# User Manual

# DC Converter 3KW

Version: 1.2

# CONTENTS

1 ABOUT THIS MANUAL .....1
1.1 Purpose .....1
1.2 Scope .....1
1.3 Safety Instructions .....1
2 INTRODUCTION.....2
2.1 Features.....2
2.2 Product Overview.....3
3. INSTALLATION.....4
3.1 Unpacking and Inspection.....4
3.2 Mounting the Unit .....4
3.3 PV Connection .....5
3.4 Output connection .....7
3.5 Battery Connection.....8
3.6 Grounding Connection .....9
3.7 Remote Temperature Sensor (optional) .....9
3.8 Communication Connections .....10
4. OPERATION.....11
4.1 Power-Up .....11
4.2 Operation and Display Panel.....11
4.3 LCD setting .....12
4.4 Display Setting.....16
4.6 Fault and Warning Code.....18
5. TROUBLE SHOOTING .....19
6. SPECIFICATIONS .....20

# 1 ABOUT THIS MANUAL

## 1.1 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.

## 1.2 Scope

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

## 1.3 Safety Instructions



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

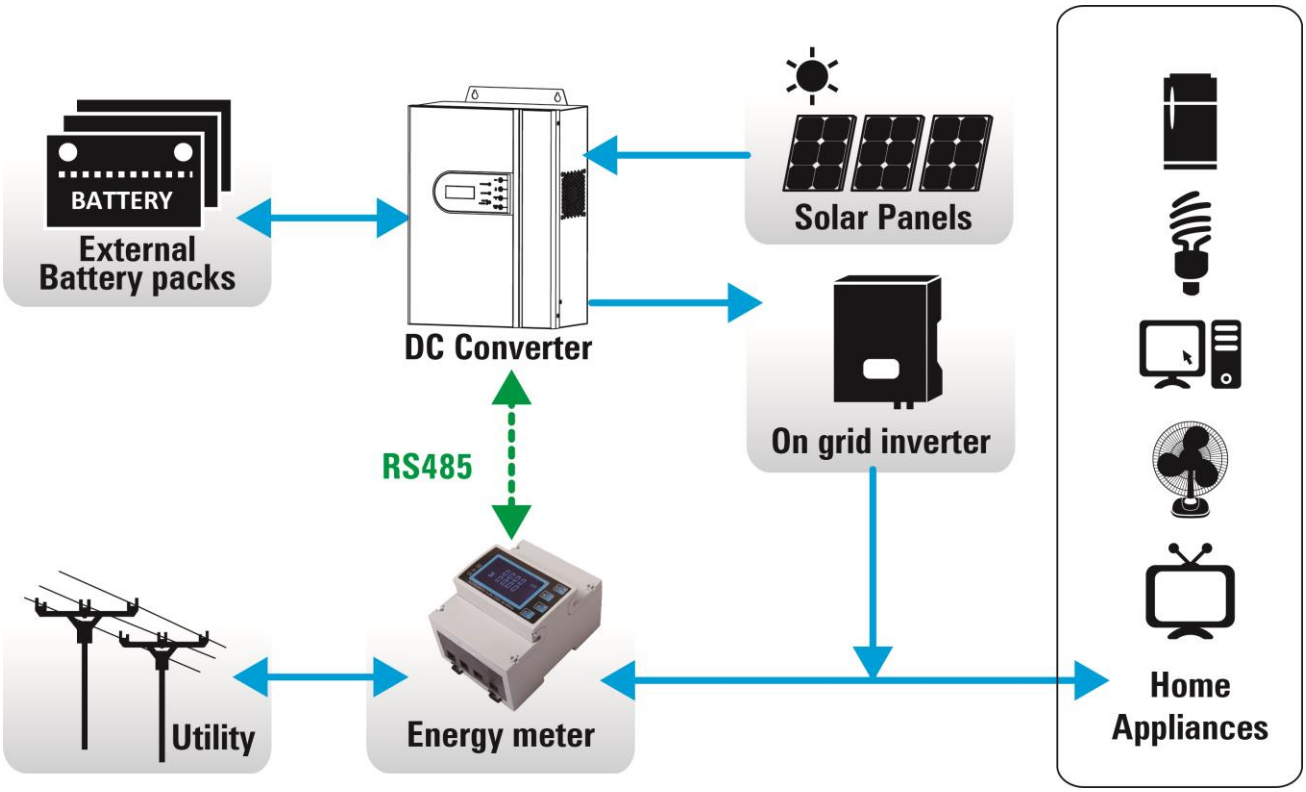
1. Before using the unit, read all instructions and cautionary markings on the unit, the batteries and all appropriate sections of this manual.
2. Do not disassemble the unit. Take it to a qualified service center when service or repair is required. Incorrect re-assembly may result in a risk of electric shock or fire.
3. To reduce risk of electric shock, disconnect all wirings before attempting any maintenance or cleaning. Turning off the unit will not reduce this risk.
4. **CAUTION** – Only qualified personnel can install this device with battery.
5. For optimum operation of this converter, please follow required spec to select appropriate cable size. It's very important to correctly operate this converter.
6. 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.
7. Please strictly follow installation procedure when you want to disconnect PV or battery terminals. Please refer to INSTALLATION section of this manual for the details.
8. GROUNDING INSTRUCTIONS -This converter should be connected to a permanent grounded wiring system. Be sure to comply with local requirements and regulation to install this charger.
9. NEVER cause short circuited on battery terminals.
10. **Warning!!** Only qualified service persons are able to service this device. If errors still persist after following troubleshooting table, please send this unit back to local dealer or service center for maintenance.

# 2 INTRODUCTION

Thank you for selecting this DC converter. This DC converter is an advanced solar converter with maximum power point tracking. Applying intelligent MPPT algorithm, it allows converter to extract maximum power from solar arrays by finding the maximum power point of the array. The power can be stored in the battery or can be used directly for self-consumption.

The smart MPPT process has been optimized for maximum energy management and improved system performance. Self-diagnostics and electronic error protections prevent damage when installation errors or system faults occur. This converter also features multifunctional LCD with communication ports for remote battery temperature sensor (optional) and energy meter application.

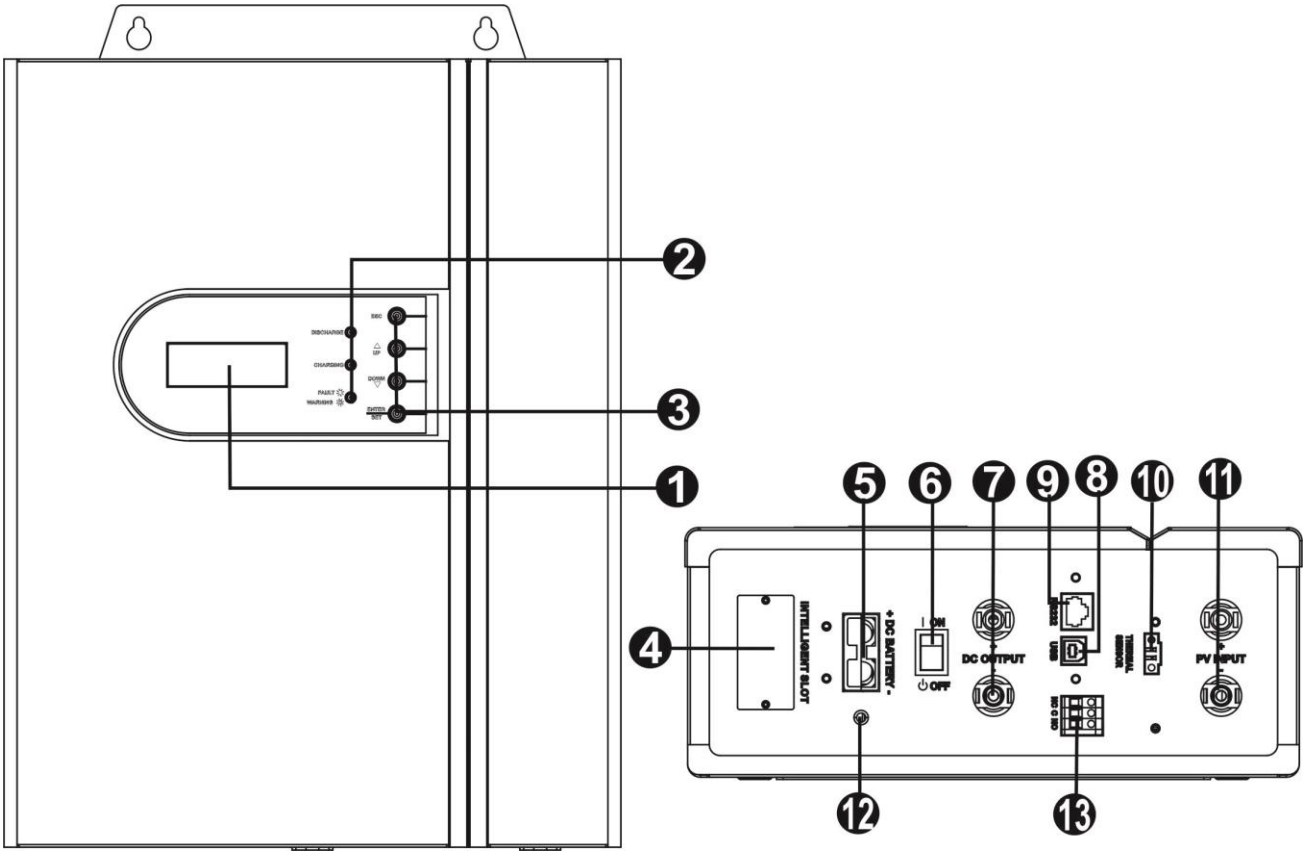
The basic system solution of converter is showed as below:




## 2.1 Features

- Built-in Intelligent Maximum Power Point Tracking technology
- Wide battery range from 250V~450V
- Four-stage charging optimizes battery performance
- Battery temperature sensor (BTS) automatically provides temperature compensation
- Support wide range of lead-acid batteries including wet, AGM and gel batteries
- Integrated intelligent slot compatible with SNMP/MODBUS/Energy meter communication

## 2.2 Product Overview




1. LCD display panel
2. LED indicators
3. Operation buttons
4. Intelligent slot
5. Battery connectors
6. Power on/off switch
7. DC output connectors
8. USB communication port
9. RS-232 communication port
10. Battery thermal connector
11. PV connectors
12. Grounding terminal
13. Dry contact (Reserved for future use)

# 3. INSTALLATION

## 3.1 Unpacking and Inspection

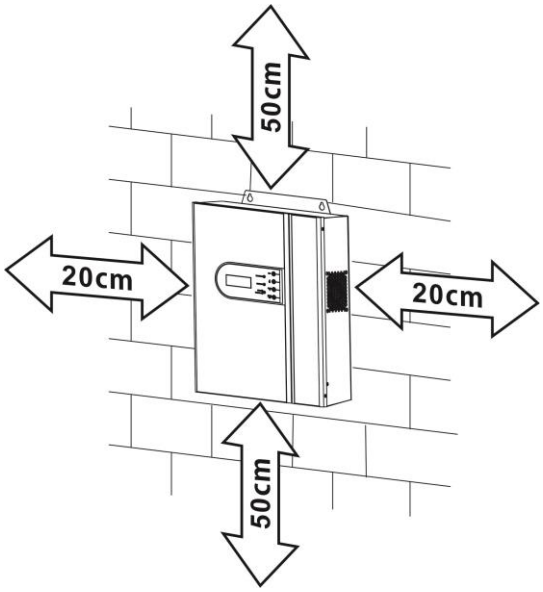
Before installation, please inspect the unit. Be sure that nothing inside the package is damaged. You should have received the following items inside of package:

- DC converter x 1
- User manual x 1
- Communication cable x 2
- Software CD x 1
- MC4 PV connectors x 4
- Flat terminals x 2
- Battery connector x 1

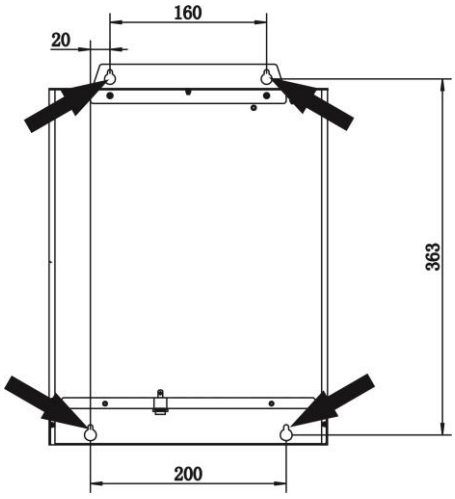
## 3.2 Mounting the Unit

Consider the following points before selecting where to install:

- This converter is designed in IP31 for indoor applications only.
- Do not mount the unit on flammable construction materials.
- Mount on a solid surface
- Install this charger at eye level in order to allow the LCD display to be read at all times.
- For proper air circulation to dissipate heat, allow a clearance of approx. 20 cm to the side and approx. 50 cm above and below the unit.
- 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.




Install the unit to the wall by screwing four screws.



## 3.3 PV Connection

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

**NOTE 1:** Please use 1000VDC/25A circuit breaker.

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

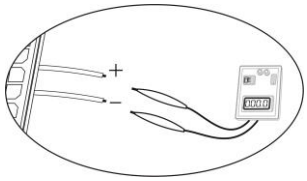
Please follow the steps below to implement PV module connection:

**WARNING:** Because the converter is non-isolated, if the output inverter is the transformer less type, only three types of PV modules are acceptable: single crystalline and poly crystalline with class A-rated and CIGS modules.

To avoid any malfunction, do not connect any PV modules with possibility of leakage current to the inverter. For example, grounded PV modules will cause leakage current to the inverter. When using CIGS modules, please be sure NOT grounding.

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

**Step 1**: Check the input voltage of PV array modules. The acceptable input voltage of the converter is 250VDC - 580VDC. Please make sure that the maximum current of the PV input connector is not more than 20A.




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

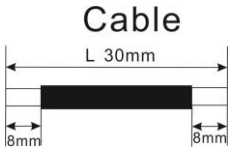
**Step 2**: Disconnect the circuit breaker.

**Step 3**: Assemble provided PV connectors with PV modules by the following steps.

**Components for PV connectors and Tools:**

| | |
|---|---|
| Female connector housing |  |
| Female terminal |  |
| Male connector housing |  |
| Male terminal |  |
| Crimping tool and spanner |  |

**Cable preparation and connector assembly process:**

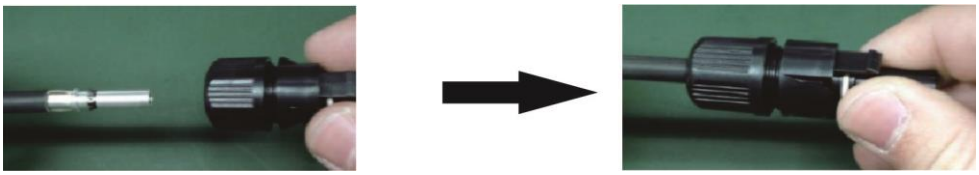



Strip one cable for 8 mm on both ends and be careful NOT to nick conductors. Please refer to the diagram on the right.

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



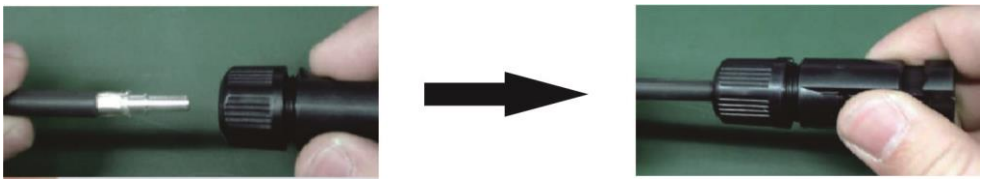
Insert assembled cable into female connector housing as shown below.



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



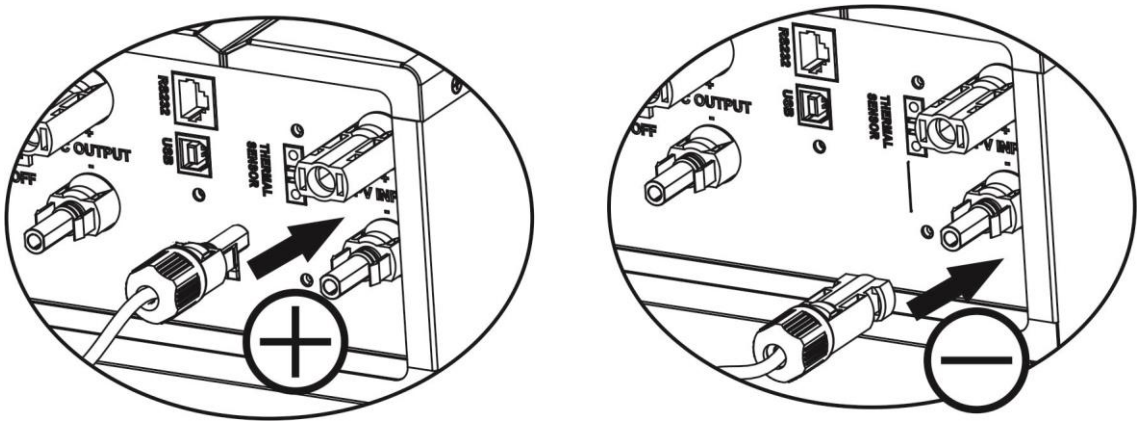
Insert assembled cable into male connector housing as shown below.



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



**Step 4**: Check correct polarity of the connected cable from PV modules and PV input connectors. Then, connect positive pole (+) of connected cable to positive pole (+) of PV input connector. Connect negative pole (-) of connected cable to negative pole (-) of PV input connector.




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

recommended below.

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

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

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

**Recommended Panel Configuration**

| **Solar Panel Spec. (reference)** | **SOLAR INPUT** | | **Q'ty of panels** | **Total Input Power** |
|---|---|---|---|---|
| | Numbers in serial | Strings in parallel | | |
| - 250Wp<br>- Vmp: 36.7Vdc<br>- Imp: 6.818A<br>- Voc: 44Vdc<br>- Isc: 7.636A<br>- Cells: 72 | 12 | 1 | 12pcs | 3000W |
| | 9 | 2 | 18pcs | 4500W |

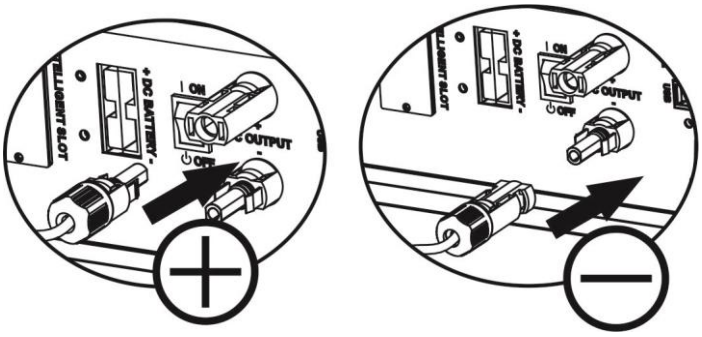
## 3.4 Output connection

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

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

**Step 1**: Assemble provided two connectors by following the **step 3** in section **3.3 PV connection**.

**Step 2**: Check correct polarity of the connected cable of the connectors. Then, connect positive pole (+) of connected cable to positive pole (+) of output connector. Connect negative pole (-) of connected cable to negative pole (-) of output connector.



## 3.5 Battery Connection

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

**NOTE1:** Please use 600VDC/20A circuit breaker.

**NOTE2:** The overvoltage category of the battery input is II.

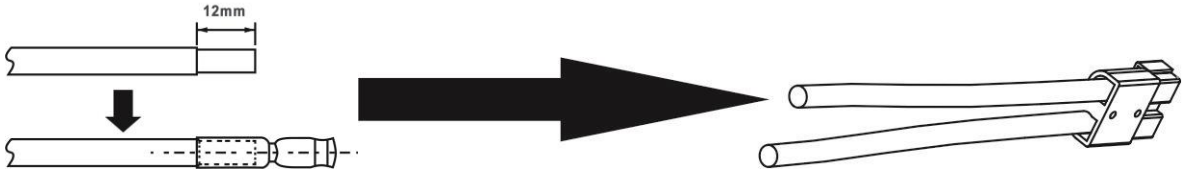
**WARNING!** It's very important for system safety and efficient operation to use appropriate cable for battery connection. To reduce risk of injury, please use the proper cable size recommended below.

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

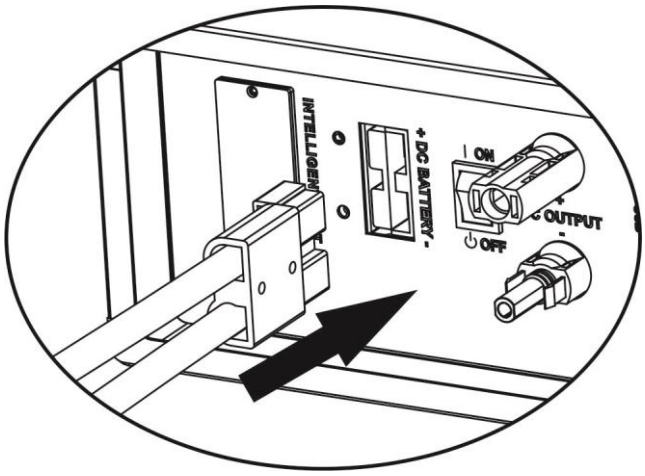
Please follow the steps below to implement battery connection:

**Step 1:** Check the nominal voltage of batteries. The nominal input voltage for converter is within the range of 250~450V.

**Step 2:** Assemble provided battery connectors with cables. Take two wires, one for black color and the other for red color. Remove insulation sleeve 12mm. Insert conductor into flat terminal and crimp it tightly. Then, insert assembled terminal into battery connector and screw it tightly.




**Step 3:** Simply plug assembled battery cables into battery connector of the converter.

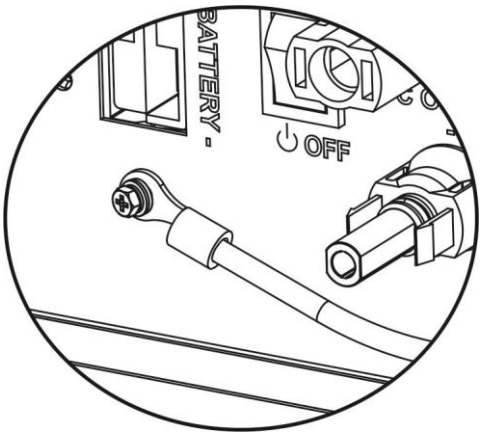



**Step 5:** Make sure the wires are securely connected.

## 3.6 Grounding Connection

For safe operation, please use one more wire with ring terminal to connect grounding. The grounding terminal is identified by the ground symbol shown below that is stamped into the panel of the converter:





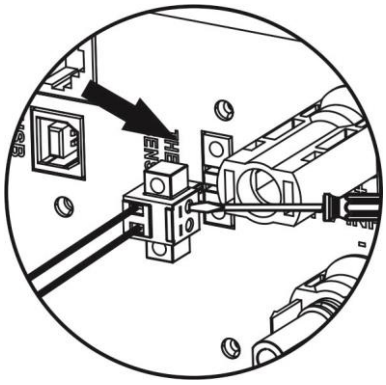

The minimum size of the copper grounding wire is 10 AWG (6 mm2).

**WARNING: Risk of Fire**

DO NOT bond system electrical negative to earth ground at the converter.

## 3.7 Remote Temperature Sensor (optional)

The optional Remote Temperature Sensor (RTS) is recommended for effective temperature compensated charging. There is no polarity for this connector. It's foolproof design. Simply connect the RTS to the 2-pole battery thermal connector (⑩). Fasten the connector screws with 5 in-lb (0.56 Nm) torque as shown in below chart. The RTS is supplied with 33 ft (10 m) of 22 AWG (0.34 mm2) cable.



**NOTE:** The RTS is an optional accessory. Please check local dealer for the details.

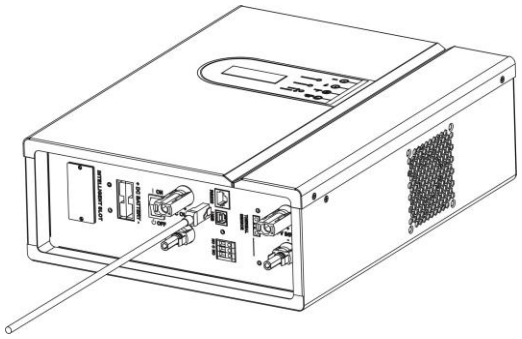
**CAUTION:** The converter will not activate temperature compensate charging function if the RTS is not used.

**NOTE:** The RTS cable may be shortened if the full length is not needed.

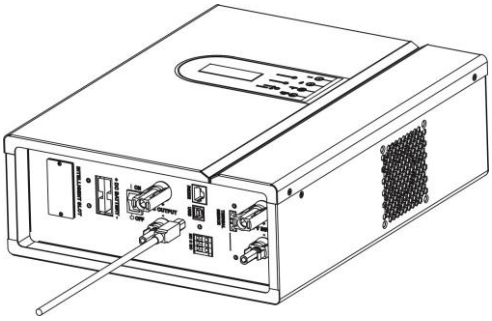
## 3.8 Communication Connections

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

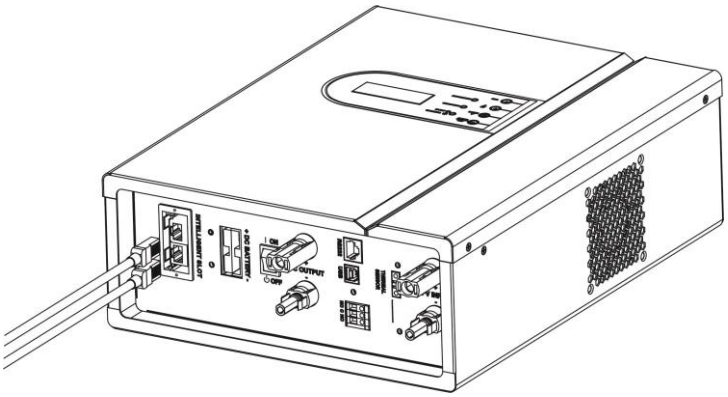
RS-232 connection



USB connection



Intelligent slot connection



Insert bundled software 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.

# 4. OPERATION

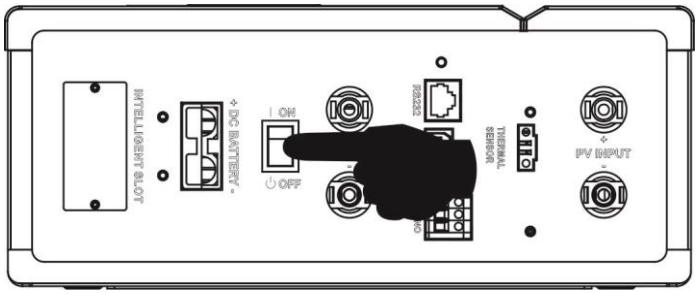
## 4.1 Power-Up

Step 1: Confirm that the solar and battery polarities are correctly connected to the converter.

**NOTE:** A battery must be connected to the converter before operating it. The converter will not operate only with solar input. Solar input can trigger the converter to start up when the battery is connected without turning on the switch.

**Step 2:** Turn on the battery circuit breaker first.

**Step 3:** Turn on the power switch on the unit. Then, it will indicate a successful start-up in LCD display.

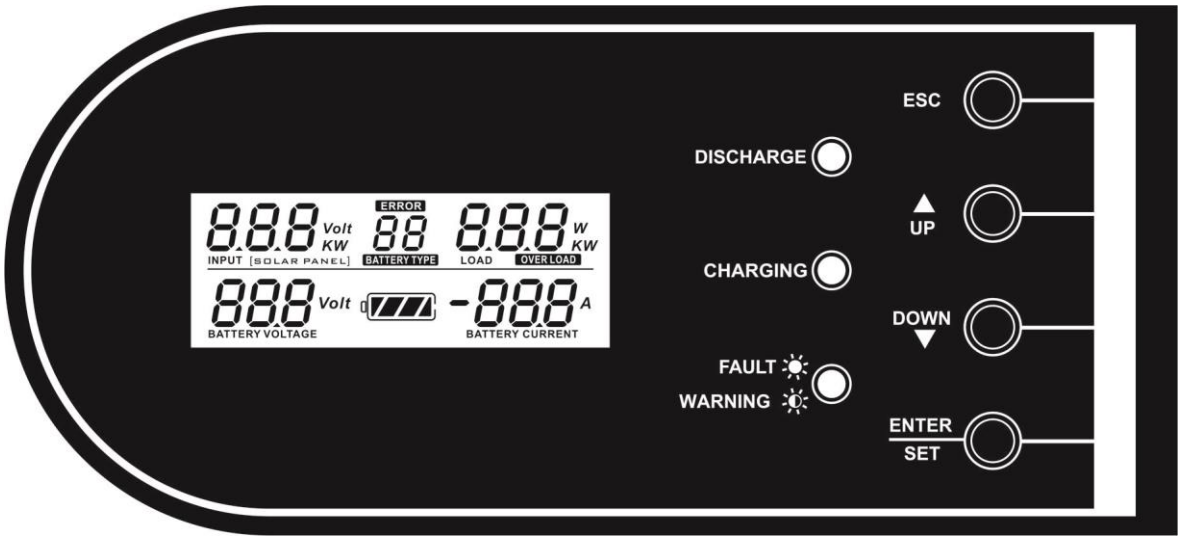



**NOTE:** This switch also controls the converter output ON/OFF.

**Step 4:** Turn on solar DC circuit breaker. If the solar module is in full sunlight, the converter will begin working .

## 4.2 Operation and Display Panel

The operation and display panel, shown in below chart, is on the front panel of the converter. It includes three indicators, four operation buttons and a LCD display, indicating the operating status and input/output power information.



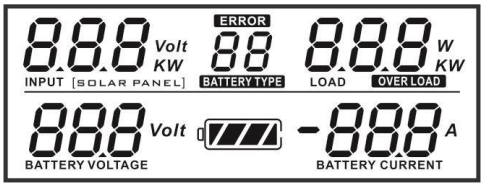
**LED Indicator**

| LED Indicator | | Messages |
|---|---|---|
| DISCHARGE | Solid On | Battery is discharging |
| CHARGING | Solid On | Battery is charging. |
| FAULT | Solid On | Fault occurs in the converter. |
| WARNING | Flashing | Warning condition occurs in the converter. |

**Button Operation**

| Function Key | Description |
|---|---|
| ESC | To exit setting mode |
| ▲ UP | To go to previous selection |
| DOWN ▼ | To go to next selection |
| ENTER / SET | To confirm the selection in setting mode or enter setting mode |

**4.3 LCD setting**

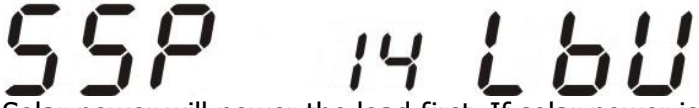
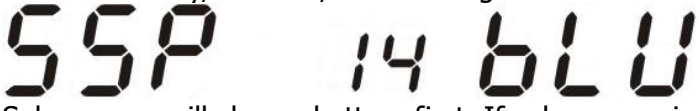



After pressing and holding "ENTER/SET" button for 3 seconds, the unit will enter setting mode. Press "▲ UP" or "DOWN ▼" button to select setting programs. And then, press "ENTER/SET" button to confirm the selection or "ESC" button to exit.

**Setting Programs:**

| Program | Description | Selectable option |
|---|---|---|
| 00 | Exit setting mode | 00 ESC |
| 01 | Max. charging current | 10A<br>CHG 01 10A |
| | | Setting range is from 5A to 18A. Increment and decrement of each click is 1A. Default value is 5A. |
| 02 | Battery stop discharging voltage | 250A<br>SdU 02 250 |
| | | Setting range is from 250V to 400V. Increment and decrement of each click is 1V. Default value is 315V. |

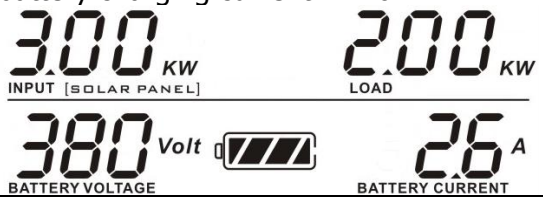
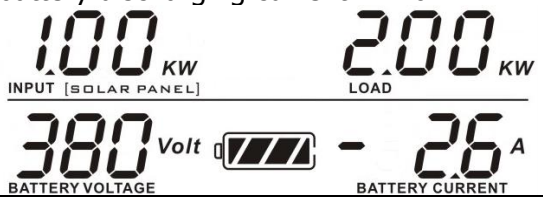
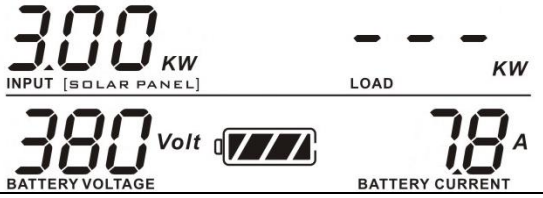
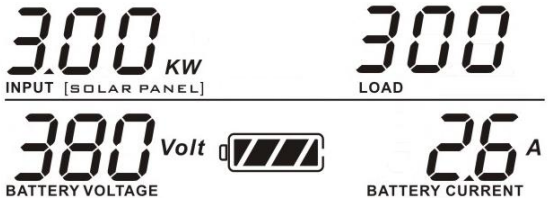
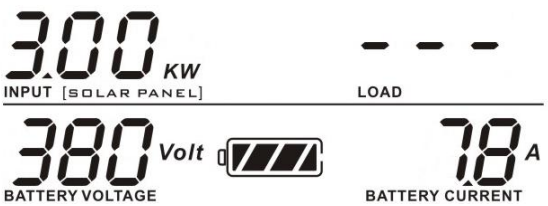
| | | | |
|---|---|---|---|
| 03 | Battery over-charged voltage |  | |
| | | Setting range is from 300V to 470V. Increment and decrement of each click is 1V. Default value is 450V. | |
| 04 | Max. charging voltage | 380V:  | |
| | | Setting range is from 300V to 450V. Increment and decrement of each click is 1V. Default value is 405V. | |
| 05 | Output open circuit voltage | 350V:  | |
| | | Setting range is from 300V to 450V. Increment and decrement of each click is 1V. Default value is 350V. | |
| 06 | Output MPP voltage | 300V:  | |
| | | Setting range is from 200V to 450V. Increment and decrement of each click is 1V. Default value is 300V. | |
| 07 | Max. output power | 3000W:  | |
| | | Setting range is from 500W to 3000W. Increment and decrement of each click is 100W. Default value is 3000W. | |
| 08 | Solar energy feed to the grid configuration | Enable (default)  | Solar energy is able to feed in to the grid. |
| | | Disable  | Solar energy is not allowed to feed in to the grid. |
| 09 | Battery energy feed to the grid configuration | Enable  | Battery energy is able to feed in to the grid. |
| | | Disable(default)  | Battery energy is not allowed to feed in to the grid. |

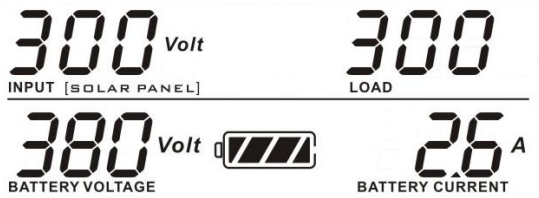
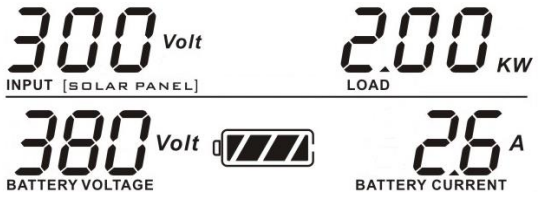
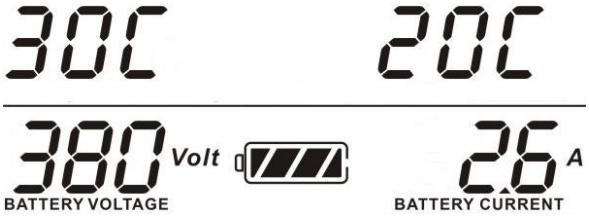
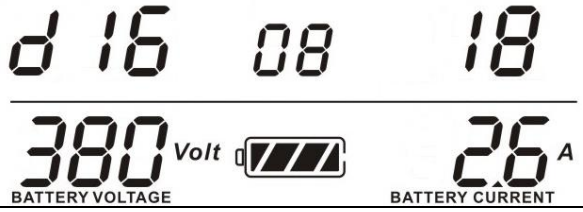
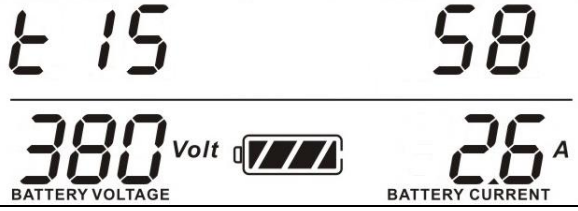
| | | |
|---|---|---|
| 10 | Start time to allow battery energy to power load on daily base | 00:00(Default):<br><br>The setting range is from 00:00 to 23:00. Increment of each click is 1 hour. |
| 11 | Stop time to allow battery energy to power load on daily base | <br>The setting range is from 00:00 to 23:00. Increment of each click is 1 hour. If setting 00:00 in program No.10 and No.11, it means battery energy will supply power to load all the time. If setting other same time such as 01:00 ~ 01:00 in program No. 10 and No. 11, it means battery energy will never supply power to load at all. |
| 12 | Start time to allow battery energy feed-in the grid on daily base | 00:00 (Default):<br><br>The setting range is from 00:00 to 23:00. Increment of each click is 1 hour. |
| 13 | Stop time to allow battery energy feed-in to the grid on daily base | 00:00(Default):<br><br>The setting range is from 00:00 to 23:00. Increment of each click is 1 hour. If setting 00:00 in program No.12 and No.13, it means battery will discharge to grid all the time. If setting other same time such as 01:00 ~ 01:00 in program No. 12 and No. 13, it means battery will never discharge to grid at all.<br>Based on this setting, if it's requested to allow battery energy feeding to the grid, please be sure to set correctly in program No. 10 and No. 11 to allow battery energy to power load first. Otherwise, battery energy will NOT feed in to the grid even though program No. 12 and No. 13 is set up. |
| 14 | Solar power source priority | LbU: 1st load, 2nd battery, 3rd feed-in grid (Default)<br><br>Solar power will power the load first. If solar power is sufficient, it will then charge battery. If there are still remaining solar power, it will feed in to the grid.<br>bLU: 1st battery, 2nd load, 3rd feed-in grid<br><br>Solar power will charge battery first. If solar power is sufficient, it will then provide to the load. If there are still remaining solar power, it will feed in to the grid. |
| 15 | Time Setting – Minute | <br>For minute setting, the range is from 00 to 59. |

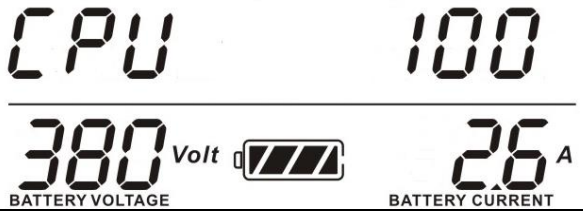
| | | |
|---|---|---|
| 16 | Time Setting – Hour | <br>For hour setting, the range is from 00 to 23. |
| 17 | Time Setting– Day | <br>For day setting, the range is from 01 to 31. |
| 18 | Time Setting– Month | <br>For month setting, the range is from 01 to 12. |
| 19 | Time Setting – Year | <br>For year setting, the range is from 16 to 99. |
| 20 | BTS temperature compensation*<br><br>*For this setting, please check installer or battery vendor for the details. | 0.00V/ per degree (Default):<br><br>Setting range is from 0.00V to 2.30V. Increment and decrement of each click is 0.01V. Default value is 0.00V. The derated battery charging voltage is followed the below formula: (Battery temperature – 25°C) * BTS temperature compensation. |
| 21 | Restore to default value | OFF:<br><br>Stay at current setting after exit setting mode. |
| | | ON:<br><br>Restore all parameters to default value after exit setting mode. |

### 4.4 Display Setting

The LCD display information will be switched in turns by pressing "UP" or "DOWN" key.

| Selectable information | LCD display |
|---|---|
| Input power/Output power<br>Battery voltage/Battery current<br>(Default Display Screen) | Input power=3000W, output power=2000W<br>Battery voltage=380V,<br>battery charging current = 2.6A<br> |
| | Input power=1000W, output power=2000W<br>Battery voltage=380V,<br>battery discharging current = 2.6A<br> |
| | Input power=3000W, output is not activated,<br>Battery voltage=380V,<br>battery charging current = 2.6A<br> |
| Input power/Output voltage<br>Battery voltage/Battery current | Input power=3000W, output voltage=300V<br>Battery voltage=380V,<br>battery charging current = 2.6A<br> |
| | Input power=3000W, output is not activated,<br>Battery voltage=380V,<br>battery charging current = 2.6A<br> |

| | |
|---|---|
| Input voltage/Output voltage<br>Battery voltage/Battery current | Input voltage =300V, output voltage=300V<br>Battery voltage=380V,<br>battery charging current = 2.6A<br> |
| Input voltage/Output power<br>Battery voltage/Battery current | Input power=300V, output power=2000W<br>Battery voltage=380V,<br>battery charging current = 2.6A<br> |
| Internal component temperature/External battery temperature<br>Battery voltage/Battery current | Internal component temperature = 30°C,<br>External battery temperature = 20°C,<br>Battery voltage=380V,<br>battery charging current = 2.6A<br> |
| Date<br>Battery voltage/Battery current | Date = Aug 18, 2016<br>Battery voltage=380V,<br>battery charging current = 2.6A<br> |
| Time<br>Battery voltage/Battery current | Time = 15:58<br>Battery voltage=380V,<br>battery charging current = 2.6A<br> |

| | |
|---|---|
| CPU firmware version<br>Battery voltage/Battery current | CPU firmware version:100<br>Battery voltage=380V,<br>battery charging current = 2.6A<br> |

### 4.6 Fault and Warning Code

| Type | Code | Event |
|---|---|---|
| Fault | 01 | Input current is abnormal. |
| | 02 | Battery current is abnormal. |
| | 03 | Output current is abnormal. |
| | 04 | Average input current is abnormal. |
| | 05 | Average battery current is abnormal. |
| | 06 | Average output current is abnormal. |
| | 07 | Temperature is too high. |
| | 08 | Fan is locked. |
| | 09 | PV voltage is too high. |
| Warning | 20 | Battery voltage is too high. |
| | 21 | Battery voltage is too low. |
| | 22 | Solar voltage is too high. |
| | 23 | Solar voltage is too low. |
| | 24 | Battery voltage had reached to stop discharging. |
| | 25 | Energy meter is not able to be detected. |

# 5. TROUBLE SHOOTING

| Situation | | Solution |
|---|---|---|
| Fault Code | Fault Event | |
| 01 | Input current is abnormal. | 1. Restart the converter.<br>2. If the problem remains, please contact your installer. |
| 02 | Battery current is abnormal. | 1. Restart the converter.<br>2. If the problem remains, please contact your installer. |
| 03 | Output current is abnormal. | 1. Restart the converter.<br>2. If the problem remains, please contact your installer. |
| 04 | Average input current is abnormal | 1. Restart the converter.<br>2. If the problem remains, please contact your installer. |
| 05 | Average battery current is abnormal. | 1. Restart the converter.<br>2. If the problem remains, please contact your installer. |
| 06 | Average output current is abnormal. | 1. Restart the converter.<br>2. If the problem remains, please contact your installer. |
| 07 | Temperature is too high. | 1. Check temperature on the LCD.<br>2. Check if fan is working.<br>3. If the problem remains, please contact your installer. |
| 08 | Fan is locked. | 1. Check if fan is working.<br>2. If the problem remains, please contact your installer. |
| 09 | PV voltage is too high | 1. Measure PV input voltage and check if it's over specification.<br>2. If yes, please reduce the PV panels.<br>3. If not, restart the converter.<br>4. If the problem remains, please contact your installer. |
| No display in LCD screen. | | 1. Check if battery and solar wire connection is correct.<br>2. If the problem remains, please contact your installer. |

# 6. SPECIFICATIONS

| **MODEL** | **3KW** |
|---|---|
| **RATED POWER** | 3000 W |
| **PV INPUT (DC)** | |
| Maximum DC Power | 4500 W |
| Maximum DC Voltage | 580 VDC |
| Start-up Voltage | 180 VDC |
| MPP Voltage Range | 180 VDC ~ 500 VDC |
| Full Load MPP Voltage Range | 230 VDC ~ 500 VDC |
| Maximum Input Current | 20 A |
| Isc PV (absolute maximum) | 20 A |
| Max. inverter back feed current to the array | 0 A |
| **BATTERY (DC)** | |
| Nominal discharging power/Nominal charging power | 3000W/4500W |
| Nominal battery range | 250~450V |
| Battery wakeup voltage | 230V |
| Battery open voltage | 200V |
| Battery overcharge protection | 460V |
| **OUTPUT (DC)** | |
| Nominal output power | 3000W |
| Output voltage range | 250V ~ 450V |
| **GENERAL** | |
| **PHYSICAL** | |
| Dimension, D X W X H (mm) | 116 x 284.4 x 388 |
| Net Weight (kgs) | 6.6 |
| **INTERACE** | |
| Communication Port | RS232 / USB |
| Intelligent Slot | Optional SNMP, GSM, WIFI, Modbus and AS-400 cards available |
| **ENVIRONMENT** | |
| Protective Class | I |
| Ingress Protection Rating | IP21 |
| Humidity | 0 ~ 90% RH (No condensing) |
| Operating Temperature | 0 to 40°C |
| Altitude | Max. 2000m* |

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