User Manual

OPTI-Solar

SP3500-5500 Handy
SOLAR INVERTER

Version: 1.0

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: All safety instructions in this document must be read, understood and followed. Failure to follow these instructions will result in death or serious injury.

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. One piece of 150A fuse is 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.
14. **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 possible current leakage to the inverter. For example, grounded PV modules will cause current leakage to the inverter. When using CIGS modules, please be sure NO grounding.
15. **CAUTION:** It's requested to use PV junction box with surge protection. Otherwise, it will cause damage on inverter when lightning occurs on PV modules.

INTRODUCTION

This is a multi-function inverter, combining functions of inverter, solar charger and battery charger to offer uninterruptible power support in a single package. The comprehensive LCD display offers user-configurable and easy-accessible button operations such as battery charging current, AC or solar charging priority, and acceptable input voltage based on different applications.

Features

- Pure sine wave inverter
- Configurable input voltage ranges for home appliances and personal computers via LCD control panel
- Configurable battery charging current based on applications via LCD control panel
- Configurable AC/Solar Charger priority via LCD control panel
- Compatible to utility mains or generator power
- Auto restart while AC is recovering
- Overload / Over temperature / short circuit protection
- Smart battery charger design for optimized battery performance

Basic System Architecture

The following illustration shows basic application for this unit. It also required the following devices to have a complete running system:

- Generator or Utility mains.
- PV modules

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

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

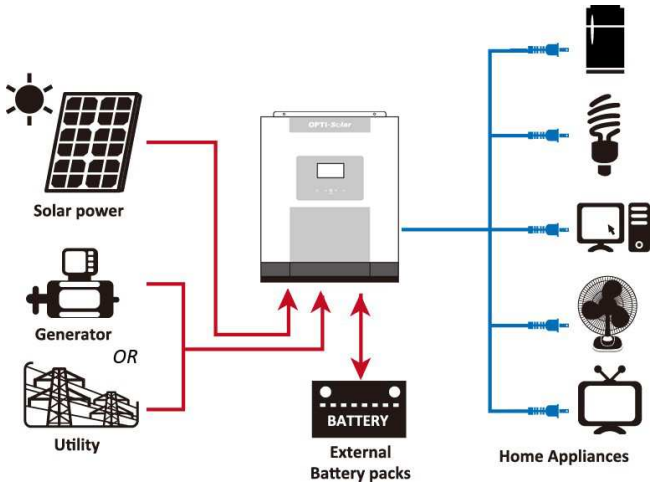
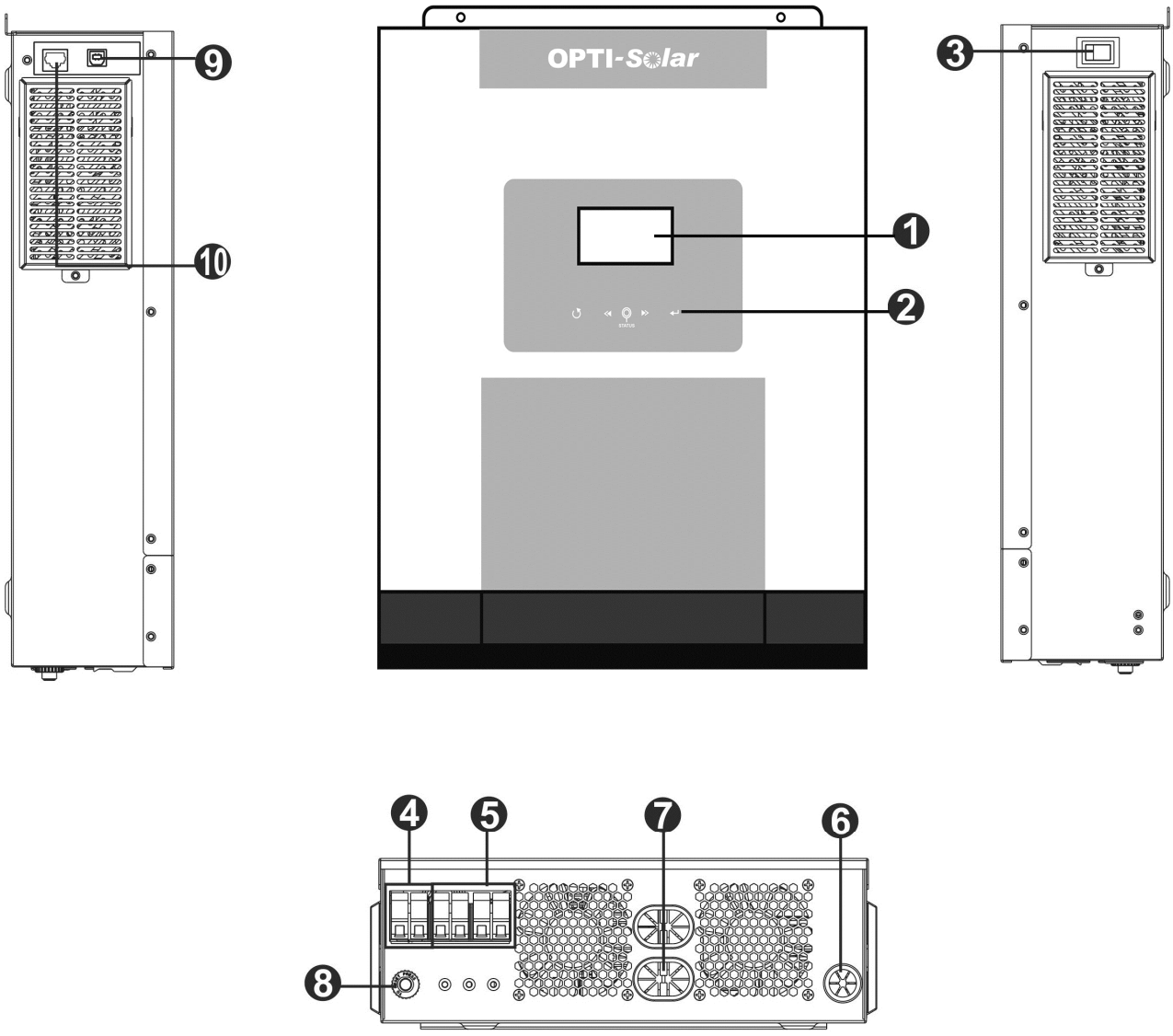


Figure 1 Hybrid Power System

Product Overview



1. LCD display
2. Function buttons with status indication
3. Power on/off switch
4. AC input
5. AC output
6. PV input
7. Battery input
8. Circuit breaker
9. USB communication port
10. RS-232 communication port

INSTALLATION

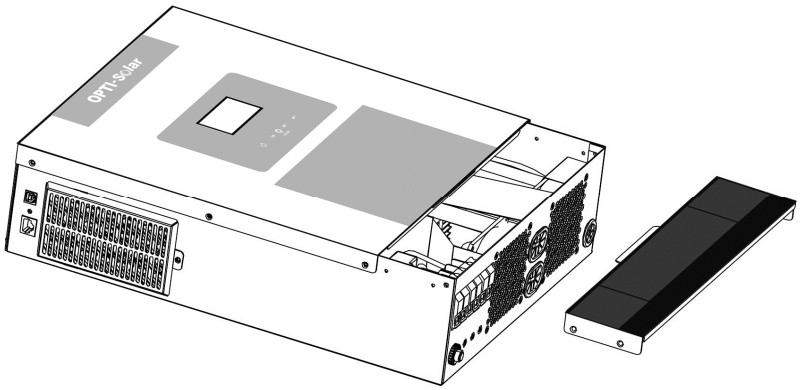
Unpacking and Inspection

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

- Inverter x 1
- User manual x 1
- RS232 Communication cable x 1
- Software CD x 1
- DC Fuse x 1

Preparation

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

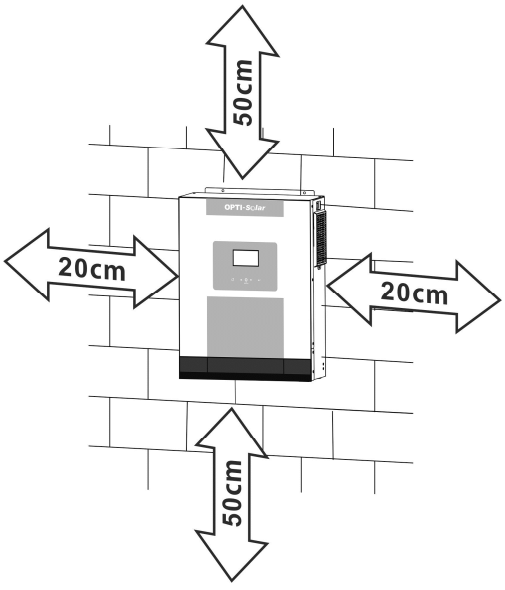


Mounting the Unit

Consider the followings before selecting your placements:

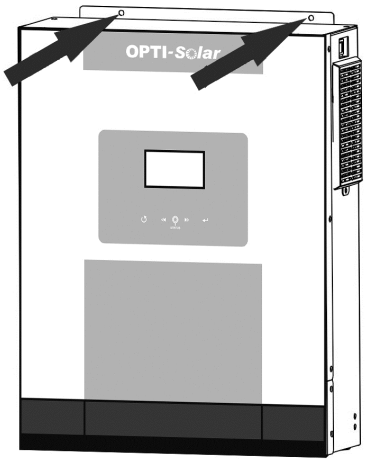
- Do not mount the inverter on flammable construction materials.
- Mount on a solid surface
- Install the inverter at eye level in order to allow easy LCD display readout.
- For proper air circulation and heat dissipation, allow a clearance of approx. 20 cm to the side and approx. 50 cm above and below the unit.
- The ambient temperature should be between 0°C and 55°C to ensure optimal operation.
- The recommended orientation is to adhered to the wall vertically.

  Be sure to keep other objects and surfaces as shown in the diagram to guarantee sufficient heat dissipation and to have enough space for wirings.



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

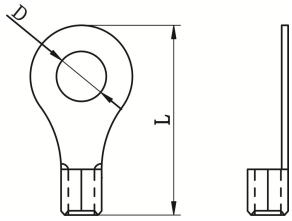
Install the unit by screwing two screws. It's recommended to use M4 or M5 screws.



Battery Connection

CAUTION: For safety operation and regulation compliance, it's requested to install a separate DC over-current protector or disconnection device between battery and the inverter. It may not be necessary to have a disconnection device in some applications, however, it's still recommended to have over-current protection installed. Please refer to typical amperage as required.

Ring terminal:



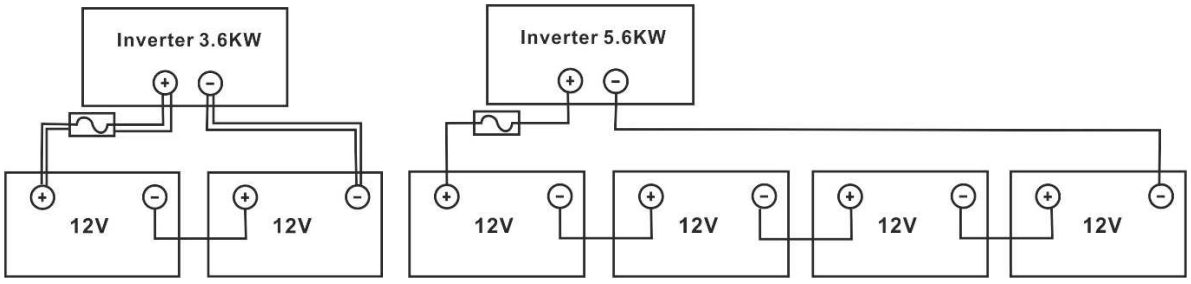
WARNING! All wiring must be performed by a qualified electrical technician.
WARNING! It's very important for system safety and efficient operation to use appropriate cables for battery connection. To reduce risk of injury, please use the proper recommended cable in the table below.

Recommended battery cable size:

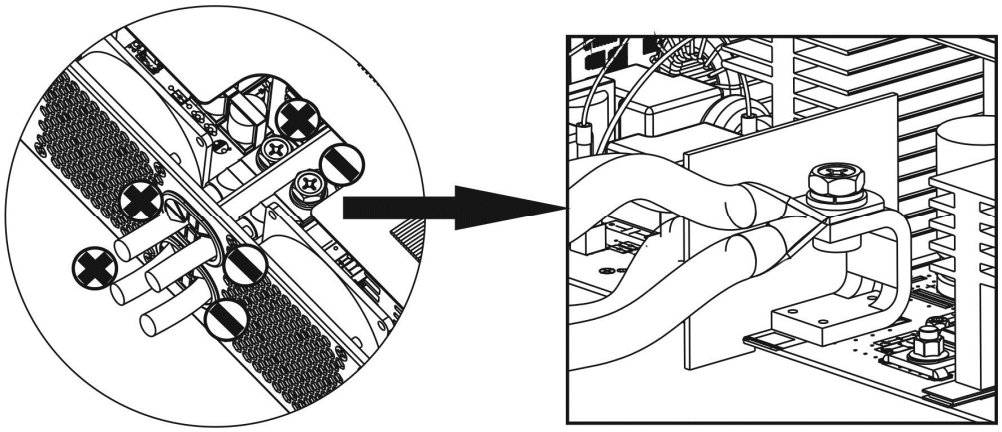
Model	Typical Amperage	Wire Size	Cable mm² (each)	Ring Terminal Dimensions		Torque Value
				D (mm)	L (mm)	
3.6KW	167A	2*4AWG	25	8.4	33.2	5 Nm
5.6KW	129.6A	1*2AWG	38	8.4	39.2	
		2*4AWG	25	8.4	33.2	

Please follow below steps to implement battery connection:

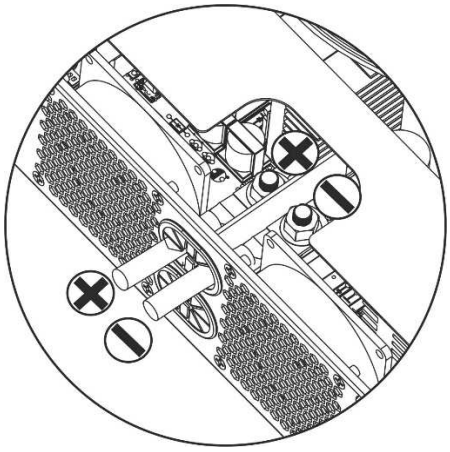
1. 3.6KW model supports 24VDC system and 5.6KW model supports 48VDC system. Connect all battery packs as below chart. It is recommend to connect minimum of 100Ah capacity battery for 3.6KW model and 200Ah capacity battery for 5.6KW model.



2. Prepare four battery wires for 3.6KW model and two or four battery wires for 5.6KW model depending on cable size (refer to recommended cable size table). Apply ring terminals to your battery wires and secure it to the battery terminal block with the bolts properly tightened. Refer to battery cable size for torque value. Make sure polarity at both the battery and the inverter is correctly connected and ring terminals are secured to the battery terminals.



3.6KW / 5.6KW



5.6KW

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

⚠	**CAUTION!!** Do not place anything between inverter terminals and the ring terminals. Otherwise, overheating may occur. **CAUTION!!** Do not apply anti-oxidant substance on the terminals before terminals are securely tightened. **CAUTION!!** Before making final DC connection or closing DC breaker/disconnector, be sure that the positive (+) must be connected to positive (+) and negative (-) connected to negative (-).

AC Input/Output Connection

CAUTION!! Before connecting to AC input power source, please install a **separate** AC breaker between the inverter and the AC input power source. This will ensure that the inverter can be safely disconnected during maintenance and fully protected from over-current. The recommended spec of AC breaker is 32A

CAUTION!! There are two power terminal blocks with "IN" (Input) and "OUT" (Output) markings. DO NOT mistakenly connect to the wrong connectors.

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

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

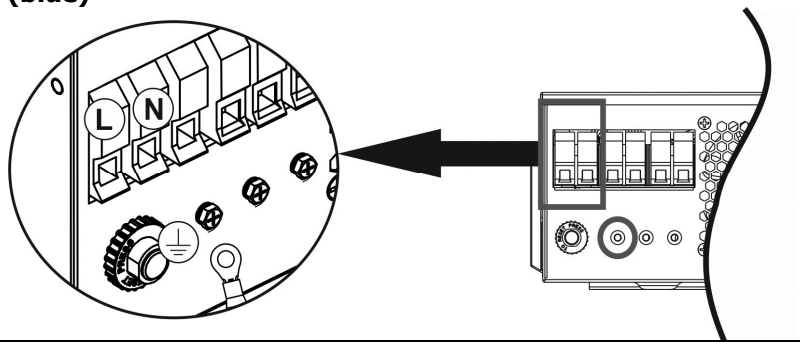
Suggested cable requirement for AC wires

Model	Gauge	Cable (mm^2)	Torque Value
3.6KW	12 AWG	4	1.2 Nm
5.6KW	10 AWG	6	1.2 Nm

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

1. Before making AC input/output connection, be sure to enable DC protector or disconnector first.
2. Remove insulation sleeves for about 10mm for the five screw terminals.
3. Insert AC input wires according to polarities indicated on terminal block and tighten the terminal screws. Be sure to connect the grounding wire (⏚) first.

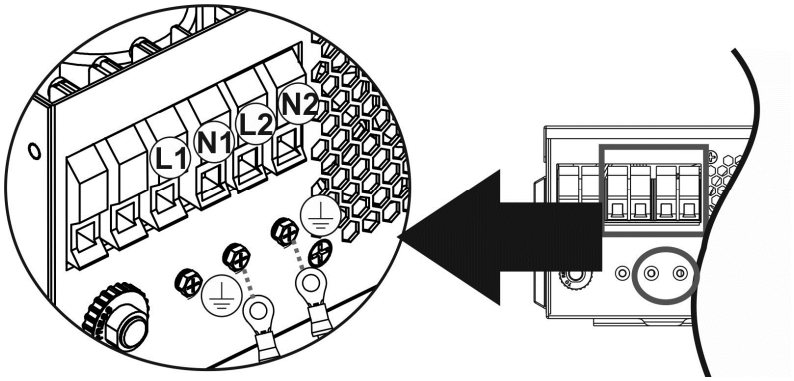
   ⏚→Ground (yellow-green)
   L→LINE (brown or black)
   N→Neutral (blue)



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

4. This inverter is equipped with dual-output. There are four terminals (L1/N1, L2/N2) available on output port. It's to set up through LCD program or monitoring software to turn on and off the second output. Refer to "LCD setting" section for the details.
   Insert AC output wires according to polarities indicated on terminal block and tighten terminal screws. Be sure to connect PE protective conductor (⏚) first.

   ⏚→Ground (yellow-green)
   L1→LINE (brown or black)
   N1→Neutral (blue)
   L2→LINE (brown or black)
   N2→Neutral (blue)



5. Make sure the wires are securely connected.

CAUTION: Appliances such as air conditioner required at least 2~3 minutes to spool up because it needs to have enough time to balance refrigerant gas inside of circuits. If a power shortage occurs and recovers in a short period of time, it may cause damage to your connected appliances. To prevent this from happening, please check with manufacturer of air conditioner if it has time-delay function before installation. Otherwise, this inverter will trigger overload fault and cut off output to protect your appliance but sometimes it may still causes damage to the air conditioner.

PV Connection

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

Model	Wire Size	Cable (mm^2)	Torque value (max)
3.6KW/5.6KW	1 x 12AWG	4	1.2 Nm

WARNING: Because this inverter is non-isolated, are accepted: single crystalline, poly crystalline with class A-rated and CIGS modules. To avoid any malfunctions, do not connect any PV modules with possible current leakage to the inverter. For example, grounded PV modules will cause current leakage to the inverter. When using CIGS modules, please be sure NO grounding connection.

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

PV Module Selection:

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

1. Open circuit Voltage (Voc) of PV modules not to exceeds maximum PV array open circuit voltage of the inverter.
2. Open circuit Voltage (Voc) of PV modules should be higher than the start-up voltage.

INVERTER MODEL	3.6KW	5.6KW
Max. PV Array Power	5000W	6000W
Max. PV Array Open Circuit Voltage	500Vdc	
PV Array MPPT Voltage Range	60Vdc~450Vdc	
Start-up Voltage	60Vdc +/- 10Vdc	
Max. PV Current	27A	

Take the 250Wp PV module as an example. After considering above two parameters, the recommended module configurations are listed in the table below.

Solar Panel Spec. (reference) - 250Wp - Vmp: 30.1Vdc - Imp: 8.3A - Voc: 37.7Vdc - Isc: 8.4A - Cells: 60	SOLAR INPUT Min in series: 2 pcs, max. in series: 12 pcs.	Q'ty of panels	Total input power
	2pcs in series	2 pcs	500W
	4pcs in series	4 pcs	1000W
	6 pcs in series	6 pcs	1500W
	8 pcs in series	8 pcs	2000W
	12 pcs in series	12 pcs	3000W
	8 pieces in series and 2 sets in parallel	16 pcs	4000W
	10 pieces in series and 2 sets in parallel	20 pcs	5000W
	11 pieces in series and 2 sets in parallel (only for 5.6KW model)	22 pcs	5500W
	12 pieces in series and 2 sets in parallel (only for 5.6KW model)	24 pcs	6000W

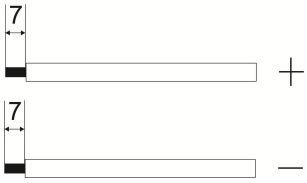
Take the 555Wp PV module as an example. After considering above two parameters, the recommended module configurations are listed in the table below.

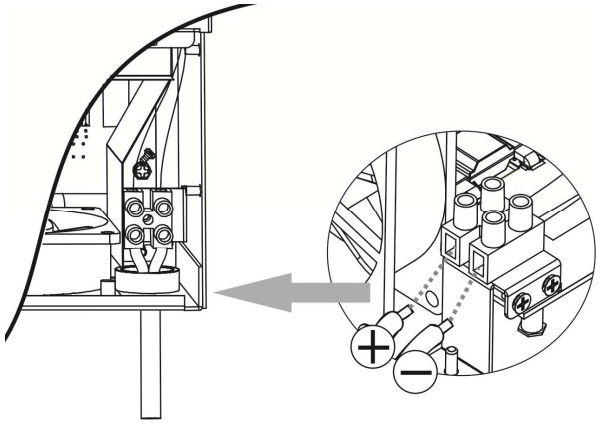
Solar Panel Spec. (reference) - 555Wp - Imp: 17.32A - Voc: 38.46Vdc - Isc: 18.33A - Cells: 110	SOLAR INPUT Min in series: 2 pcs, max. in series: 11 pcs.	Q'ty of panels	Total input power
	2pcs in series	2 pcs	1110W
	4pcs in series	4 pcs	2220W
	6 pcs in series	6 pcs	3330W
	8 pcs in series	8 pcs	4440W
	9 pcs in series	9 pcs	4995W
	10 pcs in series (only for 5.6KW model)	10 pcs	5550W
	11 pcs in series (only for 5.6KW model)	11 pcs	6000W

PV Module Wire Connection

Please take the following to implement PV module connection:

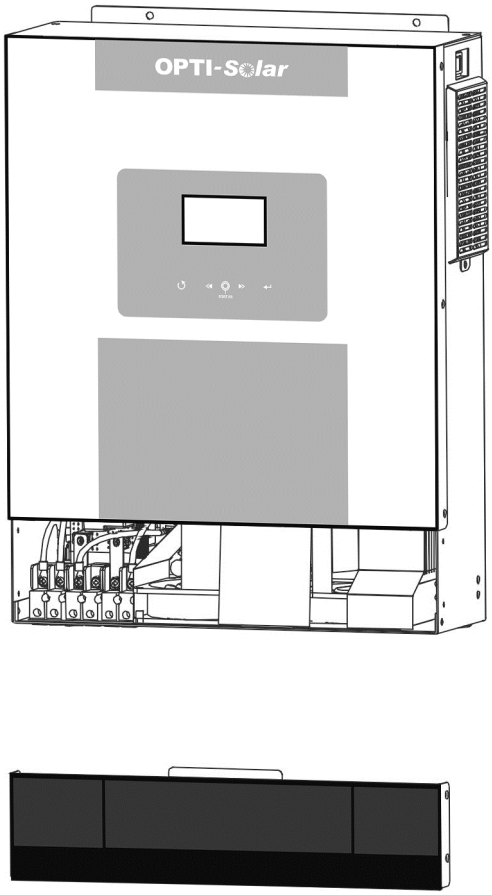
1. Remove insulation sleeve for about 7 mm on your positive and negative wires.
2. We recommend using bootlace ferrules on the wires for optimal performance.
3. Check polarities of wire connections from PV modules to PV input screw terminals. Connect your wires as illustrated below.
   Recommended tool: 4mm blade screwdriver





Final Assembly

After connecting all wirings, put the bottom cover back by fixing four screws as shown below.

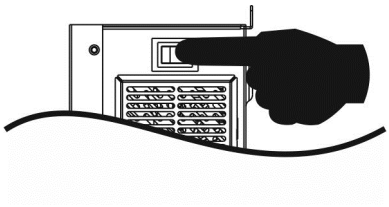


Communication Connection

Please use supplied communication cable to connect to inverter and PC. 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

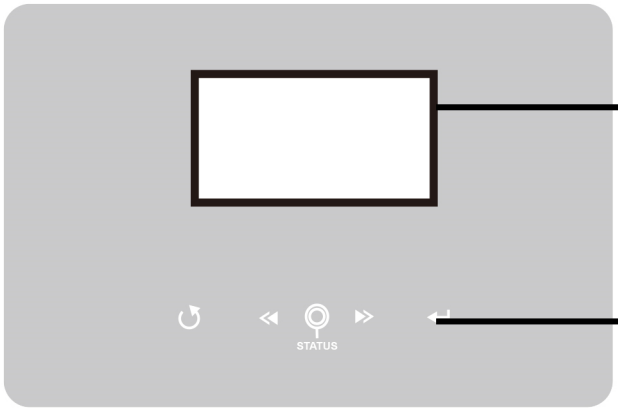
Power ON/OFF



Once the unit has been properly installed and the batteries are connected well, simply press On/Off switch (located on the side of the inverter) to turn on the unit.

Operation and Display Panel

The operation and the LCD module, shown in the chart below, includes four touchable buttons with status indication and a LCD display, indicating the operating status and input/output power information.

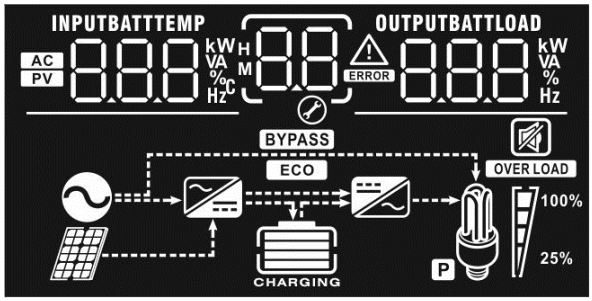


Touchable buttons with indication

Function Key	Description
↺	To exit setting mode
◀◀	To go to previous selection
▶▶	To go to next selection
↵	To confirm the selection in setting mode or enter setting mode

LED Indicator	Color	Solid/Flashing	Messages
STATUS	Green	Solid On	Unit is working normally (without any warning or fault codes and charging).
		Flashing	Battery is charging.
	Yellow	Flashing	Warning code appears.
	Red	Flashing	Fault mode.

LCD Display Icons



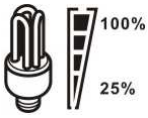
Icon	Function description
Input Source Information	
AC	Indicates the AC input.
PV	Indicates the PV input
INPUTBATT 888 kW VA %C Hz	Indicate input voltage, input frequency, PV voltage, charger current, charger power, battery voltage.
Configuration Program and Fault Information	
88	Indicates the setting 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 888 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.

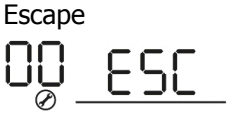
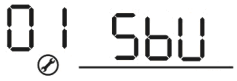
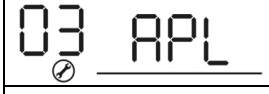
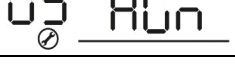
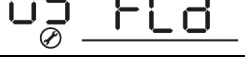
Load Percentage	Battery Voltage	LCD Display
Load >50%	< 1.85V/cell	
	1.85V/cell ~ 1.933V/cell	
	1.933V/cell ~ 2.017V/cell	
	> 2.017V/cell	
Load < 50%	< 1.892V/cell	
	1.892V/cell ~ 1.975V/cell	
	1.975V/cell ~ 2.058V/cell	
	> 2.058V/cell	

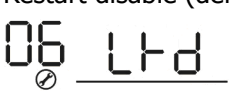
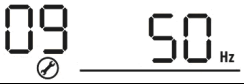
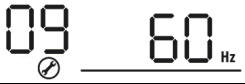
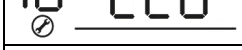
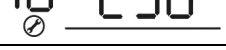
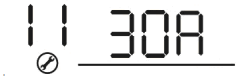
Load Information				
OVER LOAD	Indicates overload.			
	Indicates the load level by 0-24%, 25-49%, 50-74% and 75-100%.			
	0%~24%	25%~49%	50%~74%	75%~100%
				
Mode Operation Information				
	Indicates unit connects to the mains.			
	Indicates unit connects to the PV panel.			
BYPASS	Indicates load is supplied by utility power.			
	Indicates the utility charger circuit is working.			
	Indicates the DC/AC inverter circuit is working.			
P	Indicates second output is working.			
Mute Operation				
	Indicates unit alarm is disabled.			

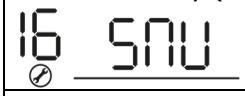
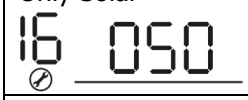
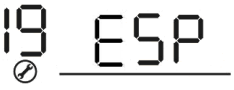
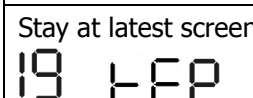
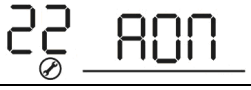
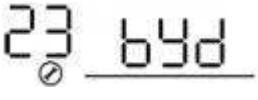
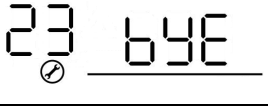
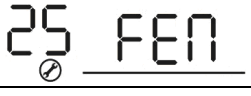
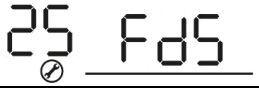
LCD Setting

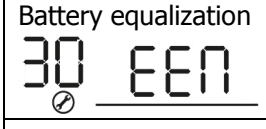
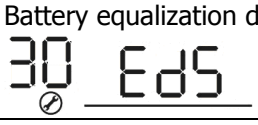
After pressing and holding ENTER button for 3 seconds, the unit will enter setting mode. Press "UP" or "DOWN" button to select setting programs. And then, press "ENTER" button to confirm the selection or ESC button to exit.

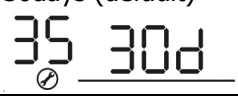
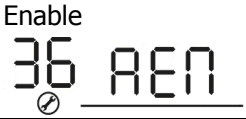
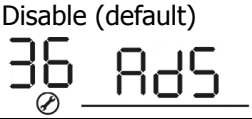
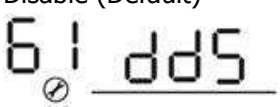
Setting Programs:

Program	Description	Selectable option	
00	Exit setting mode	Escape 	
01	Output source priority: To configure load power source priority	Utility first (default) 	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.
		Solar first 	Solar energy provides power to the loads as first priority. If solar energy is not sufficient to power all connected loads, Utility energy will supply power to the loads at the same time.
		SBU priority 	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)	60A (default) 	Setting range is from 10A to 120A. Increment of each click is 10A.
03	AC input voltage range	Appliances (default) 	If selected, acceptable AC input voltage range will be within 90-280VAC.
		UPS 	If selected, acceptable AC input voltage range will be within 170-280VAC.
05	Battery type	AGM (default) 	Flooded 

		User-Defined 	If "User-Defined" is selected, battery charge voltage and low DC cut-off voltage can be set up in program 26, 27 and 29.
06	Auto restart when overload occurs	Restart disable (default) 	Restart enable 
07	Auto restart when over temperature occurs	Restart disable (default) 	Restart enable 
09	Output frequency	50Hz (default) 	60Hz 
10	Output voltage	220V 	230V (default) 
		240V 	
11	Maximum utility charging current Note: If setting value in program 02 is smaller than that in program in 11, the inverter will apply charging current from program 02 for utility charger.	30A (default) 	Setting range is 2A, then from 10A to 100A. Increment of each click is 10A.
12	Setting voltage point back to utility source when selecting "SBU priority" in program 01.	Available options in 3.6KW model:	
		23.0V (default) 	Setting range is from 22V to 25.5V. Increment of each click is 0.5V.
		Available options in 5.6KW model:	
		46V (default) 	Setting range is from 44V to 51V. Increment of each click is 1V.
13	Setting voltage point back to battery mode when selecting "SBU priority" in program 01.	Available options in 3.6KW model:	
		Battery fully charged 	27V (default) 
		Setting range is from 24V to 29V. Increment of each click is 0.5V.	
		Available options in 5.6KW model:	
		Battery fully charged 	54V (default) 
		Setting range is from 48V to 58V. Increment of each click is 1V.	

<table>
<tr><td rowspan="6">16</td><td rowspan="6">Charger source priority:
To configure charger source priority</td><td colspan="2">If this inverter/charger is working in Line, Standby or Fault mode, charger source can be programmed as below:</td></tr>
<tr><td>Utility first
  </td><td>Utility will charge battery as first priority.
Solar energy will charge battery only when utility power is not available.</td></tr>
<tr><td>Solar first
  </td><td>Solar energy will charge battery as first priority.
Utility will charge battery only when solar energy is not available.</td></tr>
<tr><td>Solar and Utility (default)
  </td><td>Solar energy and utility will charge battery at the same time.</td></tr>
<tr><td>Only Solar
  </td><td>Solar energy will be the only charger source no matter utility is available or not.</td></tr>
<tr><td colspan="2">If this inverter/charger is working in Battery mode, only solar energy can charge battery. Solar energy will charge battery if it's available and sufficient.</td></tr>
<tr><td>18</td><td>Alarm control</td><td>Alarm on (default)
  </td><td>Alarm off
  </td></tr>
<tr><td rowspan="2">19</td><td rowspan="2">Auto return to default display screen</td><td>Return to default display screen (default)
  </td><td>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.</td></tr>
<tr><td>Stay at latest screen
  </td><td>If selected, the display screen will stay at latest screen user finally switches.</td></tr>
<tr><td>20</td><td>Backlight control</td><td>Backlight on (default)
  </td><td>Backlight off
  </td></tr>
<tr><td>22</td><td>Beeps while primary source is interrupted</td><td>Alarm on (default)
  </td><td>Alarm off
  </td></tr>
<tr><td>23</td><td>Overload bypass:
When enabled, the unit will transfer to line mode if overload occurs in battery mode.</td><td>Bypass disable (default)
  </td><td>Bypass enable
  </td></tr>
<tr><td>25</td><td>Record Fault code</td><td>Record enable (default)
  </td><td>Record disable
  </td></tr>
</table>

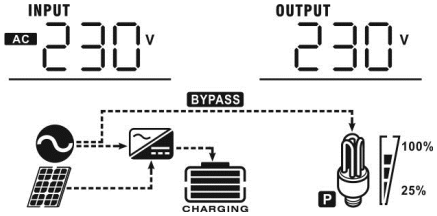
<table>
<tr><td rowspan="3">26</td><td rowspan="3">Bulk charging voltage
(C.V voltage)</td><td>3.6KW default setting: 28.2V
  </td></tr>
<tr><td>5.6KW default setting: 56.4V
  </td></tr>
<tr><td>If self-defined is selected in program 5, this program can be set up. Setting range is from 25.0V to 31.5V for 3.6KW model and 48.0V to 61.0V for 5.6KW model. Increment of each click is 0.1V.</td></tr>
<tr><td rowspan="3">27</td><td rowspan="3">Floating charging voltage</td><td>3.6KW default setting: 27.0V
  </td></tr>
<tr><td>5.6KW default setting: 54.0V
  </td></tr>
<tr><td>If self-defined is selected in program 5, this program can be set up. Setting range is from 25.0V to 31.5V for 3.6KW model and 48.0V to 61.0V for 5.6KW model. Increment of each click is 0.1V.</td></tr>
<tr><td rowspan="3">29</td><td rowspan="3">Low DC cut-off voltage:
● If battery power is only power source available, inverter will shut down.
● If PV energy and battery power are available, inverter will charge battery without AC output.</td><td>3.6KW default setting: 21.0V
  </td></tr>
<tr><td>5.6KW default setting: 42.0V
  </td></tr>
<tr><td>If self-defined is selected in program 5, this program can be set up. Setting range is from 21.0V to 24.0V for 3.6KW model and 42.0V to 48.0V for 5.6KW 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.</td></tr>
<tr><td rowspan="2">30</td><td rowspan="2">Battery equalization</td><td>Battery equalization
  </td><td>Battery equalization disable (default)
  </td></tr>
<tr><td colspan="2">If “Flooded” or “User-Defined” is selected in program 05, this program can be set up.</td></tr>
<tr><td rowspan="3">31</td><td rowspan="3">Battery equalization voltage</td><td colspan="2">3.6KW default setting: 29.2V
  </td></tr>
<tr><td colspan="2">5.6KW default setting: 58.4V
  </td></tr>
</table>

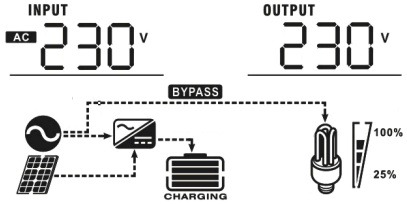
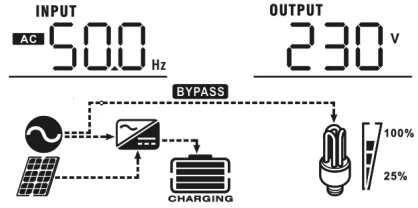
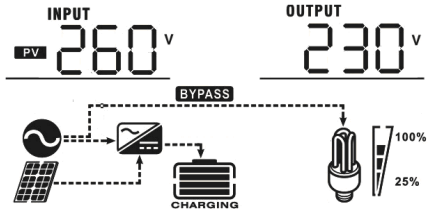
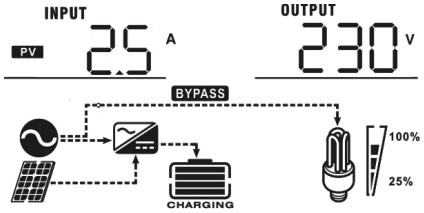
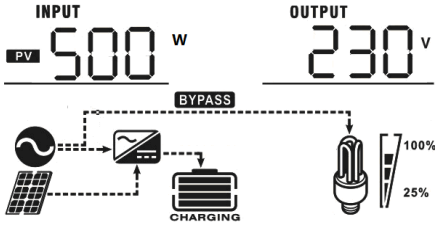
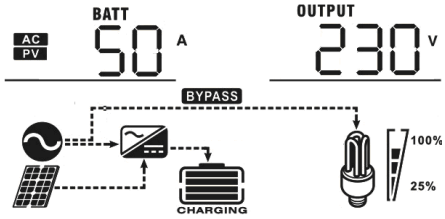
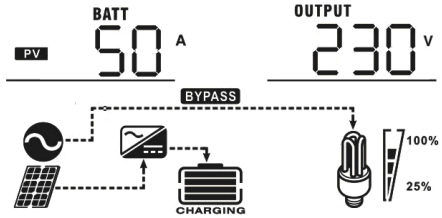
		Setting range is from 25.0V to 31.5V for 3.6KW model and 48.0V to 61.0V for 5.6KW model. Increment of each click is 0.1V.	
33	Battery equalized time	60min (default) 	Setting range is from 5min to 900min. Increment of each click is 5min.
34	Battery equalized timeout	120min (default) 	Setting range is from 5min to 900 min. Increment of each click is 5 min.
35	Equalization interval	30days (default) 	Setting range is from 0 to 90 days. Increment of each click is 1 day
36	Equalization activated immediately	Enable 	Disable (default) 
		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.	
60	Low DC cut off voltage on second output	3.6KW default setting: 21.0V 	5.6KW default setting: 42.0V 
		If "User-defined" is selected in program 05, this setting range is from 21.0V to 31.5V for 3.6KW model and from 42.0V to 61.0V for 56KW model. Increment of each click is 0.1V.	
61	Setting discharge time on the second output	Disable (Default) 	Setting range is disable and then from 0 min to 990 min. Increment of each click is 5 min. *If the battery discharge time achieves the setting time in program 61 and the program 60 function is not triggered, the second output will be turned off.

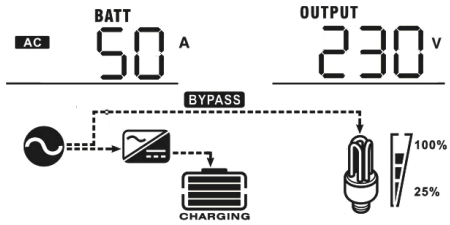
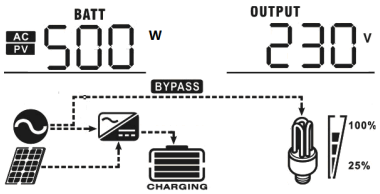
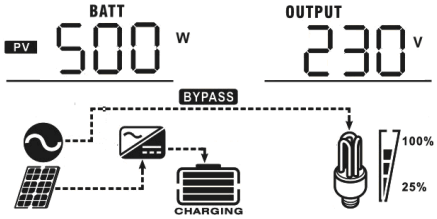
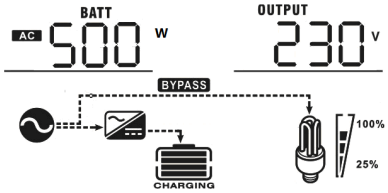
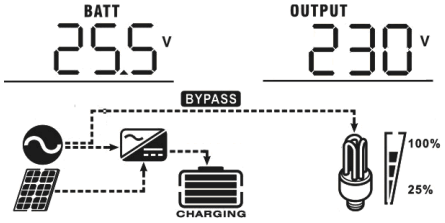
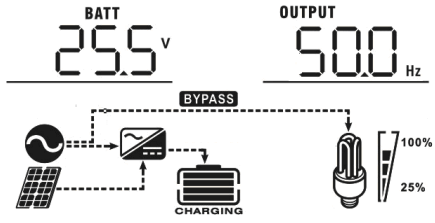
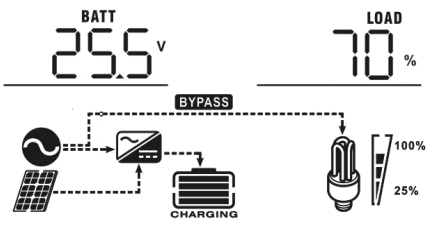
Display Setting

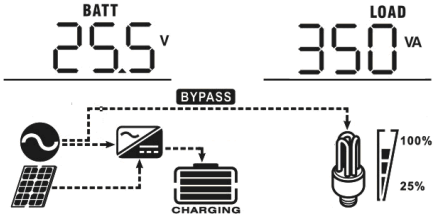
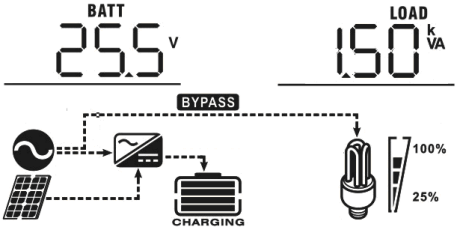
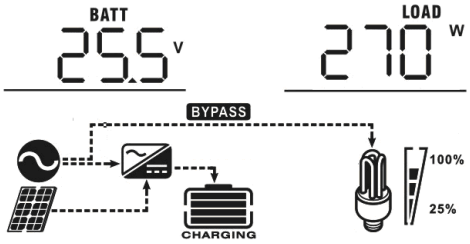
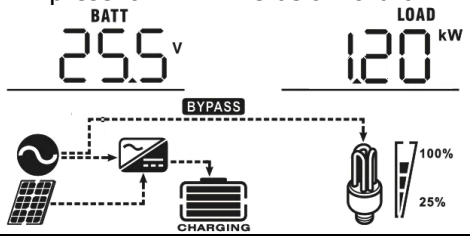
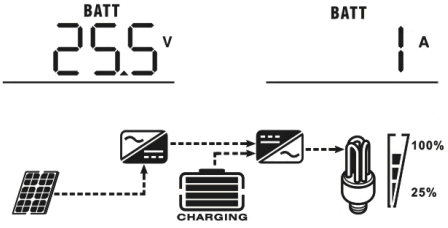
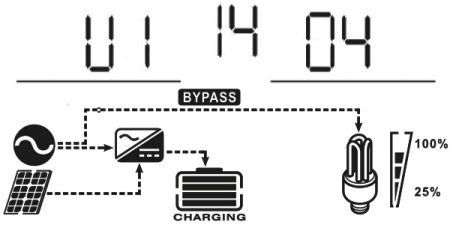
The LCD display information will be switched in turns by pressing "UP" or "DOWN" key. The selectable information is switched as below order: input voltage, input frequency, PV voltage, charging current, charging power, battery voltage, output voltage, output frequency, load percentage, load in Watt, load in VA, load in Watt, DC discharging current, main CPU Version.

If second output is on, all screens will show "P" icon in the screen.

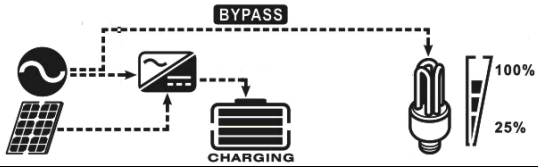
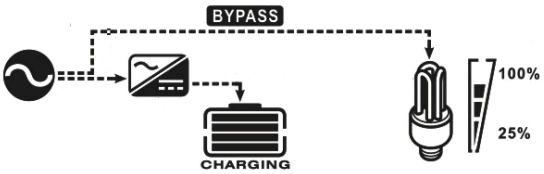


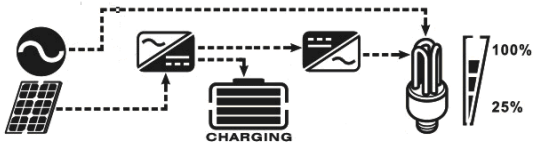
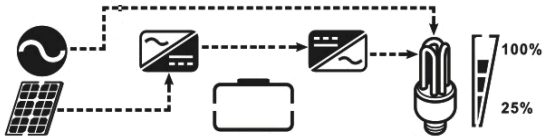
Selectable information	LCD display
Input voltage/Output voltage (Default Display Screen)	Input Voltage=230V, output voltage=230V 
Input frequency	Input frequency=50Hz 
PV voltage	PV voltage=260V 
PV current	PV current = 2.5A 
PV power	PV power = 500W 
Charging Current	AC and PV charging current=50A  PV charging current=50A 

Charging current	AC charging current=50A 
Charging power	AC and PV charging power=500W  PV charging power=500W  AC charging power=500W 
Battery voltage and output voltage	Battery voltage=25.5V, output voltage=230V 
Output frequency	Output frequency=50Hz 
Load percentage	Load percent=70% 

Load in VA	When connected load is lower than 1kVA, load in VA will present xxxVA like below chart.  When load is larger than 1kVA (≧1KVA), load in VA will present x.xkVA like below chart. 
Load in Watt	When load is lower than 1kW, load in W will present xxxW like below chart.  When load is larger than 1kW (≧1KW), load in W will present x.xkW like below chart. 
Battery voltage/DC discharging current	Battery voltage=25.5V, discharging current=1A 
Main CPU version checking	Main CPU version 00014.04 

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 and PV energy. 
		Charging by utility. 
		Charging by 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. 
		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. 
	The unit will provide output power from the mains. It will also charge the battery at line mode.	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.

<table>
<tr><td></td><td></td><td> 
</td></tr>
<tr><td></td><td></td><td>If “solar first” is selected as output source priority and battery is not connected, solar energy and the utility will provide the loads.
 
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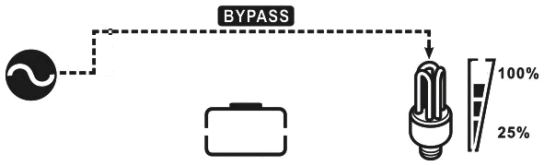
<tr><td></td><td></td><td>Power from utility.
 
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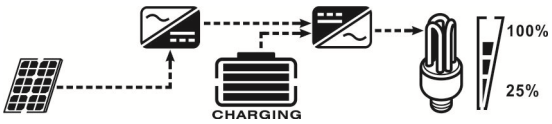
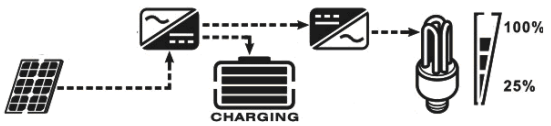
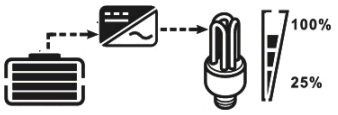
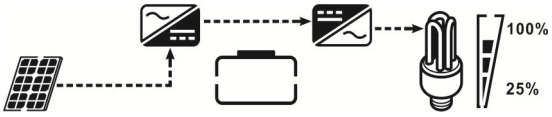
<tr><td rowspan="4">Battery Mode</td><td rowspan="3">The unit will provide output power from battery and PV power.</td><td>Power from battery and PV energy.
 
</td></tr>
<tr><td>PV energy will supply power to the loads and charge battery at the same time.
 
</td></tr>
<tr><td>Power from battery only.
 
</td></tr>
<tr><td>The unit will provide output power from battery and PV power.</td><td>Power from PV energy only.
 
</td></tr>
</table>

Battery Equalization Description

Battery equalization function is built into the charge controller. It reverses the buildup of negative chemical effects such as 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 may 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 the battery periodically.

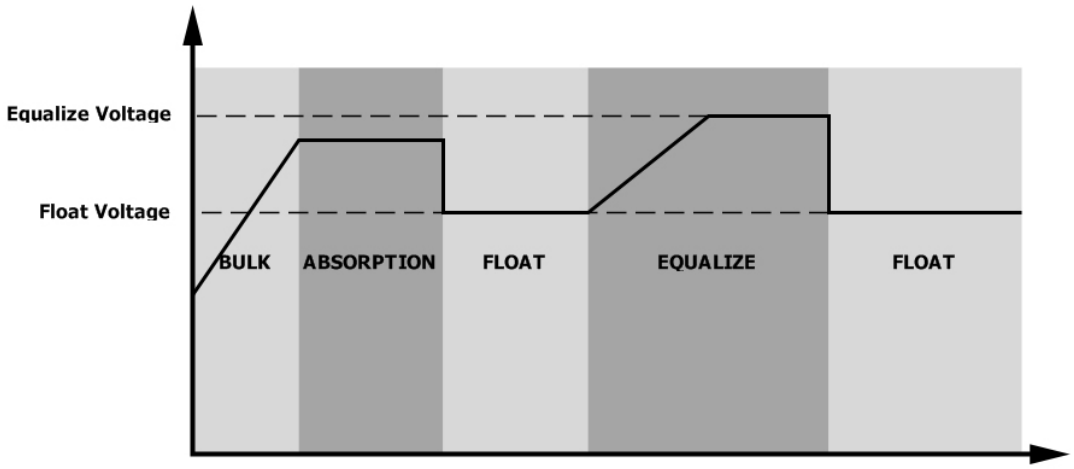
- **How to Activate Equalization Function**

You must enable battery equalization function in LCD setting Program 30 first. You can then apply this function by either one of the following methods:

1. Setting equalization interval in Program 35.
2. Activate equalization immediately in Program 36.

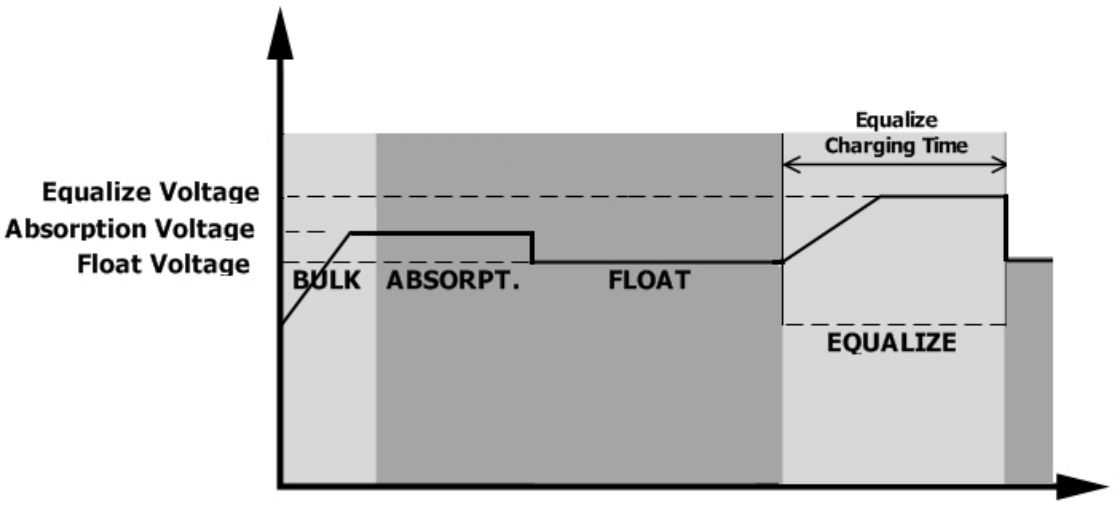
- **When to Equalize**

In floating charge stage, when setting the equalization interval (battery equalization cycle) is reached, or equalization is activated immediately, the controller will start to enter Equalize Mode.

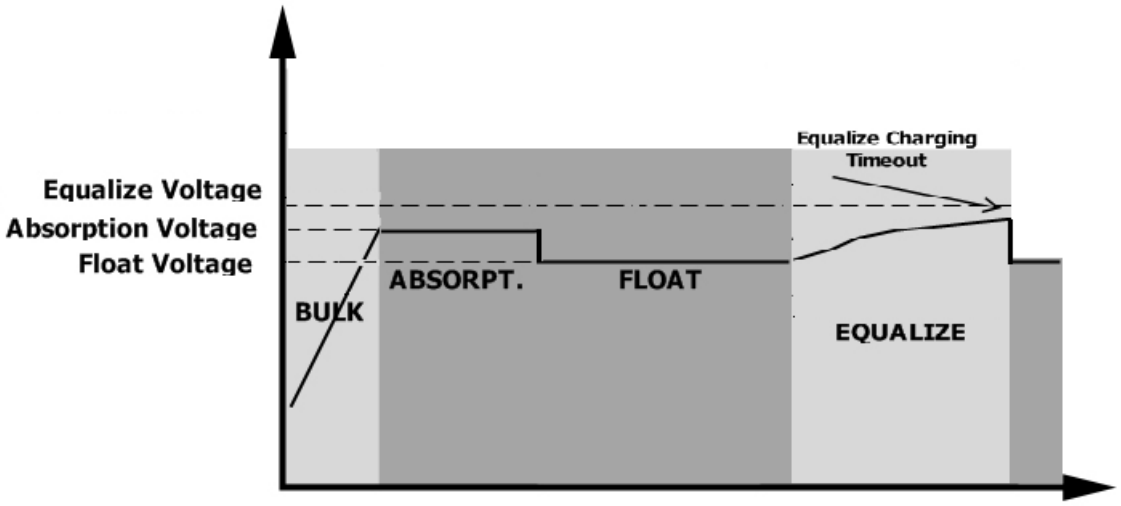


- **Equalize Charging and Timeout**

In Equalize Mode, the controller will supply power to charge battery as much as possible until battery voltage reach the equalization voltage. Then, constant-voltage regulation is applied to maintain battery voltage at the equalization level. The battery will remain in the Equalize Mode until the equalization timer runs out.



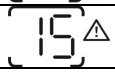
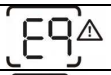
However, in Equalize Mode, if the battery equalization timer runs out and the battery voltage doesn't recover to the battery equalization voltage point, the charge controller will extend the battery equalized time until battery voltage achieves equalization voltage. If the battery voltage is still lower than equalization voltage when the extension runs out, the charge controller will stop equalization and return to the floating charging stage.



Fault Reference Code

Fault Code	Fault Event	Icon on
01	Fan is locked when inverter is off.	
02	Over temperature or NTC is not connected well.	
03	Battery voltage is too high	
04	Battery voltage is too low	
05	Output short circuited or over temperature is detected by internal converter components.	
06	Output voltage is too high.	
07	Overload time out	
08	Bus voltage is too high	
09	Bus soft start failed	
51	Over current or surge	
52	Bus voltage is too low	
53	Inverter soft start failed	
55	Over DC voltage in AC output	
57	Current sensor failed	
58	Output voltage is too low	
59	PV voltage is over limitation	

Warning Indicator

Warning Code	Warning Event	Audible Alarm	Icon flashing
01	Fan is locked when inverter is on.	Beep three times every second	
02	Over temperature	None	
03	Battery is over-charged	Beep once every second	
04	Low battery	Beep once every second	
07	Overload	Beep once every 0.5 second	
10	Output power derating	Beep twice every 3 seconds	
15	PV energy is low.	Beep twice every 3 seconds	
16	High AC input (>280VAC) during BUS soft start	None	
E9	Battery equalization	None	
bP	Battery is not connected	None	

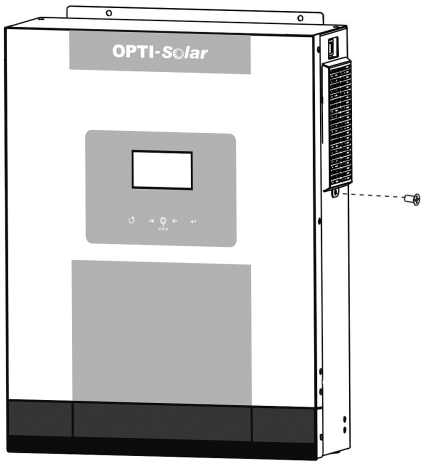
CLEARANCE AND MAINTENANCE FOR ANTI-DUST KIT

Overview

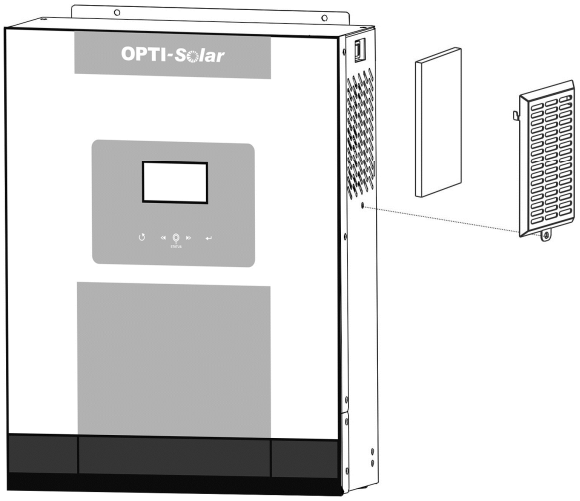
Every inverter is already installed with anti-dusk kit from factory. Inverter will automatically detect this kit and activate internal thermal sensor to adjust internal temperature. This kit also keeps dusk from your inverter and increases product reliability in harsh environment.

Clearance and Maintenance

Step 1: Please loosen the screw on the side of the inverter.



Step 2: Then, dustproof case can be removed and take out air filter foam as shown in below chart.



Step 3: Clean air filter foam and dustproof case. After clearance, re-assemble the dust-kit back to the inverter.

NOTICE: The anti-dust kit should be cleaned from dust every one month.

SPECIFICATIONS

Table 1 Line Mode Specifications

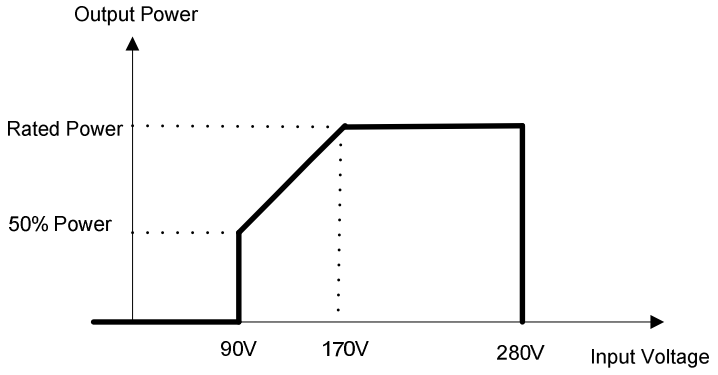
MODEL	SP3500 Handy	SP5500 Handy
Input Voltage Waveform	Sinusoidal (utility or generator)	
Nominal Input Voltage	230Vac	
Low Loss Voltage	170Vac±7V (UPS); 90Vac±7V (Appliances)	
Low Loss Return Voltage	180Vac±7V (UPS); 100Vac±7V (Appliances)	
High Loss Voltage	280Vac±7V	
High Loss Return Voltage	270Vac±7V	
Max AC Input Voltage	300Vac	
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	Circuit Breaker	
Efficiency (Line Mode)	>95% (Rated R load, battery full charged)	
Transfer Time	10ms typical (UPS); 20ms typical (Appliances)	
Output power derating: When AC input voltage drops to 170V, the output power will be derated.		

Table 2 Inverter Mode Specifications

MODEL	SP3500 Handy	SP5500 Handy
Rated Output Power	3.6KVA/3.6KW	5.6KVA/5.6KW
Output Voltage Waveform	Pure Sine Wave	
Output Voltage Regulation	230Vac±5%	
Output Frequency	50Hz	
Peak Efficiency	93%	
Overload Protection	5s@≥130% load; 10s@105%~130% load	
Surge Capacity	2* rated power for 5 seconds	
Nominal DC Input Voltage	24Vdc	48Vdc
Cold Start Voltage	23.0Vdc	46.0Vdc
Low DC Warning Voltage		
@ load < 50%	23.0Vdc	46.0Vdc
@ load ≥ 50%	22.0Vdc	44.0Vdc
Low DC Warning Return Voltage		
@ load < 50%	23.5Vdc	47.0Vdc
@ load ≥ 50%	23.0Vdc	46.0Vdc
Low DC Cut-off Voltage		
@ load < 50%	21.5Vdc	43.0Vdc
@ load ≥ 50%	21.0Vdc	42.0Vdc
High DC Recovery Voltage	32Vdc	62Vdc
High DC Cut-off Voltage	33Vdc	63Vdc
No Load Power Consumption	<40W	<55W

Table 3 Charge Mode Specifications

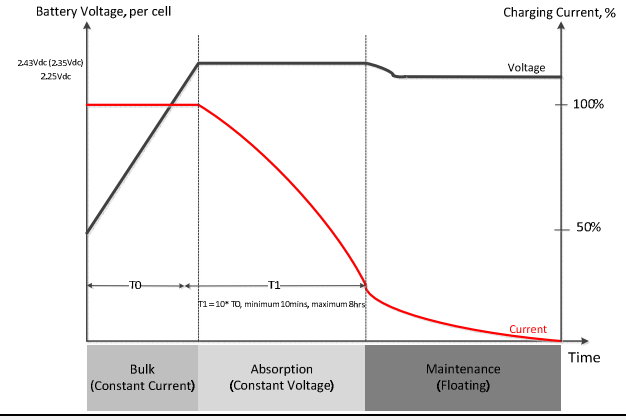
Utility Charging Mode			
MODEL		**SP3500 Handy**	**SP5500 Handy**
Charging Current (UPS) @ Nominal Input Voltage		100Amp(@$V_{I/P}$=230Vac)	
Bulk Charging Voltage	**Flooded Battery**	29.2	58.4Vdc
	AGM / Gel Battery	28.2	56.4Vdc
Floating Charging Voltage		27Vdc	54Vdc
Charging Algorithm		3-Step	
Charging Curve			
Solar Input			
MODEL		**SP3500 Handy**	**SP5500 Handy**
Max. PV Array Power		5000W	6000W
Max. PV Current		27A	
Nominal PV Voltage		320Vdc	360Vdc
Start-up Voltage		60Vdc +/- 10Vdc	
PV Array MPPT Voltage Range		60~450Vdc	
Max. PV Array Open Circuit Voltage		500Vdc	
Max Charging Current **(AC charger plus solar charger)**		120Amp	

Table 4 General Specifications

MODEL	**SP3500 Handy**	**SP5500 Handy**
Operating Temperature Range	-10°C to 50°C	
Storage temperature	-15°C~ 60°C	
Humidity	5% to 95% Relative Humidity (Non-condensing)	
Dimension (D x W x H), mm	107 x 322.6 x 420.3	
Net Weight, kg	9.5	10.5

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. Internal fuse tripped.	1. Contact repair center for replacing the fuse. 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.	Input protector is tripped	Check if AC breaker is tripped and AC wiring is connected well.
	No indication.	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)
	No indication.	Set "SUB" (solar first) as the priority of output source.	Change output source priority to "USB" (utility first).
When the unit is turned on, internal relay is switched on and off repeatedly.	LCD display is 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.
		If PV input voltage is higher than specification, the output power will be derated. At this time, if connected loads is higher than derated output power, it will cause overload.	Reduce the number of PV modules in series or the connected load.
	Fault code 05	Output short circuited.	Check if wiring is connected well and remove abnormal load.
		Temperature of internal converter component is over 120°C.	Check whether the air flow of the unit is blocked or whether the ambient temperature is too high.
	Fault code 02	Internal temperature of inverter component is over 100°C.	
	Fault code 03	Battery is over-charged.	Return to repair center.
		The battery voltage is too high.	Check if spec and quantity of batteries are meet requirements.
	Fault code 01	Fan fault	Replace the fan.
	Fault code 06/58	Output abnormal (Inverter voltage below than 190Vac or is higher than 260Vac)	1. Reduce the connected load. 2. Return to repair center
	Fault code 08/09/53/57	Internal components failed.	Return to repair center.
	Fault code 51	Over current or surge.	Restart the unit, if the error happens again, please return to repair center.
	Fault code 52	Bus voltage is too low.	
	Fault code 55	Output voltage is unbalanced.	
	Fault code 59	PV input voltage is beyond the specification.	Reduce the number of PV modules in series.