Photonic Universe
www.photonicuniverse.com
+44 (0) 203 150 11 11

# 8kW – 12kW
# Solar Hybrid Inverter

*ST-PV Series*

# INSTRUCTION MANUAL

# Table of Contents


**ABOUT THIS MANUAL** ..... 1

**SAFETY INSTRUCTIONS** ..... 1

**INTRODUCTION** ..... 2

Features ..... 2

Basic System Architecture ..... 2

Product Overview ..... 3

**INSTALLATION** ..... 4

Unpacking and Inspection ..... 4

Preparation ..... 4

Battery Connection ..... 5

AC Input / Output Connection ..... 6

PV Connection ..... 7

PV Module Selection ..... 8

PV Connectors ..... 9

Final Assembly ..... 10

Communication Connection ..... 10

Dry Contact Signal ..... 10

**OPERATION** ..... 11

Power ON/OFF ..... 11

Operation and Display Panel ..... 11

LCD Display Icons ..... 12

Settings Menu ..... 14

Fault Reference Codes ..... 21

Warning Codes ..... 22

Operating Mode Description ..... 23

Display Information ..... 24

**SPECIFICATIONS** ..... 24

Table 1 Line Mode Specifications ..... 24

Table 2 Inverter Mode Specifications ..... 25

Table 3 Charge Mode Specifications ..... 26

Table 4 General Specifications ..... 27

**TROUBLESHOOTING** ..... 28

**ABOUT THIS MANUAL**

This manual covers the instructions and detailed procedure for installing, operating, maintaining, and troubleshooting the ST-PV 8-12kW series of inverters.

Please keep this manual available at all times in case of emergency.

This manual does not cover any details concerning equipment connected to the unit (e.g. PV modules)

**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, and all relevant sections of the user manual.
2. **CAUTION!** Only use suitable batteries compatible with the inverter settings.
3. Do not disassemble or attempt to repair the unit. In the event of a fault, contact your supplier.
4. To reduce the risk of electric shock, disconnect all wiring before performing any maintenance or cleaning. Turning off the unit does not eliminate this risk.
5. **CAUTION!** This device must be installed with a battery and only by qualified electricians.
6. For optimal operation of this inverter/charger, please follow the required specifications to select the appropriate cable size. Correct cable selection is essential for safe and proper operation of the unit.
7. Exercise extreme caution when using metal tools on or near batteries. There is a risk that a tool may be dropped, causing sparks or short-circuiting the batteries or other electrical components, which may result in fire or equipment damage.
8. Please strictly follow the installation procedure when disconnecting AC or DC terminals. Refer to the INSTALLATION section of this manual for details.
9. The inverter/charger should be connected to a permanent grounded wiring system. Be sure to comply with local requirements and regulations to install this inverter.
10. Never short circuit the AC output or DC input. Do not connect to the mains if the DC input is short circuited.
11. Warning: Only qualified service personnel are permitted to service this device. If the fault persists after following the troubleshooting table, return the inverter/charger to your local dealer or service centre for maintenance.

**INTRODUCTION**

This inverter is a hybrid solar inverter, combining functions of inverter, solar charge controller and mains battery charger. The 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 output
- High power solar input with 2 MPPT trackers
- Configurable input voltage range
- Configurable battery charging parameters
- Configurable charging source priority
- Suitable for an AC input from a generator
- Overload, over temperature, short circuit protection

**Basic System Architecture**

The following illustration shows the basic application for this inverter-charger.

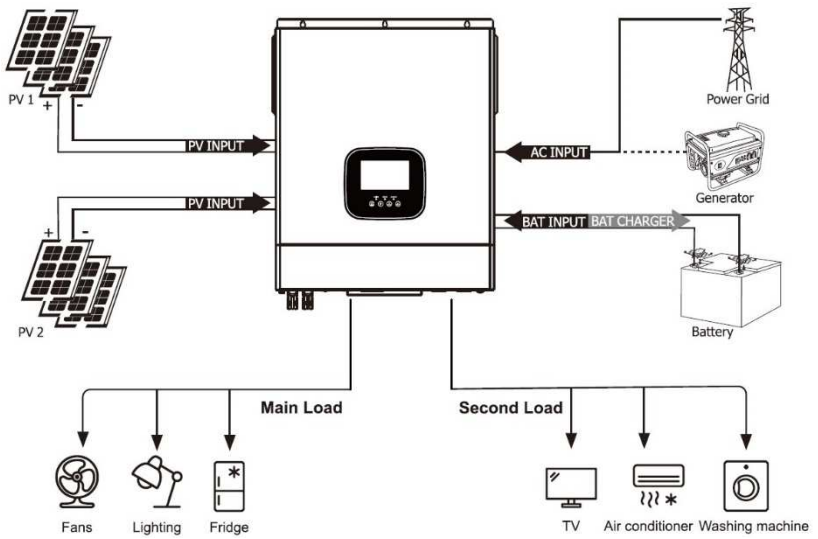
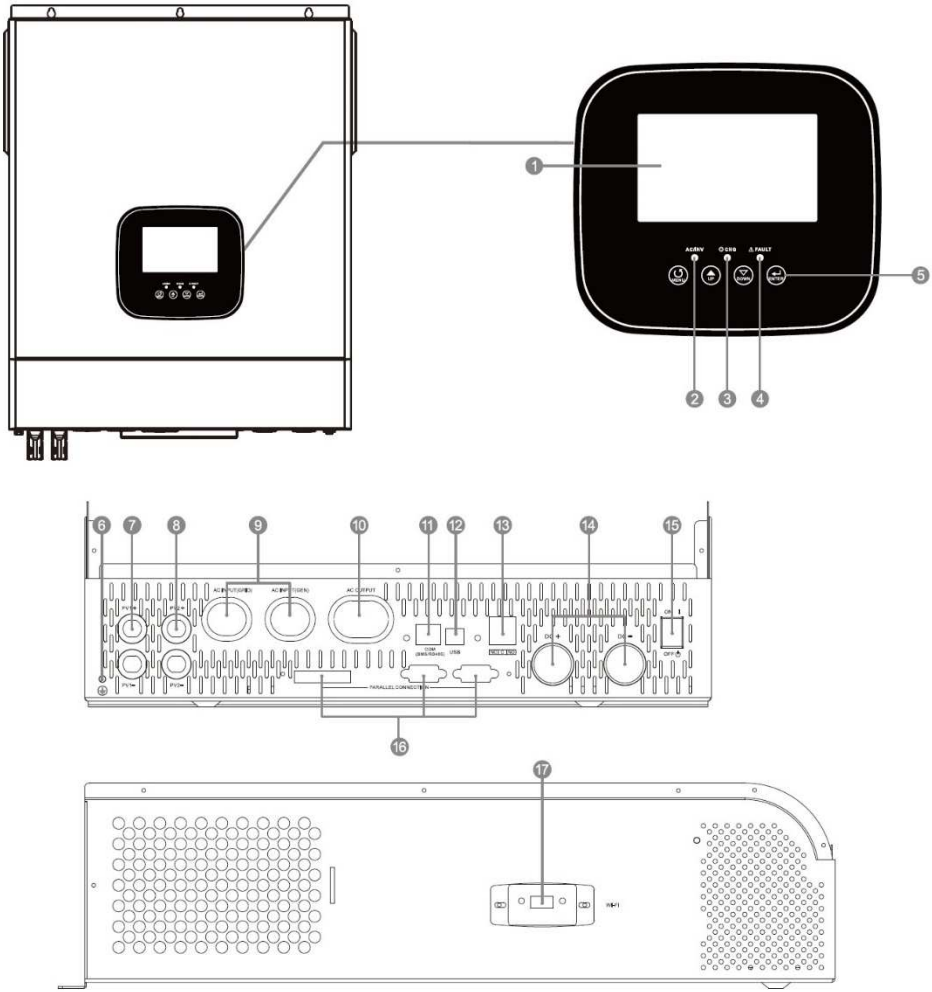



Figure 1. Hybrid Solar Power System

**Product Overview**




1. LCD display
2. Status indicator
3. Charging indicator
4. Fault indicator
5. Function buttons
6. Grounding terminal
7. PV1 input terminals
8. PV2 input terminals
10. AC output
11. RS485/BMS communication port
12. USB port
13. Dry contact
14. Battery Input terminals
15. Power ON/OFF Switch
16. Parallel communication port
17. Wi-Fi port

## INSTALLATION

### Unpacking and Inspection

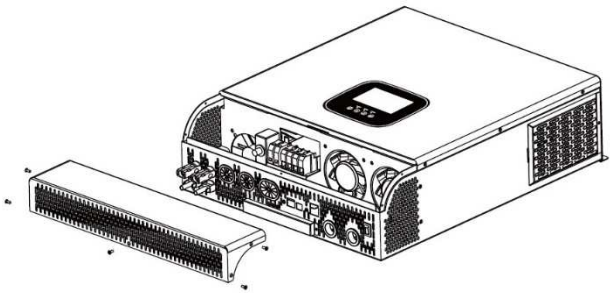
Although the inverter has undergone stringent testing and is checked before it leaves the factory, the unit can suffer damages during transportation. Please check the package for any signs of damage within 7 days after delivery. If damage is found, do not open the package and contact the supplier as soon as possible.

After opening the package, please refer to the packing list below to ensure all parts are provided. Please contact the supplier if anything is missing or damaged.

The unit x 1
User manual x 1
USB cable x 1

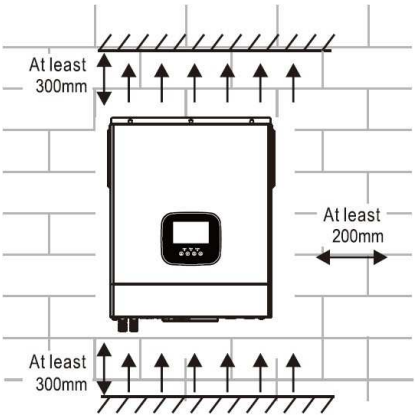
### Preparation

Before wiring, the bottom cover must be removed using the screws as shown below.

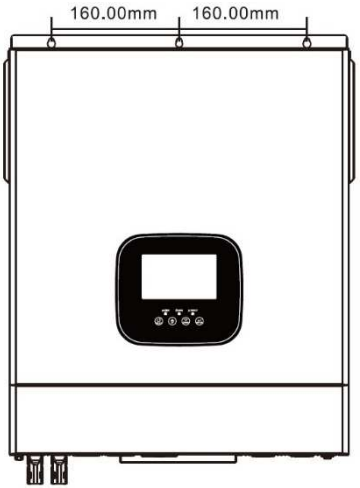


### Selecting the installation location

- Do not mount the inverter on surfaces made of flammable or combustible materials.
- The installation location must be suitable to support the inverter's weight and size for a long period of time.
- Select the installation location so that the status display can be easily viewed.
- To allow sufficient ventilation and heat dissipation, install with a minimum clearance to walls, other equipment or objects of 200 mm to the side of the inverter and 300 mm above and below the unit.
- The ambient temperature of the installation location should be between 0°C and 55°C.
- The inverter should be mounted vertically. Make sure the connection terminals of the inverter are located on the bottom.



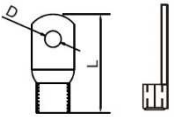
The inverter is mounted using the three mounting holes shown in the image below.




**Battery Connection**

**CAUTION:** Before connecting to the battery, a separate DC breaker must be installed between the inverter and the battery for overcurrent protection and isolation during maintenance. The current rating of the breaker should be chosen according to the inverter DC input current, but in any case, it should not be higher than the maximum current rating of the cables connecting the inverter and the battery.

Ring terminal:

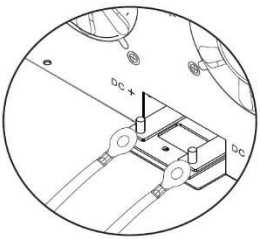



**WARNING!** All wiring must be performed by a qualified electrician.
**WARNING!** Always use appropriate cable for the connection to the battery. Please use the proper recommended cable and terminal size as shown in the table below.

**Recommended battery cable and terminal size:**

| Inverter Power | Typical Amperage | Cable $mm^2$ | Cable AWG size | Ring Terminal Dimensions | | Torque Value |
|---|---|---|---|---|---|---|
| | | | | D(mm) | L(mm) | |
| 8KW | 60A | 50 | 1/0 | 8.4 | 43.2 | 5 Nm |
| 10KW | 200A | 70 | 2/0 | 8.4 | 50.2 | 5 Nm |
| 11KW | 210A | 70 | 2/0 | 8.4 | 50.2 | 5 Nm |
| 12KW | 220A | 95 | 3/0 | 8.4 | 50.2 | 5 Nm |

Please ensure when connecting the batteries that the ring terminal sits flat on the mounting plate on the inverter, and make sure the bolts are tightened with torque of 5 Nm. Check the polarity of the battery cables is correct before installing.



| | |
|---|---|
| ⚠ | Do not place any items between the battery cable and inverter battery input terminals as this may cause overheating.<br><br>Before closing the DC breaker between the batteries and inverter, check that the polarity is correct. Reversed polarity will damage the inverter. |

**AC Input / Output Connection**

An AC circuit breaker must be installed between the inverter and AC power source (mains or generator). This will ensure the inverter can be safely isolated during maintenance and that the system is protected from over-current. The recommended current rating of AC breaker is 70A for 8-12KW inverters.

It is very important for system safety and efficient operation to use appropriate cable for the AC input connection. Please ensure the AC cable is sized appropriately based on the power rating of the inverter.

**WARNING!** All wiring must be performed by a qualified electrician.

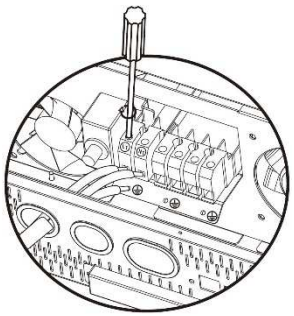
Suggested cable size for AC wires:

| Inverter Power Rating | Cable $mm^2$ | Cable AWG size | Torque Value |
|---|---|---|---|
| 8-12KW DC48V | 10 | 8 | 1.4~ 1.6Nm |

Please follow the steps below to complete the AC input/output connections:

1) Before wiring the AC input and output connections, make sure the DC breaker is open.
2) Strip back the AC cables by 10mm for connection into the terminals. Make sure the Live (L) and Neutral (N) wires are 3mm shorter than the earth connection.
3) Always connect the earth (⏚) wire before the Live and Neutral wires.
4) Make sure the wires are connected with the correct polarity as shown below:

⏚ → **Ground (yellow-green)**
**L1 → Live (brown or black)**
**N1 → Neutral (blue)**

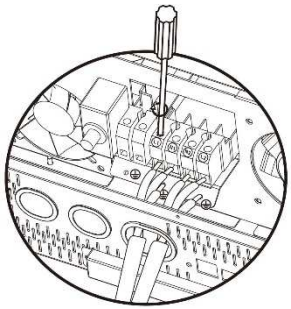


| | |
|---|---|
| ⚠ | **WARNING:**<br>Make sure that the AC power source is fully isolated before wiring to the unit. |

When wiring the loads to the AC output terminals, make sure they are connected with the correct polarity. Always connect the earth (⏚) wire before the Live and Neutral wires.

This inverter is equipped with dual AC outputs, allowing the user to programme the ON/OFF status of one of the outputs based on the battery level or by using a timer, if required. There are four terminals (L1, N1, L2 & N2) available on the AC output terminal block. The AC output terminals are wired as shown below:

**⏚ → Ground (yellow-green)**
**L1 → Output 1 Live (brown or black)**
**N1 → Output 1 Neutral (blue)**
**L2 → Output 2 Live (brown or black)**
**N2 → Output 2 Neutral (blue)**



Make sure the wires are securely connected.

**CAUTION:** Important
Make sure that all wiring is connected with the correct polarity. Reversing the Live (L) and Neutral (N) conductors may result in damage to the inverter or loads, and can lead to a utility side short circuit, for example if the inverter is operating in a parallel system.

**CAUTION:** Certain appliances, such as air conditioners, may require a restart delay of at least 2-3 minutes after power interruption. This delay allows refrigerant pressures inside the system to stabilise before the compressor restarts.

If power is restored too quickly after an outage, overload, or inverter shutdown, the appliance may attempt to restart under high pressure conditions. This can result in excessive startup current, inverter overload protection activation, or damage to the appliance compressor.

Before installation, verify whether the appliance is equipped with a built-in restart delay or time-delay protection function. If not, installation of an external delay timer is recommended.

**PV Connection**

It is recommended to install a DC isolator switch between the solar array and inverter to allow for easy disconnection during maintenance.

**WARNING!** All wiring must be performed by a qualified electrician.

Make sure to use an appropriate cable for the connection between the solar array and the inverter. The cable must be rated for outdoor use and must have a suitable cross-sectional area.

| Inverter power rating | Typical amperage | Cable thickness ($mm^2$) | Cable thickness (AWG) | Torque value |
|---|---|---|---|---|
| 8KW | 18A | 4-6 | 10 | 1.4~1.6Nm |
| 10-12K | 27A | 4-6 | 10 | 1.4~1.6Nm |

**PV Module Selection**

When selecting the solar array to use with the inverter, please make sure of the following:

1. The open circuit Voltage (Voc) of the PV array does not exceed the maximum PV open circuit voltage rating of inverter.
2. The maximum power Voltage (Vmpp) of the PV array is greater than the start-up voltage rating of the inverter.

**Maximum PV modules in Series =** (Maximum open circuit voltage of inverter*0.9) / Voc rating of PV module.
**Maximum PV modules in parallel =** Maximum charging current of inverter / Impp rating of PV module.
**Maximum number of PV modules =** Maximum PV power rating of inverter / power rating of PV module.

| **Solar Charging Mode** | |
|---|---|
| **INVERTER MODEL** | **8-12KW** |
| Max. PV Array Open Circuit Voltage | 500Vdc (single model) / 450Vdc (parallel model) |
| PV Array MPPT Voltage Range | 90~450Vdc (single model) / 90~430Vdc (parallel model) |
| MPPT Number | 2 |
| Start-up Voltage | 80Vdc |

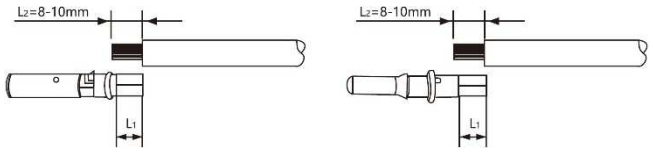
**Recommended PV module configuration (per independent MPPT input)**

| **PV module specifications** (reference example):<br>• Maximum power (Pmax): 330W<br>• Maximum Power Voltage (Vmpp): 38.70V<br>• Maximum Power Current (Impp): 8.54A<br>• Open Circuit Voltage (Voc): 46.1V<br>• Short Circuit Current (Isc): 9.17A | **Total input power** | **Solar input 1 + Solar Input 2** | **Qty of modules** |
|---|---|---|---|
| | 1320W | 4 pieces in series + open | 4pcs |
| | | open + 4 pieces in series | |
| | 1980W | 6 pieces in series + open | 6pcs |
| | | open + 6 pieces in series | |
| | 2640W | 8 pieces in series +open | 8pcs |
| | | open + 8 pieces in series | |
| | | 4 pieces in series + 4 pieces in series | |
| | 3960W | 6 pieces in series,2 strings in parallel + open | 12pcs |
| | | open + 6 pieces in series,2 strings in parallel | |
| | | 6 pieces in series + 6 pieces in series | |
| | 5280W | 8 pieces in series,2 strings in parallel + open | 16pcs |
| | | open + 8 pieces in series,2 strings in parallel | |
| | | 8 pieces in series + 8 pieces in series | |
| | 5940W | 9 pieces in series,2 strings in parallel + open | 18pcs |
| | | open + 9 pieces in series,2 strings in parallel | |
| | | 9 pieces in series + 9 pieces in series | |
| | 6600W | 5 pieces in series,2 strings in parallel + 5 pieces in series,2 strings in parallel | 20pcs |
| | 7920W | 6 pieces in series,2 strings in parallel + 6 pieces in series,2 strings in parallel | 24pcs |
| | 9240W | 7 pieces in series,2 strings in parallel + 7 pieces in series,2 strings in parallel | 28pcs |
| | 10560W | 8 pieces in series,2 strings in parallel + 8 pieces in series,2 strings in parallel | 32pcs |
| | 11880W | 9 pieces in series,2 strings in parallel + 9 pieces in series,2 strings in parallel | 36pcs |

**PV Connectors**

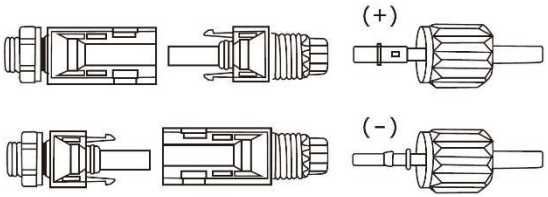
**Step 1** Remove the cable glands from the positive and negative connectors.

**Step 2** Take out the metal pins from the accessory package, and strip the cable ends as shown in the image below.



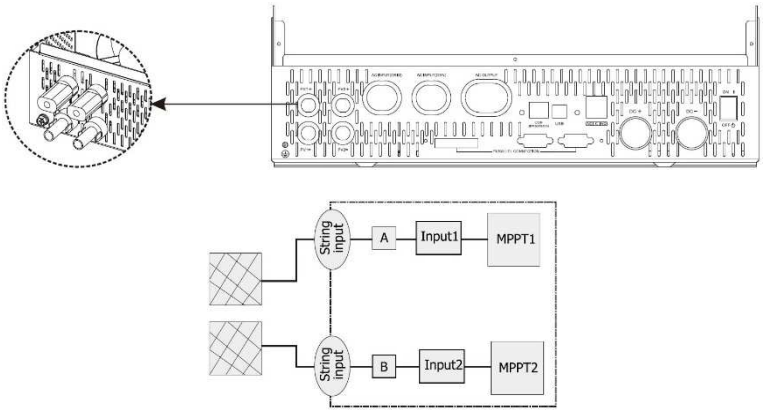

**Step 3** Insert the positive and negative power cables into corresponding cable glands.

**Step 4** Insert the stripped positive and negative power cables into the positive and negative metal pins respectively and crimp them using a suitable crimping tool. Ensure that the cables are crimped until they cannot be pulled out by force less than 400 N.




**Step 5** Insert the positive and negative connectors into corresponding DC input terminals of the Inverter until you hear a "click" sound.

The inverter has 2 independent PV inputs: input A and input B. Each input has a separate MPPT tracker which extracts the maximum power from each solar array independently. This significantly increases the system efficiency for installations where 2 solar arrays are positioned at a different angle or orientation on the roof, or they are affected by shading at different times of day.

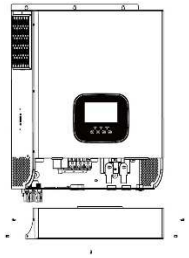



In smaller systems only one of the solar inputs can be used (either A or B) as long as the maximum output voltage and current of the array are within the maximum limits of the inverter.

**Note:** while it is permissible to use different makes or sizes of solar modules in one of the arrays compared to the other, please ensure that all modules connected within the same array are identical.

**Final Assembly**

After completing all connections to the inverter, and checking all the connections are secure and correctly wired, secure the bottom cover back in place as shown in the image below.



## Communication Connection

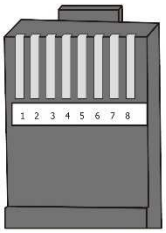
Use the supplied communication cable to connect the inverter to a PC.
Download the monitoring software using the link below or the QR code:
https://www.photonicuniverse.com/upload/file/Software/Solar_Power_Monitor.zip
Follow the on-screen instructions to complete the installation.

Do not use a standard network (Ethernet) cable to connect the inverter directly to the PC communication port or to a battery management system (BMS). Incorrect cabling may result in damage to the inverter's internal components.

*Scan the QR code to download PC software*

The table below provides the RJ45 pin configuration:

| Pin | Definition | Function |
|---|---|---|
| 1 | RS-485-B | PC communication |
| 2 | RS-485-A | |
| 3 | GND | |
| 4 | CANH | BMS communication |
| 5 | CANL | |
| 6 | | |
| 7 | | |
| 8 | | |



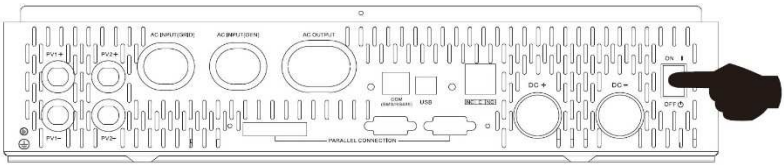

*Pin numbers*

**Dry Contact Signal**

The inverter is equipped with a dry contact port (rated 3A/250VAC), which can be used to signal an external device when the battery voltage reaches a predefined warning threshold.

| Unit status | Condition | | | Dry contact port: NC C NO | |
|---|---|---|---|---|---|
| | | | | NC&C | NO&C |
| Power Off | Unit is off and no output is powered | | | Close | Open |
| Power On | Output is powered from Utility | | | Close | Open |
| | Output is powered from Battery or Solar | Program 01 set as utility | Battery voltage < Setting value in Program 19 | Open | Close |
| | | | Battery voltage > Setting value in Program 21 or Program 39 or the battery is in the float stage of charge | Close | Open |
| | | Program 01 set as SBU, SUB, SOL | Battery voltage < Setting value in Program 20 or Program 38 | Open | Close |
| | | | Battery voltage > Setting value in Program 21 or Program 39 or the battery is in the float stage of charge | Close | Open |

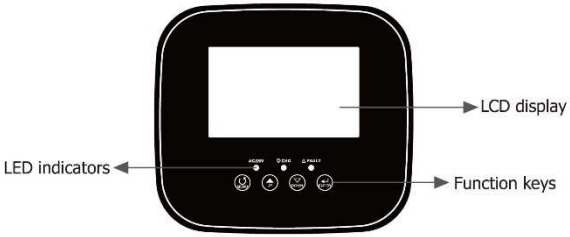
## OPERATION
## Power ON/OFF




Once the unit has been correctly installed and the batteries are properly connected, press the On/Off switch (located on the bottom of the enclosure) to power on the unit.

### Operation and Display Panel

The operation and display panel, shown in image below, is on the front of the inverter. It includes three status indicators, four function keys and an LCD display, which provides information on operating status and input/output power.



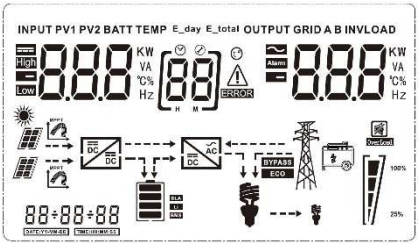

### LED Indicators

| LED Indicator | | | Messages |
|---|---|---|---|
| AC/ INV | Green | Solid On | The output is being powered by the grid in Line mode. |
| | | Flashing | The output is being powered by the battery or PV in battery mode. |
| CHG | Yellow | Flashing | The battery is charging or discharging. |
| ⚠ FAULT | Red | Solid On | Fault mode |
| | | Flashing | Warning mode |

### Function Keys

| Function Keys | Description |
|---|---|
| MENU | Enter reset mode, setting mode or go to previous selection. |
| UP | Increase the setting value. |
| DOWN | Decrease the setting value. |
| ENTER | Enter setting mode.<br>Confirm the selection in setting mode, go to next parameter, or exit reset mode. |

**LCD Display Icons**




| Icon | Function description |
|---|---|
| **Input Source Information and Output Information** | |
| | Indicating AC related information |
| | Indicating DC related information |
| 8.8.8 KW VA ℃% Hz | Indicating the AC input voltage, input frequency, PV voltage, battery voltage and charger current, AC output voltage, output frequency, load in VA, load in W and discharging current. |
| **Configuration Program and Fault Information** | |
| 88 | Indicating the setup interface page number. |
| 88 ⚠ ERROR | Indicating warning or fault codes.<br>Warning code: 88 ⚠<br>Fault code: 88 ERROR |
| **Battery Information** | |
| SLA Li CHARGING | Indicating the battery capacity (0-24%, 25-49%, 50-74% and 75-100%) and the charging status |

When in AC mode, the battery indicator will show the charging status of the batteries according to the below table:

| Status | Battery voltage | Battery icon on the display |
|---|---|---|
| Constant Current mode / Constant Voltage mode | <48V | 4 bars flashing |
| | 48V~50V | Bottom bar on<br>Top 3 bars flashing |
| | 50V~52V | Bottom 2 bars on<br>Top 2 bars flashing |
| | >52V | Bottom 3 bars on<br>Top bar flashing |
| Batteries fully charged | | 4 bars on. |

When in battery mode, the battery indicator will show the battery state of charge according to the table below:

| Load Percentage | Battery Voltage | LCD Display |
|---|---|---|
| Load >50% | < 41.2V |  |
| | 41.2V~43.2V |  |
| | 43.2V~45.2V |  |
| | > 45.2V |  |
| 50%> Load>20% | < 43.6V |  |
| | 43.6V ~45.6V |  |
| | 45.6V ~47.6V |  |
| | > 47.6V |  |
| Load<20% | < 44.8V |  |
| | 44.8V~46.8V |  |
| | 46.8V~48.8V |  |
| | >48.8V |  |

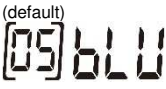
| **Load Information** | | | | |
|---|---|---|---|---|
| OverLoad | Indicating overload. | | | |
|  | Indicating the load level (0-24%, 25-49%, 50-74% and 75-100%) | | | |
| | 0%~24% | 25%~49% | 50%~74% | 75%~100% |
| |  |  |  |  |
| **Mode Operation Information** | | | | |
|  | Indicating that the inverter is connected to the mains. | | | |
|  | Indicating that the inverter is connected to PV. | | | |
| BYPASS | Indicating that the load is being supplied by utility power. | | | |
|  | Indicating that the solar charger circuit is being used. | | | |
|  | Indicating that the DC/AC inverter circuit is being used. | | | |
| **Mute Operation** | | | | |
|  | Indicating that the unit alarm is disabled. | | | |

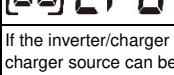
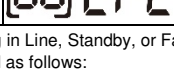
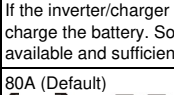
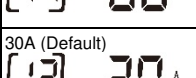
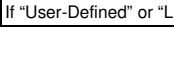
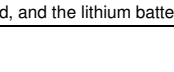
**Settings Menu**

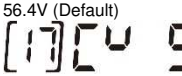
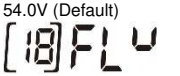
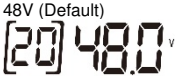
After pressing and holding the “ENTER” button for 2 seconds, the unit will enter setting mode. Press the “UP” or “DOWN” button to select the setting programs, then press “ENTER” or “MENU” to confirm the selection and exit.

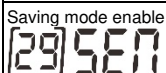
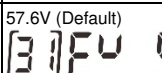
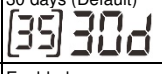
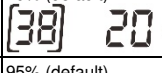
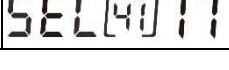
**Setting Programs:**

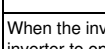
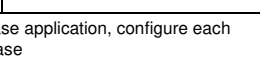
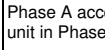
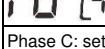
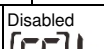
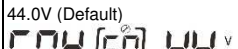
| Program | Description | Selectable option | |
|---|---|---|---|
| 00 | Exit setting mode | Escape  | |
| 01 | Output source priority selection | (default)  | Solar energy provides power to the loads as first priority. If solar energy is not sufficient to power all connected loads, utility energy will supply power to the loads simultaneously. Battery energy will supply power to the loads only when utility power is unavailable.<br><br>If solar power is unavailable, the utility will charge the battery until the battery voltage reaches the set point in program 21 or 39.<br><br>If solar power is available but the battery voltage is below the set point in program 20 or 38, the utility will charge the battery until the voltage reaches the set point to protect the battery from damage |
| | |  | Solar energy provides power to the loads as first priority. If solar energy is not sufficient to supply all connected loads, battery energy will supplement the load. Utility power will supply the loads only when the battery voltage drops to the low-level warning voltage, reaches the set point in program 20 or 38, or when both solar and battery energy are insufficient.<br><br>Battery energy will supply power to the loads when utility power is unavailable, or when the battery voltage is above the set point in program 21 or 39 (when BLU is selected), or program 20 or 38 (when LBU is selected).<br><br>If solar power is available but the battery voltage is below the set point in program 20 or 38, the utility will charge the battery until the voltage reaches the set point, protecting the battery from damage. |

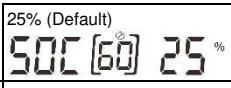
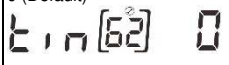
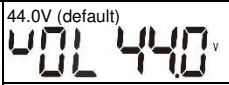
| | | | |
|---|---|---|---|
| | |  | Solar energy provides power to the loads as first priority.<br><br>If the battery voltage remains above the set point in program 21 or 39 for 5 minutes, and solar energy has been available for 5 minutes, the inverter will switch to battery mode, allowing solar and battery energy to supply power to the loads simultaneously.<br><br>When the battery voltage drops to the set point in program 20 or 38, the inverter will switch to bypass mode. In this mode, utility power supplies the loads, while solar energy simultaneously charges the battery. |
| | |  | Utility power provides energy to the loads as first priority. Solar and battery energy supply the loads only when utility power is unavailable. |
| 02 | AC input voltage range | Appliances (default)<br> | If selected, the acceptable AC input voltage range will be within 90-280VAC. |
| | | UPS<br> | If selected, the acceptable AC input voltage range will be within 170-280VAC. |
| | | GEN<br> | When the inverter is connected to a generator, select the generator mode. |
| | | VDE<br> | If selected, the acceptable AC input voltage range will conform to VDE4105 (184VAC-253VAC) |
| 03 | Output voltage |  | Set the output voltage (220VAC-240VAC) |
| 04 | Output frequency | 50Hz (Default)<br> | 60Hz<br> |
| | | The inverter will need to be restarted after changing the frequency | |
| 05 | Solar supply priority | (default)<br> | Solar energy provides power to charge the battery as first priority.<br><br>When utility power is available, if the battery voltage is below the set point in program 21 or 39, solar energy will not supply the loads and will be used only to charge the battery.<br><br>If the battery voltage is above the set point in program 21 or 39, solar energy will supply power to the loads or recharge the battery as needed. |

| | | | |
|---|---|---|---|
| | |  | Solar energy provides power to the loads as first priority.<br><br>If the battery voltage is below the set point in program 20 or 38, solar energy will not supply the loads and will be used only to charge the battery.<br><br>If the battery voltage is above the set point in program 20 or 38, solar energy will supply power to the loads or recharge the battery as required. |
| 06 | Overload Bypass: When enabled, the inverter will switch to line (utility) mode if an overload occurs while operating in battery mode. | Bypass disabled<br> | Bypass enabled (Default)<br> |
| 07 | Auto restart when overload occurs | Restart disabled (Default)<br> | Restart enabled<br> |
| 08 | Auto restart when over temperature occurs | Restart disabled (Default)<br> | Restart enabled<br> |
| 10 | Charger source priority | If the inverter/charger is operating in Line, Standby, or Fault mode, the charger source can be configured as follows: | |
| | | Solar first<br> | Solar energy charges the battery as first priority. Utility power will charge the battery only when solar energy is unavailable. |
| | | Solar and Utility<br> | Solar energy and utility will charge battery at the same time. |
| | | Only Solar<br> | Solar energy will be the only charging source even if utility is available |
| | | If the inverter/charger is operating in Battery mode, only solar energy can charge the battery. Solar energy will charge the battery whenever it is available and sufficient. | |
| 11 | Maximum charging current | 80A (Default)<br> | The setting range is 1 A to 120 A for the 8 kW model, and 1 A to 150 A for the 10–12 kW models. The value increments by 1 A with each adjustment step. |
| 13 | Maximum utility charging current | 30A (Default)<br> | The setting range is 1 A to 120 A for the 8 kW model, and 1 A to 150 A for the 10–12 kW models. The value increments by 1 A with each adjustment step. |
| 14 | Battery type | AGM (Default)<br> | Flooded<br> |
| | | GEL<br> | LEAD<br> |
| | | Lithium Ion<br> | User-Defined<br> |
| | | If “User-Defined” or “LI” is selected, and the lithium battery does not | |

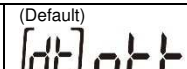
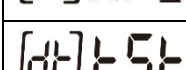
| | | | |
|---|---|---|---|
| | | communicate properly with the inverter, the battery icon will flash.<br><br>If “LI” is selected and the battery icon does not flash, programs 11, 17, and 18 will be set automatically. Programs 19 and 37 will use the SOC percentage method, and programs 11, 17, 18, and 37 cannot be modified by the user.<br><br>If “User-Defined” is selected and the battery icon does not flash, the battery charge voltage, charge current, and BMS control method can be configured in programs 11, 17, 18, 19, and 37. | |
| 17 | Bulk charging voltage (C.V voltage) | 56.4V (Default)<br><br> | |
| | | Setting range is from 48.0V to 58.4V. Increment of each click is 0.1 V | |
| 18 | Floating charging voltage | 54.0V (Default)<br><br> | |
| | | Setting range is from 48.0V to 58.4V for 48Vdc model.<br>Increment of each click is 0.1V. | |
| 19 | Low DC cut-off voltage or SOC percentage | 42V (Default)<br><br> | |
| | | If “User-Defined” or “LI” is selected in program 14, this program can be configured. The setting range is 42.0 V to 54.0 V. Each adjustment step increments the value by 0.1 V. The low DC cut-off voltage will remain fixed at the set value, regardless of the load percentage connected. | |
| | | SOC 10% (Default)<br><br> | |
| | | If “User-Defined” or “LI” is selected in program 14 and the SOC percentage method is selected in program 37, the low DC cut-off SOC percentage can be configured. The low DC cut-off SOC percentage will remain fixed at the set value, regardless of the load percentage connected. The setting range is 0 % to 90 %, with each adjustment step incrementing by 1 %. | |
| 20 | Battery stop discharging voltage when grid is available | 48V (Default)<br><br> | Setting range is from 44.0V to 58.0V.<br>Increment of each step is 0.1V. |
| 21 | Battery stop charging voltage when grid is available | 54V (Default)<br><br> | Setting range is from 44.0V to 58.0V.<br>Increment of each step is 0.1V. |
| 22 | Auto turn page | (Default)<br><br> | If enabled, the display screen will automatically cycle through the display pages |
| | | <br> | If enabled, the display screen will remain on the last page selected by the user. |
| 23 | Backlight control | Backlight on<br><br> | Backlight off (Default)<br><br> |
| 24 | Alarm control (main) | Alarm on (Default)<br><br> | Alarm Off<br><br> |
| 25 | Alarm control (beeping while primary source is interrupted) | Alarm on<br><br> | Alarm Off (Default)<br><br> |

| | | | |
|---|---|---|---|
| 27 | Record fault code | Record enabled (Default)<br> | Record disabled<br> |
| 29 | Power saving mode enable/ disable | Saving mode disable (default)<br> | If disabled, the inverter output on/off status will not be affected by the level of connected load. |
| | | Saving mode enable<br> | If enabled, the inverter output will turn off when the connected load is very low or not detected. |
| 30 | Battery equalization | Battery equalization enabled<br> | Battery equalization disabled (default)<br> |
| 31 | Battery equalization voltage | 57.6V (Default)<br> | |
| | | Setting range is from 48.0V to 58.4V. Increment of each click is 0.1V. | |
| 33 | Battery equalization time | 60min (Default)<br> | Setting range is from 5 min to 900 min. Increment of each click is 5 min. |
| 34 | Battery equalization timeout | 120min (Default)<br> | Setting range is from 5 min to 900 min. Increment of each click is 5 min. |
| 35 | Equalization interval | 30 days (Default)<br> | Setting range is from 0 to 90 days. Increment of each click is 1 day. |
| 36 | Equalization activated immediately | Enabled<br> | Disabled (Default)<br> |
| | | If the equalisation function is enabled in program 30, this program can be configured. If **"Enable"** is selected, battery equalisation will be activated immediately, and **"**  **"** will be displayed on the LCD main page. If **"Disable"** is selected, the equalisation function will be cancelled until the next scheduled equalisation time based on the setting in program 35. In this case, **"**  **"** will also be shown on the LCD main page | |
| 37 | BMS control method | Voltage method(default)<br> | SOC Percentage method<br> |
| 38 | Battery stops discharging percent when SOC is available | 20% (default)<br> | Setting range is from 5%-95% Increment of each step is 1%. |
| 39 | Battery stops charging percent when SOC is available | 95% (default)<br> | Setting range is from 10%-100% Increment of each step is 1%. |
| 40 | BMS communication | (Default)<br> | When the communication between BMS and inverter is abnormal, the inverter still charges or discharges the battery. |
| | |  | When the communication between BMS and inverter is abnormal, the inverter stops charging or discharging the battery. |
| 41 | Lithium battery protocol |  | Setting range is from 0 to 31 Increment of each step is 1 |

<table>
<tr><td></td><td></td><td colspan="3">If “LI” is selected in program 14, program 41 can be configured. After setting program 41, the inverter must be restarted for the changes to take effect. For example, if program 41 is set to 17, the inverter can communicate with the corresponding lithium battery.<br><table><tr><th>Setting Value</th><th>Communication protocol</th><th>Communication mode</th></tr><tr><td>0</td><td>PU (old)</td><td>CAN</td></tr><tr><td>1</td><td>Dyness</td><td>CAN</td></tr><tr><td>5</td><td>Ultracell</td><td>RS485</td></tr><tr><td>7</td><td>Vision</td><td>RS485</td></tr><tr><td>8</td><td>Pylon</td><td>CAN</td></tr><tr><td>17</td><td>PU (New)</td><td>CAN</td></tr></table></td></tr>
<tr><td>42</td><td>Parallel Address Setting<br><br>After this program is configured, the inverter must be restarted for the settings to take effect. Before confirming that the settings are active, and before restarting the inverter, do not connect / disconnect the wires linking the AC outputs of different inverters, otherwise they may be damaged.<br><br>The AC outputs of multiple inverters must only be connected in parallel after parallel mode has been enabled on all inverters in the group and all units have been restarted successfully.</td><td colspan="3">Single: this inverter is used as a standalone unit<br><br>Parallel: this inverter operates within a parallel system (e.g. set the first unit to IP1, the second unit to IP2, the third unit to IP3, etc.).<br><br>When the inverter is used in a three-phase application, configure each inverter to operate in the designated phase<br>Phase A: set the inverter assigned to Phase A accordingly (e.g. set the first unit in Phase A to 3A1).<br><br>Phase B: set the inverter assigned to Phase B accordingly (e.g. set the first unit in Phase B to 3B1).<br><br>Phase C: set the inverter assigned to Phase C accordingly (e.g. set the first unit in Phase C to 3C1).<br></td></tr>
<tr><td>48</td><td>PV input configuration</td><td colspan="3">ALO (default)<br><br>PV1 and PV2 are connected to independent solar arrays<br><br>PV1 and PV2 are connected to the same solar array</td></tr>
<tr><td>55</td><td>Alarm control (error 55 beeping enabled / disabled)</td><td>Enabled (default)<br></td><td>Disabled<br></td><td>Beep 5 times<br></td></tr>
<tr><td>56</td><td>Alarm control (error 56 display and beeping enabled / disabled)</td><td colspan="2">Disabled<br></td><td>Enabled (Default)<br></td></tr>
<tr><td>59</td><td>Dual AC output enable/disable</td><td colspan="2">Disabled<br></td><td>If disabled, the second load will follow the main load.</td></tr>
<tr><td></td><td></td><td colspan="2">Enabled (Default)<br></td><td>If enabled, setting 60 can be configured for the second load.</td></tr>
<tr><td>60</td><td>Set the cut-off voltage point or SOC percentage for the second AC output (L2) if “0” is selected in program 42 (based on the</td><td colspan="2">44.0V (Default)<br></td><td>Setting range is from 44.0V to 58.0V.<br><br>Increment of each step is 0.1V.</td></tr>
</table>

| | | | |
|---|---|---|---|
| | setting in program 37: VOL or SOC) | 25% (Default)<br> | Setting range is from 20%-95%. Increment of each step is 1%. |
| 61 | Maximum discharge time for the second load output (L2) if “0" is selected in program 42 | Disabled (Default)<br> | Setting range is disabled and then from 0 min to 990 min. Increment of each step is 1 min. |
| 62 | Start time (hour) to turn on the second load output (L2) if “0" is selected in program 42 | 0 (Default)<br> | The setting range is 00 to 23, with each adjustment incrementing by 1 hour. If the range is set from 00 to 08, the second output will remain on until 09:00. During this period, it will turn off if any set value in program 60 or 61 is reached. |
| 63 | End time (hour) to turn off the second load output (L2) if "0" is selected in program 42 | 23 (Default)<br> | |
| 64 | Restart voltage point or SOC percentage for the second load output (L2) if “0” is selected in program 42 (based on the setting in program 37: VOL or SOC). | 44.0V (default)<br> | Setting range is from 44.0V to 58.0V<br>Increment of each step is 0.1V. |
| | | 25% (default)<br> | Setting range is from 20% to 95%.<br>Increment of each step is 1%. |
| 95 | Time setting - Minute |  | For minute setting, the range is from 0 to 59. |
| 96 | Time setting - Hour |  | For hour setting, the range is from 0 to 23. |
| 97 | Time setting - Day |  | For day setting, the range is from 1 to 31. |
| 98 | Time setting - Month |  | For month setting, the range is from 1 to 12. |
| 99 | Time setting - Year |  | For year setting, the range is from 1 to 98. |

After pressing and holding the “MENU” button for 6 seconds, the unit will enter reset mode. Use the “UP” and “DOWN” buttons to navigate through the programs, and press the “ENTER” button to exit.

| | | |
|---|---|---|
|  | (Default)<br> | Reset setting disable |
| |  | Reset setting enable |

**Fault Reference Codes**

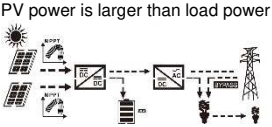
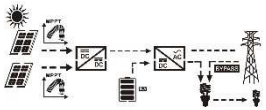
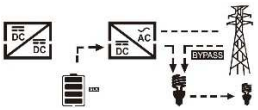
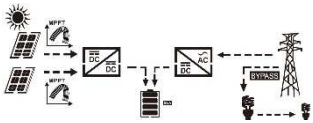
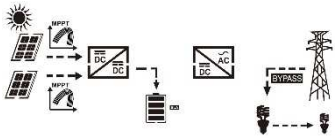
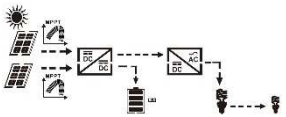
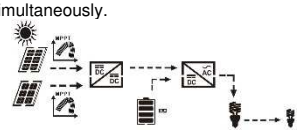
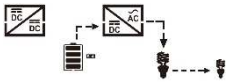
| Fault Code | Fault Cause | LCD Indication |
|---|---|---|
| 01 | Fan is locked when inverter is off |  |
| 02 | Inverter transformer over temperature |  |
| 03 | Battery voltage is too high |  |
| 04 | Battery voltage is too low |  |
| 05 | Output short circuited |  |
| 06 | Inverter output voltage is high |  |
| 07 | Overload time out |  |
| 08 | Inverter bus voltage is too high |  |
| 09 | Bus soft start failed |  |
| 11 | Main relay failed |  |
| 21 | Inverter output voltage sensor error |  |
| 22 | Inverter grid voltage sensor error |  |
| 23 | Inverter output current sensor error |  |
| 24 | Inverter grid current sensor error |  |
| 25 | Inverter load current sensor error |  |
| 26 | Inverter grid over current error |  |
| 27 | Inverter heatsink over temperature |  |
| 31 | Solar charger battery voltage class error |  |
| 32 | Solar charger current sensor error |  |
| 33 | Solar charger current is uncontrollable |  |
| 41 | Inverter grid voltage is low |  |
| 42 | Inverter grid voltage is high |  |

| | | |
|---|---|---|
| 43 | Inverter grid under frequency |  |
| 44 | Inverter grid over frequency |  |
| 51 | Inverter over current protection error |  |
| 52 | Inverter bus voltage is too low |  |
| 53 | Inverter soft start failed |  |
| 55 | Over DC voltage in AC output |  |
| 56 | Battery connection is open |  |
| 57 | Inverter control current sensor error |  |
| 58 | Inverter output voltage is too low |  |

**Warning Codes**

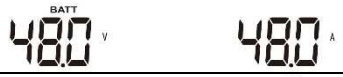
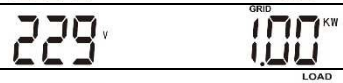
| Warning Code | Warning Event | Icon flashing |
|---|---|---|
| 61 | Fan 1 is locked when inverter is on |  |
| 62 | Fan 2 is locked when inverter is on |  |
| 63 | Battery is over-charged |  |
| 64 | Low battery |  |
| 67 | Overload |  |
| 70 | Output power derating |  |
| 72 | Solar charger stops due to low battery |  |
| 73 | Solar charger stops due to high PV voltage |  |
| 74 | Solar charger stops due to over load |  |
| 75 | Solar charger over temperature |  |
| 76 | PV charger communication error |  |
| 77 | Parameter error |  |
| 90 | Lithium battery full (single model) |  |

**Operating Mode Description**

| Operating Mode | Description | LCD display |
|---|---|---|
| Matching load power | PV energy is used to power the AC output directly. Any excess power is used to charge the battery. | PV power is larger than load power  |
| | | PV power is smaller than load power  |
| | | PV is off  |
| Charging | PV energy and grid are both charging the battery. |  |
| Bypass | The loads are being powered directly from utility. |  |
| Off-Grid | The loads are being powered from the battery and PV power. | Loads are being powered from PV.  |
| | | Loads are being powered from the battery and PV simultaneously.  |
| | | Loads are being powered from the battery  |
| Stop mode | The inverter stops operating if it is turned off using the on/off button or if an error occurs while grid power is unavailable. |  |

**Display Information**

Pressing the “UP” or “DOWN” key will cycle through the information displayed on the LCD. The display sequence is as follows: battery voltage, battery current, inverter voltage, inverter current, grid voltage, grid current, load in watts, load in VA, grid frequency, inverter frequency, PV voltage, PV charging current, PV charging output voltage, and PV charging power.

| Selectable information | LCD display |
|---|---|
| Battery voltage / DC discharging current |   |
| Inverter output voltage / Inverter output current |   |
| Grid voltage / Grid active power |   |
| Load in W / VA |   |
| Grid frequency / Output frequency |   |
| PV1 voltage / current |   |
| PV2 voltage / current |   |
| PV charger output voltage / PV charging power |   |

**SPECIFICATIONS**

**Table 1. Line Mode Specifications**

| Inverter Model | 8-12kW |
|---|---|
| Input Voltage Waveform | Sinusoidal (utility or generator) |
| Nominal Input Voltage | 230Vac |
| Low AC Voltage Disconnect | 90Vac±7V (APL,GEN);<br>170Vac±7V (UPS);<br>186Vac±7V (VDE) |
| Low AC Voltage Reconnect | 100Vac±7V (APL,GEN);<br>180Vac±7V (UPS);<br>196Vac±7V (VDE) |
| High AC Voltage Disconnect | 280Vac±7V (UPS,APL,GEN);<br>253Vac±7V (VDE) |
| High AC Voltage Reconnect | 270Vac±7V (UPS,APL,GEN);<br>250Vac±7V(VDE) |
| Max AC Input Voltage | 300Vac |
| Nominal Input Frequency | 50Hz / 60Hz (Auto detection) |
| Low AC Frequency Disconnect | 40Hz± 1Hz (UPS,APL,GEN);<br>47.5Hz±0.5Hz(VDE) |
| Low AC Frequency Reconnect | 42Hz± 1Hz (UPS,APL,GEN);<br>48.5Hz±0.5Hz(VDE) |
| High AC Frequency Disconnect | 65Hz±1Hz (UPS,APL,GEN); |

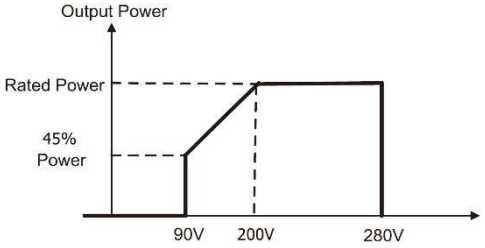
| | |
|---|---|
| | 51.5Hz±0.5Hz (VDE) |
| High AC Frequency Reconnect | 63Hz±1Hz (APL,GEN, UPS);<br>50.5Hz±0.5Hz(VDE) |
| Output Short Circuit Protection | Line mode: Circuit Breaker Battery mode: Electronic Circuits |
| Efficiency (Line Mode) | > 95% (Rated R load, battery fully charged) |
| Transfer Time | 10ms typical (UPS,VDE)<br>20ms typical (APL)<br>50ms typical (For parallel operation) |
| Output Power Derating |  |

**Table 2. Inverter Mode Specifications**

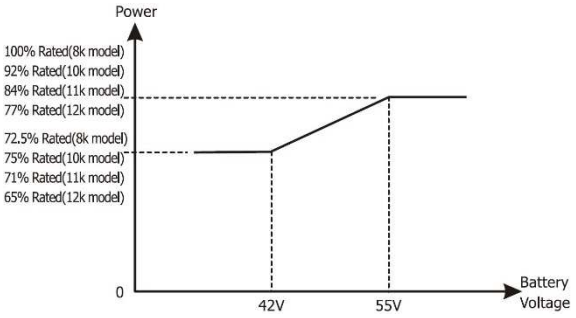
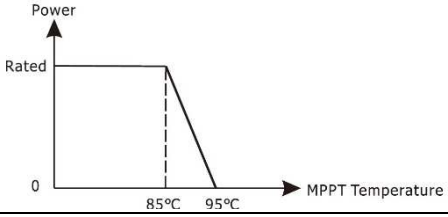
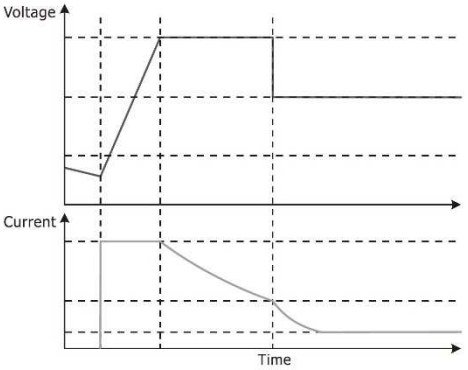
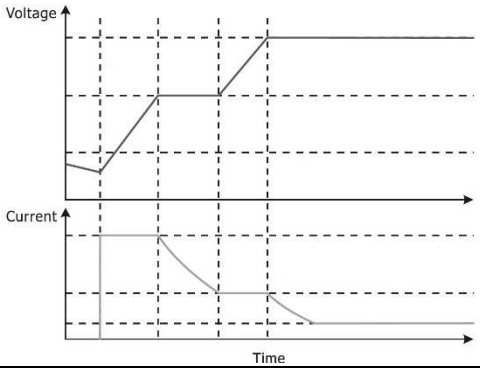
| Inverter model | 8kW | 10kW | 11kW | 12kW |
|---|---|---|---|---|
| Rated Output Power | 8,000W | 10,000W | 11,000W | 12,000W |
| Output Voltage Waveform | Pure Sine Wave | | | |
| Output Voltage Regulation | 230Vac±5% | | | |
| Output Frequency | 60Hz or 50Hz | | | |
| Peak Efficiency | 92% | | | |
| Overload Protection | 5s if load is >110%; 10s if load is 105%~110% | | | |
| Output Power Derating |  | | | |
| Nominal DC Input Voltage | 48Vdc | | | |
| Cold Start Voltage | 46.0Vdc | | | |
| Low DC Warning Voltage<br>• load is < 50%<br>• load is > 50% | <br>46.0Vdc<br>44.0Vdc | | | |
| Low DC Warning Recovery Voltage<br>• load is < 50%<br>• load is > 50% | <br>47.0Vdc<br>46.0Vdc | | | |
| Low DC Cut-off Voltage<br>• load is < 50%<br>• load is > 50% | <br>43.0Vdc<br>42.0Vdc | | | |
| High DC Recovery Voltage | 58Vdc | | | |
| High DC Cut-off Voltage | 60Vdc | | | |

**Table 3 Charge Mode Specifications**

| **Utility Charging Mode** | | | | | |
|---|---|---|---|---|---|
| **Inverter model** | | **8kW** | **10-12kW** | | |
| Nominal Voltage Range for Charging | | 170-260Vac | | | |
| Charging Current @ Nominal Input Voltage | | 120A max | 150A max | | |
| Floating charging voltage | AGM / Gel / LEAD Battery | 54.8Vdc | | | |
| | Flooded battery | 54.8Vdc | | | |
| Bulk charging voltage (C.V. voltage) | AGM / Gel/LEAD Battery | 57.6Vdc | | | |
| | Flooded battery | 56.8Vdc | | | |
| Charging Algorithm | | 3-Stage (Flooded Battery, AGM / Gel / Lead-acid Battery), 4-Stage (LI) | | | |
| **Solar Charging Mode** | | | | | |
| **Inverter model** | | **8kW** | **10kW** | **11kW** | **12kW** |
| Maximum PV Input Power | | 4,000W x 2 | 5,000W x 2 | 5,500W x 2 | 6,000W x 2 |
| Maximum PV Input Current | | 18A x 2 | 27A x 2 (Max 40A) | | |
| Power Derating | |  | | | |
| **MPPT Charger** | | | | | |
| Solar Charging Current | | 120A max | 150A max | | |
| Max. PV Array Open Circuit Voltage | | 500Vdc max (single model) / 450Vdc max (parallel model) | | | |
| PV Array MPPT Voltage Range | | 90~450Vdc (single model) / 90~430Vdc (parallel model) | | | |
| Min battery voltage for PV charging | | 34Vdc | | | |
| Battery Voltage Accuracy | | +/- 0.3% | | | |
| PV Voltage Accuracy | | +/- 2V | | | |
| Charging Algorithm | | 3-Sage (Flooded Battery, AGM / Gel / Lead-acid Battery), 4-Stage (LI) | | | |

| | |
|---|---|
| Charging algorithm for lead acid battery |  |
| Charging algorithm for Lithium battery |  |

| **Joint Utility and Solar Charging** | | | | |
|---|---|---|---|---|
| **Inverter model** | **8kW** | **10kW** | **11kW** | **12kW** |
| Max Charging Current | 120A | 150A | | |
| Default Charging Current | 80A | | | |

**Table 4 General Specifications**

| **Inverter model** | **8kW** | **10kW** | **11kW** | **12kW** |
|---|---|---|---|---|
| Compliance | CE | | | |
| Operating Temperature Range | -10°C to 50°C (>30°C derating, 1%/°C) | | | |
| Storage Temperature | -15°C ~ 60°C | | | |
| Dimensions (D*W*H) | 425*527*145 mm | | | |
| Net Weight | 18 kg | | 18.1 kg | |

**TROUBLESHOOTING**

| Problem | LCD/LED/Buzzer | Explanation / Possible cause | Actions |
|---|---|---|---|
| Unit shuts down automatically during startup. | LCD/LEDs and buzzer will be active for 3 seconds and then the inverter will turn off. | The battery voltage is too low (less than 45.8V) | Check the voltage across the battery terminals. If the voltage is too low, recharge the battery. |
| No response after power on. | No indication. | 1. The battery voltage is too low (less than 33.6V)<br>2. The battery is connected with reverse polarity | 1. Check whether the battery wiring is securely connected.<br>2. Recharge battery.<br>3. Replace battery if necessary. |
| Mains power is available, but the unit operates in battery mode. | Input voltage is displayed as 0 on the LCD and the green LED is flashing. | No AC input connected, or the AC input breaker has tripped. | Check whether the AC breaker has tripped and ensure that the AC wiring is connected properly. |
| | Green LED is flashing. | Poor AC input power quality. | 1. Check whether the AC cables are too thin or too long.<br>2. Check whether the generator (if used) is operating correctly or whether the input voltage range setting is correct (Appliance mode = Wide). |
| When the unit is turned on, the internal relay switches on and off repeatedly. | LCD display and LEDs are flashing | Battery is disconnected. | Check whether the battery cables are connected properly. |
| Buzzer beeps continuously and the red LED is on. | Fault code 07 | Overload fault. The inverter is overloaded (> 110% for too long). | Reduce the connected load by switching off some equipment. |
| | Fault code 05 | Output short circuit. | Check whether the AC output wiring is connected properly and disconnect any abnormal loads. |
| | Fault code 02 | Internal inverter temperature exceeds 90°C. | Check whether the airflow of the unit is blocked or whether the ambient temperature is too high. |
| | Fault code 03 | Battery overcharged. | Contact the supplier. |
| | | Battery voltage is too high. | Check whether the battery specification and number of batteries meet the requirements. |
| | Fault code 01 | Fan fault. | Replace the fan. |
| | Fault code 06/58 | Output voltage abnormal (Inverter output voltage is below 202 Vac or above 253 Vac). | 1. Reduce the connected load.<br>2. Contact the supplier |
| | Fault code 08/09/53/57 | Internal component failure. | Contact the supplier. |
| | Fault code 51 | Over current or surge fault. | Restart the unit. If the error happens again, please contact the supplier. |
| | Fault code 52 | Bus voltage is too low. | |
| | Fault code 55 | Output voltage is unbalanced. | |
| | Fault code 56 | Battery connection fault. | Check whether the battery is connected properly. If the problem persists, contact the supplier. |

**Photonic Universe Ltd**

**E-mail: info@photonicuniverse.com**

**Web: www.photonicuniverse.com**
**Tel.: +44 (0) 203 150 11 11**

**Fax: +44 (0) 203 150 12 12**