Disable (default) **36 AdS** If equalization function is enabled in program 30, this program can be set up. If "Enable" is selected in this program, it's to activate battery equalization immediately and LCD main page will shows "E9". If "Disable" is selected, it will cancel equalization function until next activated equalization time arrives based on program 35 setting. At this time, "E9" will not be shown in LCD main page.	

Display Setting

The LCD display information will be switched in turns by pressing "SELECT" key. The selectable information is switched to display in order as below: input voltage/output voltage, input frequency, PV voltage, total charging power, solar charging power, battery voltage/output frequency, main CPU Version and second CPU Version.
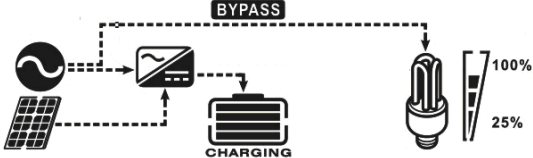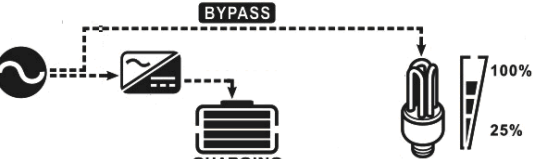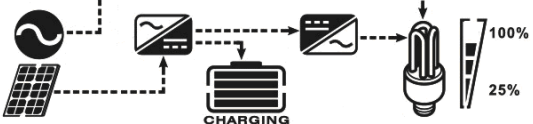
Selectable information	LCD display
Input voltage/Output voltage (Default Display Screen)	Input Voltage=120V, output voltage=120V INPUT AC 120 v OUTPUT 120 v
Input frequency/Output frequency	Input frequency=50Hz, output frequency =50Hz INPUT AC 50.0 Hz OUTPUT 50.0 Hz
PV voltage/Output voltage	PV voltage=40V, output voltage=120V INPUT PV 40 v OUTPUT 120 v

Solar charging power/Output voltage	Solar charging power=500W, output voltage=120V **BATT** PV **500** W **OUTPUT** **120** V BYPASS ... CHARGING ... 100% 25%
Battery voltage/Load percentage	batt voltage 25.5V, Load percent=70% **BATT** **25.5** V **LOAD** **70** % BYPASS ... CHARGING ... 100% 25%
Battery voltage/Load in VA	When connected load is lower than 1kVA, load in VA will present xxxVA like below chart. **BATT** **25.5** V **LOAD** **350** VA BYPASS ... CHARGING ... 100% 25% When load is larger than 1kVA (≧1KVA), load in VA will present x.xkVA like below chart. **BATT** **25.5** V **LOAD** **1.50** k VA BYPASS ... CHARGING ... 100% 25%
Battery voltage/Load in Watt	When load is lower than 1kW, load in W will present xxxW like below chart. **BATT** **25.5** V **LOAD** **270** W BYPASS ... CHARGING ... 100% 25% When load is larger than 1kW (≧1KW), load in W will present x.xkW like below chart. **BATT** **25.5** V **LOAD** **1.20** kW BYPASS ... CHARGING ... 100% 25%

	Battery voltage=25.5V, output frequency = 50.0Hz
Battery voltage/ Output frequency	
Main CPU version checking	Main CPU version U1.01.01
Secondary CPU version checking	Secondary CPU version U2.01.01

Operating Mode Description
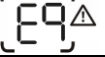
Operation mode	Description	LCD display
Standby mode **Note:** *Standby mode: The inverter is not turned on yet but at this time, the inverter can charge battery without AC output.	No output is supplied by the unit but it still can charge batteries.	Charging by utility.
		Charging by PV energy.
		Charging by utility and PV energy.
		No charging.
Fault mode Note: *Fault mode: Errors are caused by inside circuit error or external reasons such as over temperature, output short circuited and so on.	PV energy and utility can charge batteries.	Charging by utility and PV energy.
		Charging by utility.

Fault mode Note: *Fault mode: Errors are caused by inside circuit error or external reasons such as over temperature, output short circuited and so on.	PV energy and utility can charge batteries.	Charging by PV energy. No charging.
Line Mode	The unit will provide output power from the mains. It will also charge the battery at line mode.	Charging by utility and PV energy. Charging by utility. If "solar first" is selected as output source priority and solar energy is not sufficient to provide the load, solar energy and the utility will provide the loads and charge the battery at the same time.
Battery Mode	The unit will provide output power from battery and PV power.	Power from battery and PV energy. PV energy will supply power to the loads and charge battery at the same time. Power from battery only.

Fault Reference Code

Fault Code	Fault Event	Icon on
01	Fan is locked when inverter is off.	01 ERROR
02	Over temperature	02 ERROR
03	Battery voltage is too high	03 ERROR
05	Output short circuited or over temperature is detected by internal converter components.	05 ERROR
06	Output voltage is abnormal.	06 ERROR
07	Overload time out	07 ERROR
08	Bus voltage is too high	08 ERROR
09	Bus soft start failed	09 ERROR

Warning Indicator

Warning Event	Audible Alarm	Icon flashing
Fan is locked when inverter is on.	Beep three times every second	01 ⚠
Low battery	Beep once every second	(battery icon)
Overload	Beep once every 0.5 second	07 ⚠ 100% 25% OVER LOAD
Battery equalization		E9 ⚠

Battery Equalization Description

Equalization function is added into charge controller. It reverses the buildup of negative chemical effects like stratification, a condition where acid concentration is greater at the bottom of the battery than at the top. Equalization also helps to remove sulfate crystals that might have built up on the plates. If left unchecked, this condition, called sulfation, will reduce the overall capacity of the battery. Therefore, it's recommended to equalize battery periodically.

● **How to Apply Equalization Function**

You must enable battery equalization function in monitoring LCD setting program 30 first. Then, you may apply this function in device by either one of following methods:

1. Setting equalization interval in program 35.
2. Active equalization immediately in program 36.

● **When to Equalize**

In float stage, when the setting equalization interval (battery equalization cycle) is arrived, or equalization is active immediately, the controller will start to enter Equalize stage.
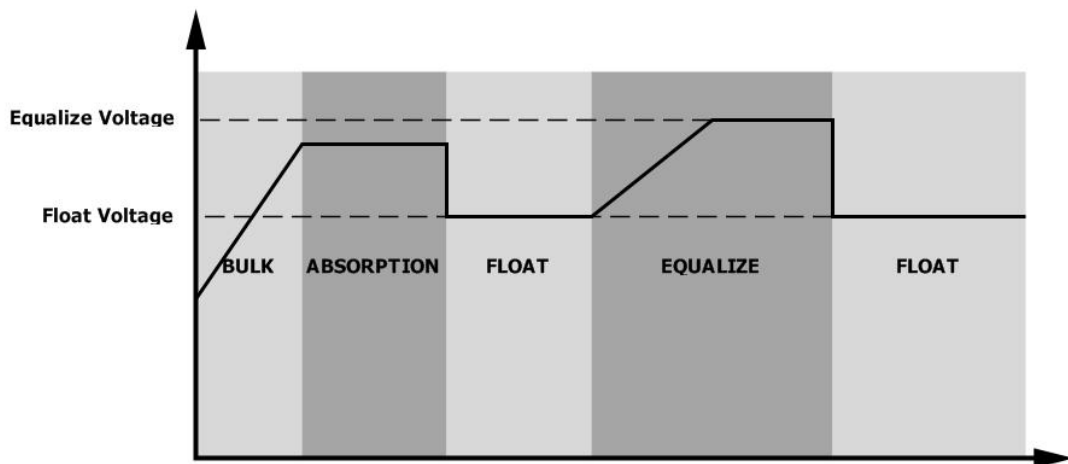
● **Equalize charging time and timeout**

In Equalize stage, the controller will supply power to charge battery as much as possible until battery voltage raises to battery equalization voltage. Then, constant-voltage regulation is applied to maintain battery voltage at the battery equalization voltage. The battery will remain in the Equalize stage until setting battery equalized time is arrived.
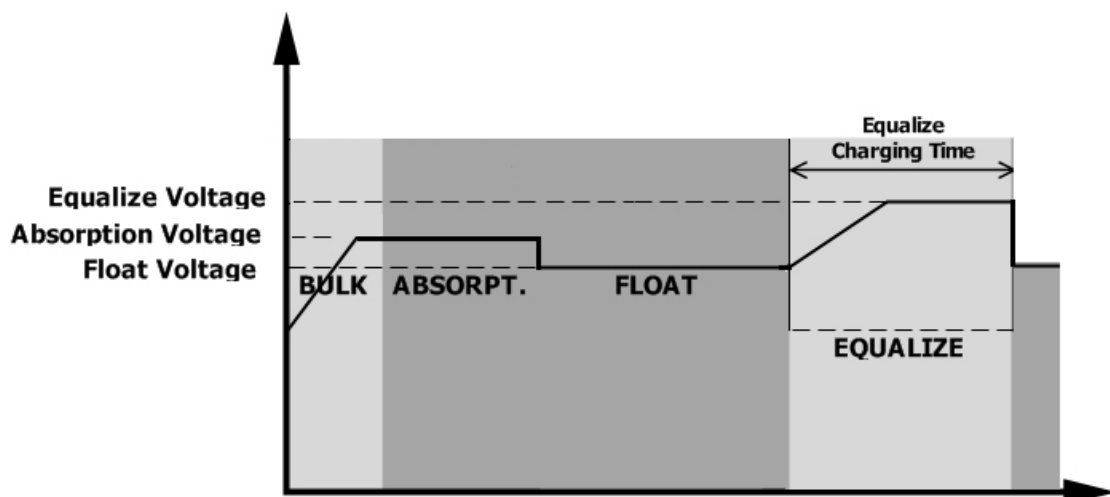
However, in Equalize stage, when battery equalized time is expired and battery voltage doesn't rise to battery equalization voltage point, the charge controller will extend the battery equalized time until battery voltage achieves battery equalization voltage. If battery voltage is still lower than battery equalization voltage when battery equalized timeout setting is over, the charge controller will stop equalization and return to float stage.
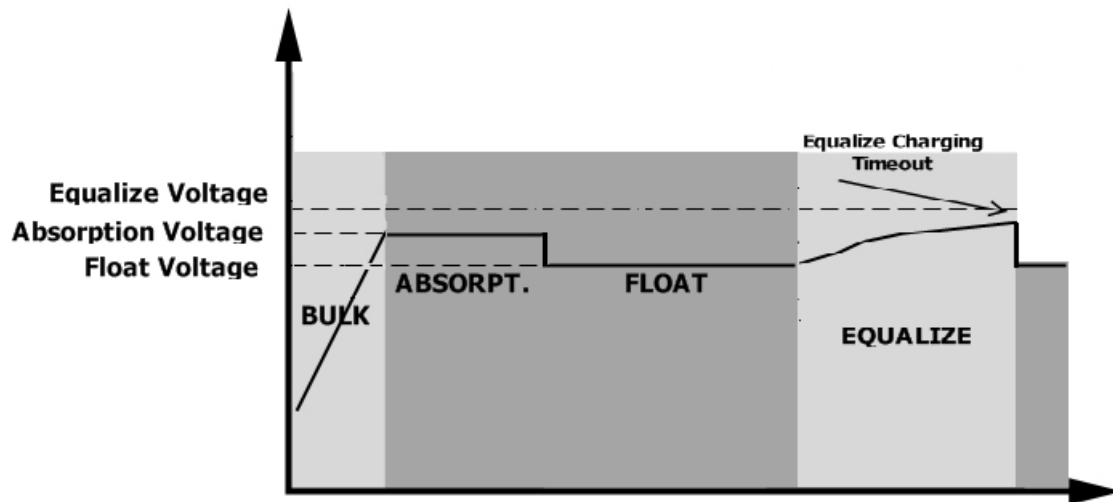
SPECIFICATIONS

Table 1 Line Mode Specifications

INVERTER MODEL	3KVA
Input Voltage Waveform	Sinusoidal (utility or generator)
Nominal Input Voltage	120Vac
Low Loss Voltage	95Vac± 3% (UPS) 85Vac± 3% (Appliances)
Low Loss Return Voltage	100Vac± 3% (UPS); 90Vac± 3% (Appliances)
Boost activation voltage	108Vac± 3%
Boost deactivation voltage	111Vac± 3%
Buck activation voltage	132Vac± 3%
Buck deactivation voltage	129Vac± 3%
High Loss Voltage	140Vac± 3%
High Loss Return Voltage	135Vac± 3%
Max AC Input Voltage	150Vac
Nominal Input Frequency	50Hz / 60Hz (Auto detection)
Low Loss Frequency	40±1Hz
Low Loss Return Frequency	42±1Hz
High Loss Frequency	65±1Hz
High Loss Return Frequency	63±1Hz
Output Short Circuit Protection	Line mode: Circuit Breaker Battery mode: Electronic Circuits
Efficiency (Line Mode)	>95% (Rated R load, battery full charged)
Transfer Time [*]	10ms typical, 12ms maximum @50Hz (UPS); 20ms typical, 25ms maximum @50Hz (Appliances)
Output power derating: When AC input voltage drops to 95V depending on models, the output power will be derated.	

Table 2 Inverter Mode Specifications

INVERTER MODEL	3KVA
Rated Output Power	3KVA/2.7KW
Output Voltage Waveform	Pure Sine Wave
Output Voltage Regulation	120Vac±5%
Output Frequency	60Hz or 50Hz
Peak Efficiency	90%
Overload Protection	5s@≥150% load; 10s@110%~150% load
Surge Capacity	2* rated power for 5 seconds
Nominal DC Input Voltage	24Vdc
Cold Start Voltage	23.0Vdc
Low DC Warning Voltage @ load < 20% @ 20% ≤ load < 50% @ load ≥ 50%	22.0Vdc 21.4Vdc 20.2Vdc
Low DC Warning Return Voltage @ load < 20% @ 20% ≤ load < 50% @ load ≥ 50%	23.0Vdc 22.4Vdc 21.2Vdc
Low DC Cut-off Voltage @ load < 20% @ 20% ≤ load < 50% @ load ≥ 50%	21.0Vdc 20.4Vdc 19.2Vdc
High DC Recovery Voltage	29Vdc
High DC Cut-off Voltage	31Vdc
No Load Power Consumption	<25W

Table 3 Charge Mode Specifications

Utility Charging Mode	
INVERTER MODEL	**3KVA**
Charging Current (UPS) @ Nominal Input Voltage	25A
Bulk Charging Voltage — **Flooded Battery**	29.2
Bulk Charging Voltage — **AGM / Gel Battery**	28.2
Floating Charging Voltage	27Vdc
Charging Algorithm	3-Step
Charging Curve	

Solar Charging Mode	
INVERTER MODEL	**3KVA**
Efficiency	98.0% max.
Max. PV Array Open Circuit Voltage	60VDC
PV Array MPPT Voltage Range	30~50VDC
Min battery voltage for PV charge	17VDC
Charging current	25A
Standby Power Consumption	2W
Battery Voltage Accuracy	+/-0.3V
PV Voltage Accuracy	+/-2V
Charging Algorithm	3-Step
Joint Utility and Solar Charging	
Max Charging Current	25Amp
Default Charging Current	25Amp

Table 4 USB Charger

INVERTER MODEL	**3KVA**
Voltage	5Vdc
Total Charging Current	3Amp

Table 5 General Specifications

INVERTER MODEL	**3KVA**
Safety Certification	CE
Operating Temperature Range	0°C to 55°C
Storage temperature	-15°C~ 60°C
Dimension (D*W*H), mm	349 x 383 x 100
Net Weight, kg	13

TROUBLE SHOOTING

Problem	LCD/LED/Buzzer	Explanation / Possible cause	What to do
Unit shuts down automatically during startup process.	LCD/LEDs and buzzer will be active for 3 seconds and then complete off.	The battery voltage is too low (<1.91V/Cell)	1. Re-charge battery. 2. Replace battery.
No response after power on.	No indication.	1. The battery voltage is far too low. (<1.4V/Cell) 2. Battery polarity is connected reversed.	1. Check if batteries and the wiring are connected well. 2. Re-charge battery. 3. Replace battery.
Mains exist but the unit works in battery mode.	Input voltage is displayed as 0 on the LCD and green LED is flashing.	Input protector is tripped	Check if AC breaker is tripped and AC wiring is connected well.
	Green LED is flashing.	Insufficient quality of AC power. (Shore or Generator)	1. Check if AC wires are too thin and/or too long. 2. Check if generator (if applied) is working well or if input voltage range setting is correct. (UPS→Appliance)
	Green LED is flashing.	Set "Solar First" as the priority of output source.	Change output source priority to Utility first.
When the unit is turned on, internal relay is switched on and off repeatedly.	LCD display and LEDs are flashing	Battery is disconnected.	Check if battery wires are connected well.
Buzzer beeps continuously and red LED is on.	Fault code 07	Overload error. The inverter is overload 110% and time is up.	Reduce the connected load by switching off some equipment.
	Fault code 05	Output short circuited.	Check if wiring is connected well and remove abnormal load.
	Fault code 02	Internal temperature of inverter component is over 100°C.	Check whether the air flow of the unit is blocked or whether the ambient temperature is too high.
	Fault code 03	Battery is over-charged.	Return to repair center.
		The battery voltage is too high.	Check if spec and quantity of batteries are meet requirements.
	Fault code 01	Fan fault	Replace the fan.
	Fault code 06	Output abnormal. (Inverter voltage is lower than 90Vac or higher than 140Vac.)	1. Reduce the connected load. 2. Return to repair center
	Fault code 08/09	Internal components failed.	Return to repair center.

Appendix I: Approximate Back-up Time Table

Model	Load (VA)	Backup Time @ 24Vdc 100Ah (min)	Backup Time @ 24Vdc 200Ah (min)
3KVA	300	449	1100
	600	222	525
	900	124	303
	1200	95	227
	1500	68	164
	1800	56	126
	2100	48	108
	2400	35	94
	2700	31	74
	3000	28	67

Note: Backup time depends on the quality of the battery, age of battery and type of battery.
Specifications of batteries may vary depending on different manufacturers.