# User Manual

# ICY-2K-12

## INVERTER / CHARGER

**Version: 1.0**

# Table Of Contents

# ABOUT THIS MANUAL

## Purpose

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

## Scope

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

# SAFETY INSTRUCTIONS

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

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

# INTRODUCTION

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

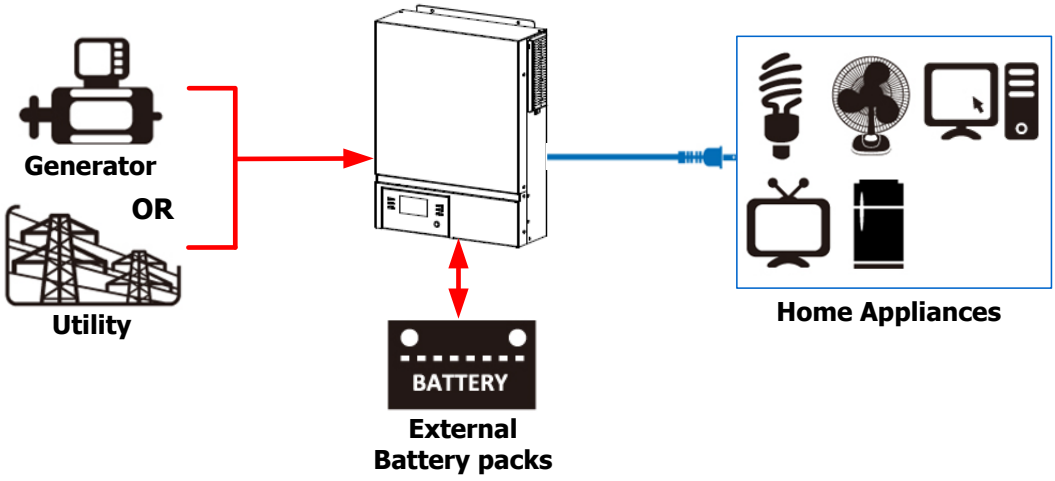
## Features

- Pure sine wave inverter
- Configurable input voltage ranges for home appliances and personal computers via LCD control panel
- Configurable battery charging current based on applications via LCD control panel
- Compatible to utility mains or generator power
- Auto restart while AC is recovering
- Overload / Over temperature / short circuit protection
- Smart battery charger design for optimized battery performance
- Cold start function
- Removable LCD control module
- Multiple communication ports for BMS (RS485, CAN-BUS, RS232)
- Built-in Bluetooth for mobile monitoring (Requires App), OTG USB function, dusk filters
- Configurable AC Output usage timer and prioritization

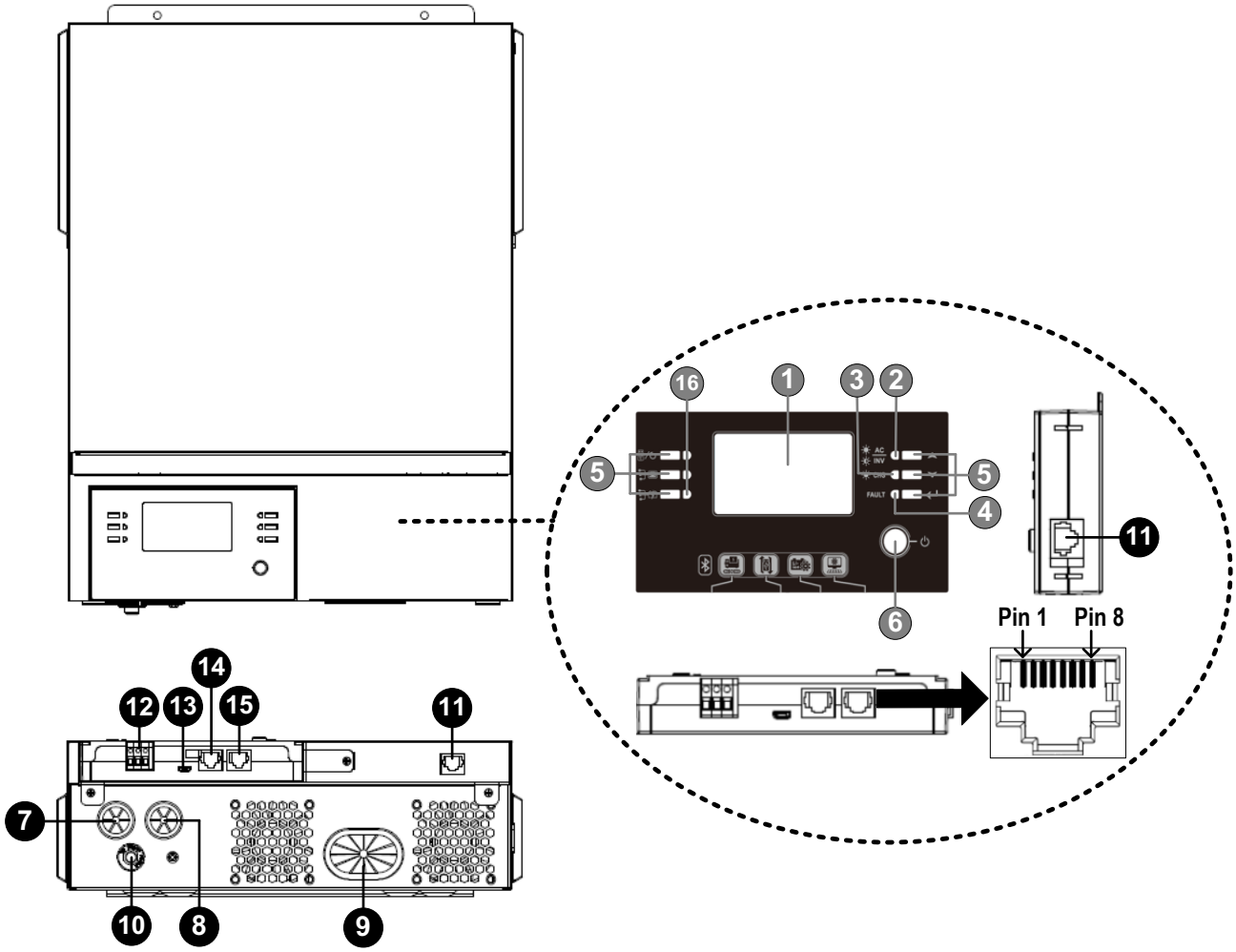
## Basic System Architecture

The following illustration shows basic application for this unit. It also required the following devices to have a complete running system.
Consult with your system integrator for other possible system architectures depending on your requirements.

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



## Product Overview




1. LCD display
2. Status indicator
3. Charging indicator
4. Fault indicator
5. Function buttons
6. Power on/off switch
7. AC input
8. AC output
9. Battery input
10. Circuit breaker
11. Remote LCD panel communication port
12. Dry contact
13. USB communication port
14. BMS communication port: CAN and RS232 or RS485
15. RS-232 communication port
16. Output source indicators (refer to OPERATION/Operation and Display Panel section for details) and USB function setting reminder (refer to OPERATION/Function Setting for the details)

# INSTALLATION

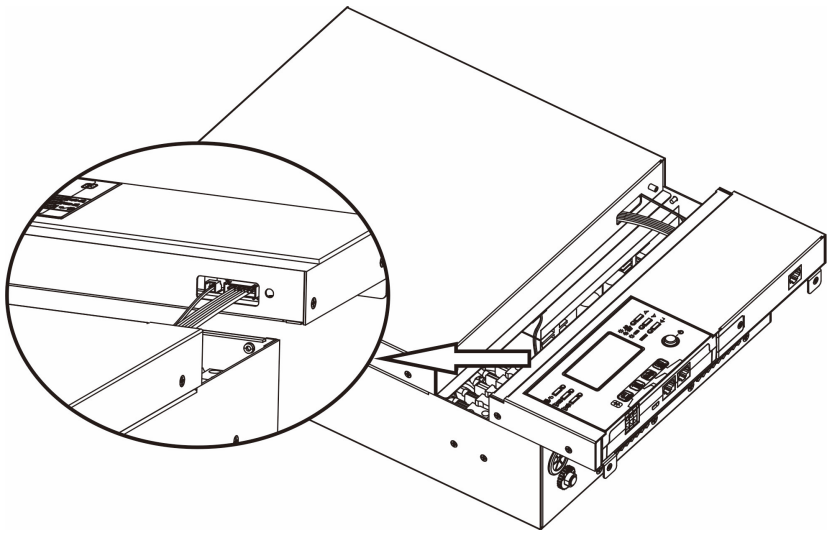
## Unpacking and Inspection

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

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

## Preparation

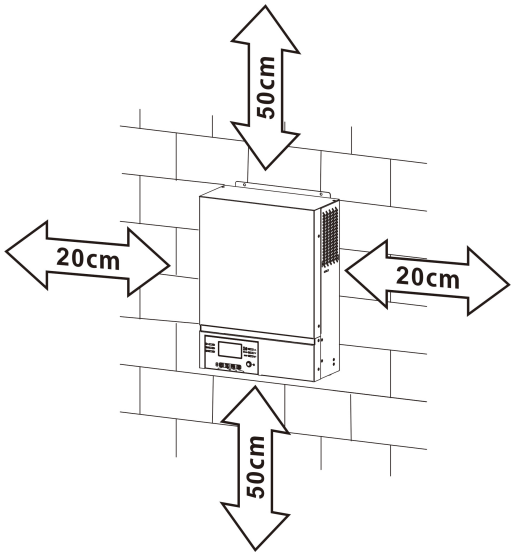
Before connecting all wirings, please take off the bottom cover by removing two screws as shown below. Detach the cables from the cover.



## Mounting the Unit

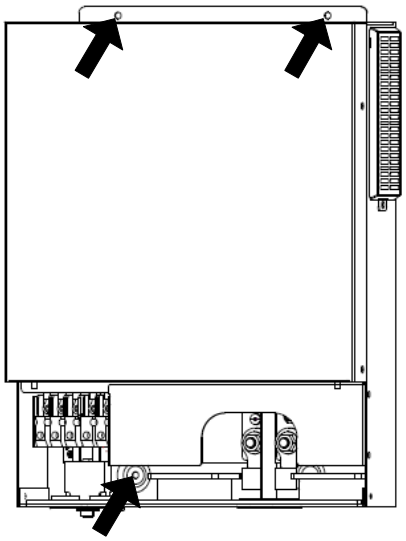
Consider the followings before selecting your placements:

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




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

Mounting the unit by screwing the three screws as shown below. It's recommended to use M4 or M5 screws.

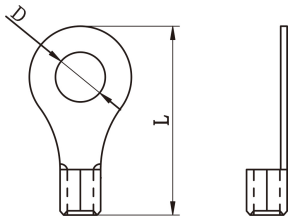


## Battery Connection

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

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

**Ring terminal:**

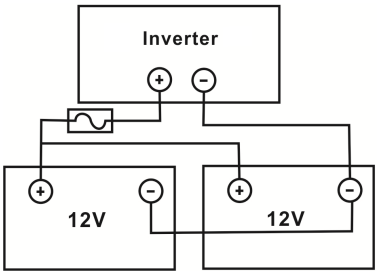



**Recommended battery cable size:**

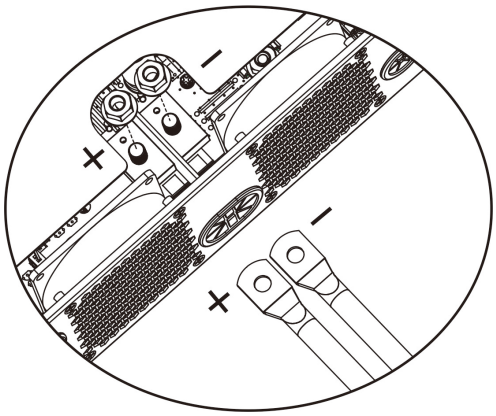
| Typical Amperage | Wire Size | Cable mm² | Ring Terminal Dimensions | | Torque Value |
|---|---|---|---|---|---|
| | | | D (mm) | L (mm) | |
| 185A | 1*2AWG | 38 | 8.4 | 33.2 | 5 Nm |

Please take the following steps to implement battery connection:

1. Assemble battery ring terminal based on recommended battery cable and terminal size.
2. Unit supports 12VDC system. Connect all battery packs as below chart. It is recommended to connect minimum of 100Ah capacity battery.




3. Apply ring terminals to your battery wires and secure it to the battery terminal block with the bolts properly tightened. Refer to battery cable size for torque value. Make sure polarity at both the battery and the inverter is correctly connected and ring terminals are secured to the battery terminals.



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

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

## AC Input/Output Connection

**CAUTION!!** Before connecting to AC input power source, please install a **separate** AC breaker between the inverter and the AC input power source. This will ensure that the inverter can be safely disconnected during maintenance and fully protected from over-current. The recommended spec of AC breaker is 16A for 1.5KW and 32A for 3KW and 50A for 5KW.

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

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

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

**Suggested cable requirement for AC wires**

| Gauge | Cable ($mm^2$) | Torque Value |
|---|---|---|
| 12 AWG | 4 | 1.2 Nm |

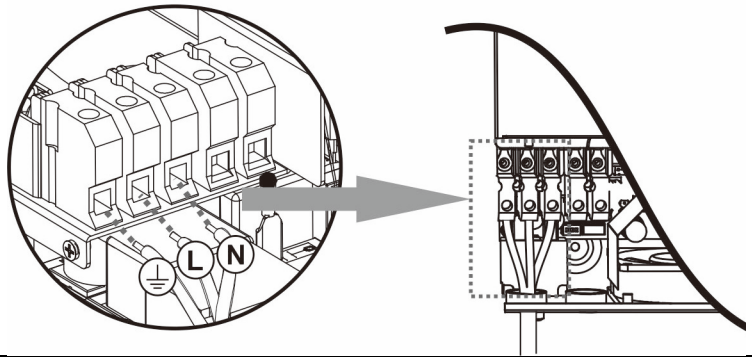
Please follow these steps to implement AC input/output connection:

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

   ⏚**→Ground (yellow-green)**

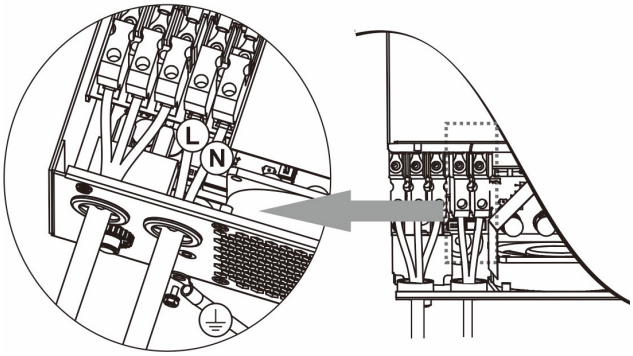
   **L→LINE (brown or black)**

   **N→Neutral (blue)**




| | |
|---|---|
| ⚠ | **WARNING:**<br>Be sure that the AC power source is disconnected before attempting wire connections. |

4. Insert AC output wires according to polarities indicated on terminal block and tighten terminal screws. Be sure to connect the grounding wire (⏚**)** first.
   ⏚**→Ground (yellow-green)**
   **L→LINE (brown or black)**
   **N→Neutral (blue)**

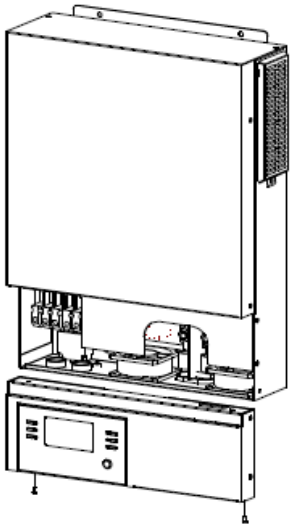



5. Make sure the wires are securely connected.

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

## Final Assembly

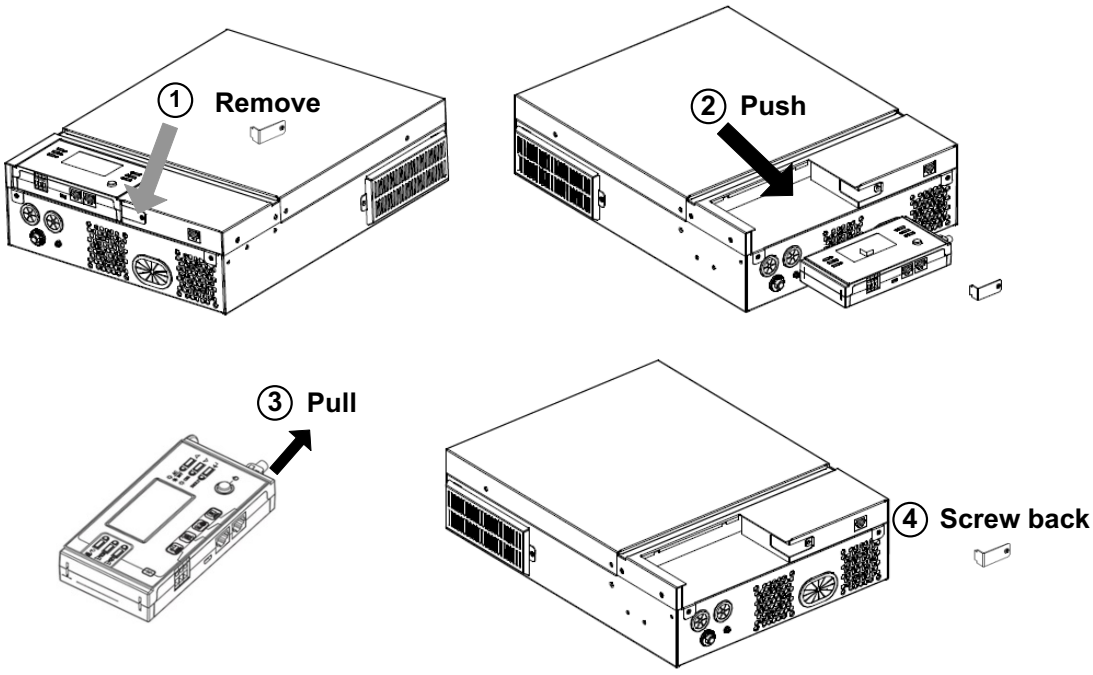
After connecting all wirings, replace the bottom cover as shown below.



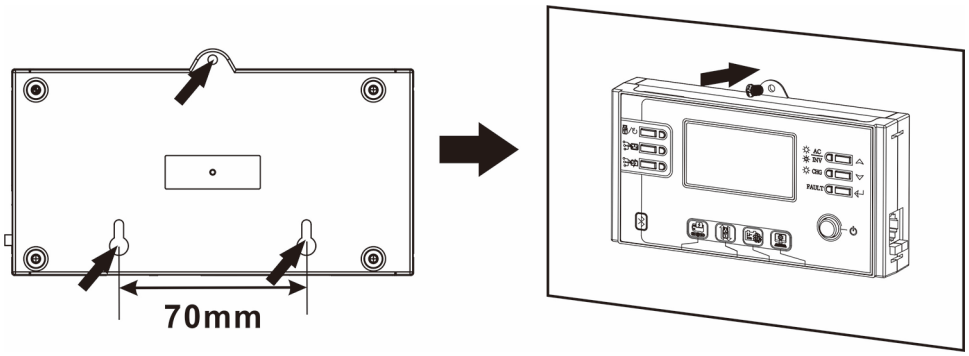
# Remote Display Panel Installation

The LCD module can be removable and installed in a remote location with an optional communication cable. Please take the follow steps to implement this remote panel installation.

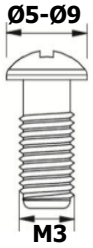
**Step 1.** Remove the screw on the bottom of LCD panel and pull down the module from the case. Detach the cable from the remote communication port. Be sure to replace the retention plate back to the inverter.



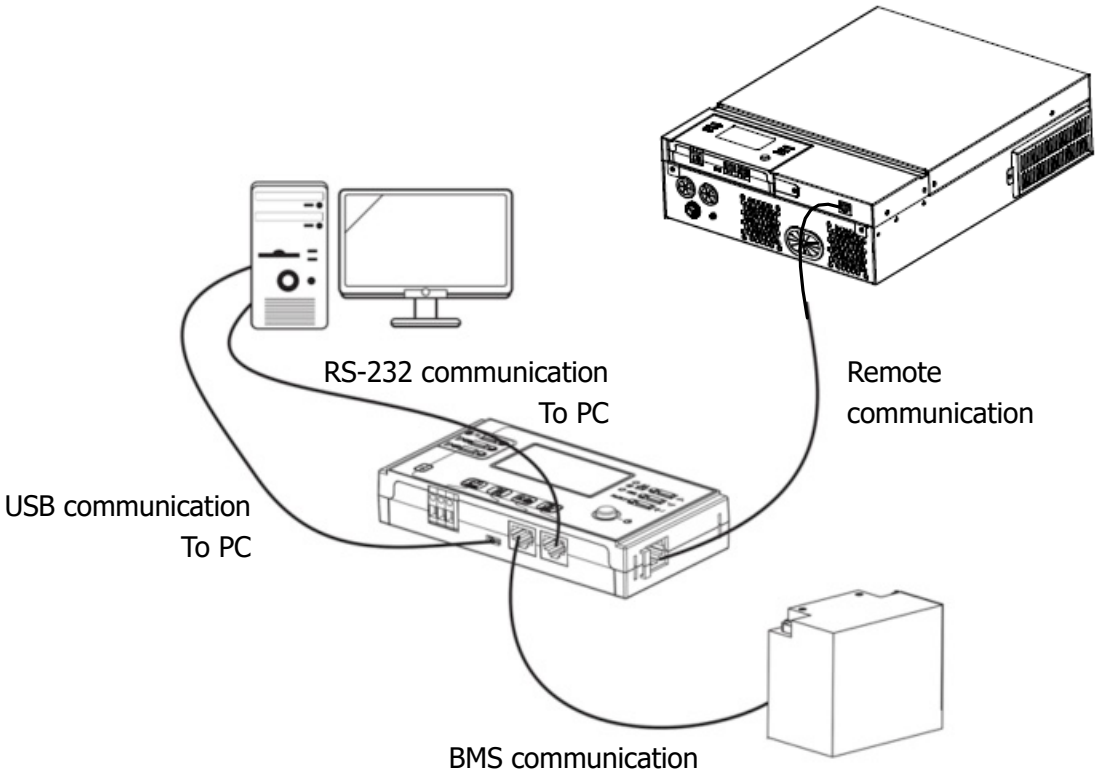

**Step 2.** Prepare your mounting holes in the marked locations as shown in the illustration below. The LCD module then can be securely mounted to your desired location.




**Note:** Wall installation should be implemented with the proper screws to the right.



**Step 3.** Connect LCD module to the inverter with an optional RJ45 communication cable as shown below.




# Communication Options

## Serial Connection

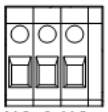
Please use the supplied serial cable to connect between the inverter and your PC. Install the monitoring software from the bundled CD and follow the on-screen instructions to complete your installation. For detailed software operation, refer to the software user manual on the bundled CD.

## Bluetooth Connection

This unit is equipped with a Bluetooth transmitter. Download "WatchPower" APP from Google Play or Google Store. Once the APP is download, you may connect "WatchPower" APP to your inverter with the password "123456". The communication distance is roughly 6 ~ 7 meters.

## Dry Contact Signal

There is one dry contact (3A/250VAC) available on the rear panel. It could be used to deliver signal to external device when battery voltage reaches warning level.

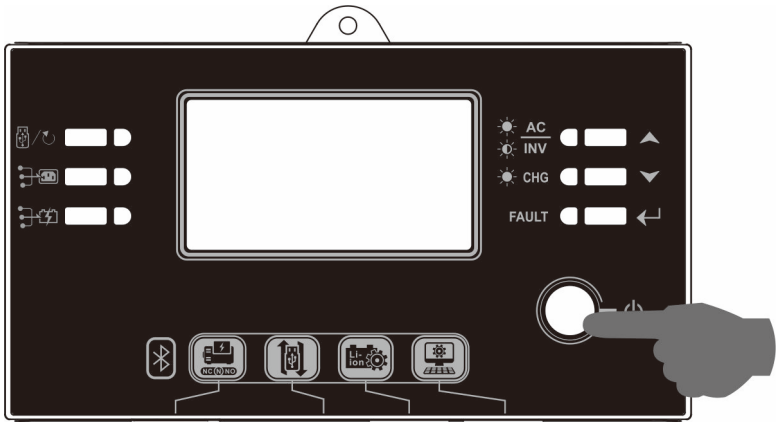
| Unit Status | Condition | | Dry contact port:   | |
|---|---|---|---|---|
| | | | NC & C | NO & C |
| Power Off | Unit is off and no output is powered. | | Close | Open |
| Power On | Output is powered from Battery power. | Battery voltage < Low DC warning voltage | Open | Close |
| | | Battery voltage > battery charging reaches floating stage | Close | Open |

## BMS Communication

It is recommended to purchase a special communication cable if you are connecting to Lithium-Ion battery banks. Please refer to Appendix I- BMS Communication Installation for details.

# OPERATION

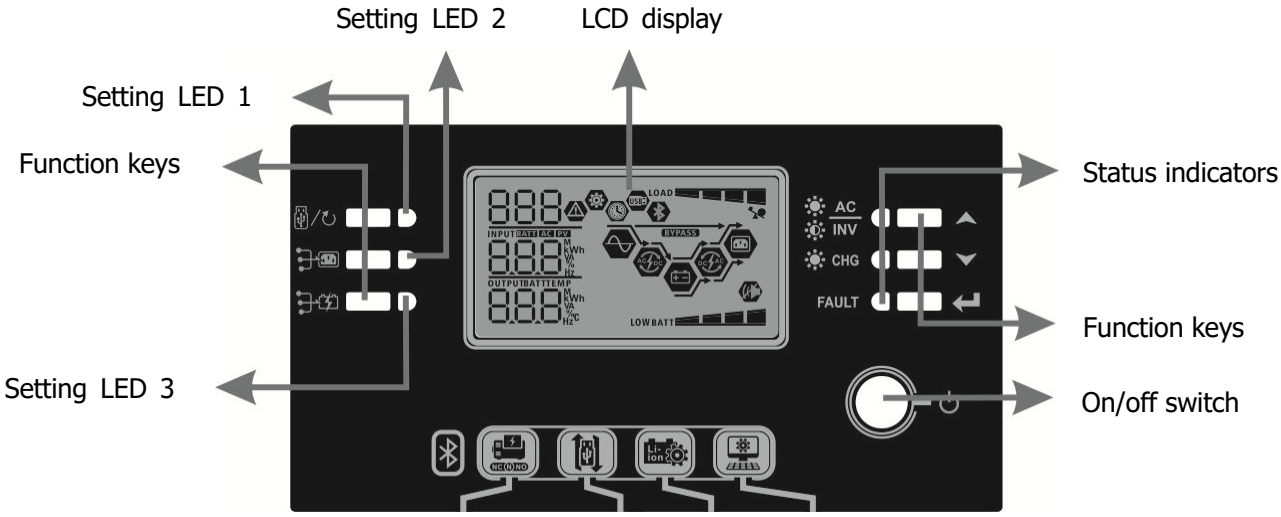
## Power ON/OFF




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

## Operation and Display Panel

The operation and the LCD module, shown in the chart below, includes six indicators, six function keys, on/off switch and a LCD display, indicating the operating status and input/output power information.



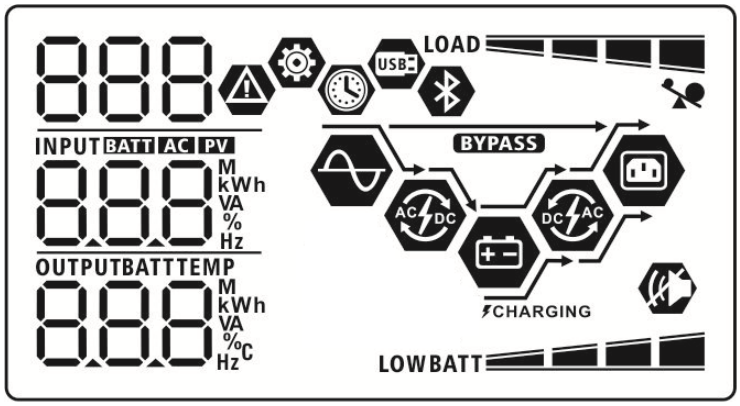

**Indicators**

| LED Indicator | | Color | Solid/Flashing | Messages |
|---|---|---|---|---|
| **Setting LED 1** | | Green | Solid On | Output powered by utility |
| **Setting LED 2** | | / | / | Reserved |
| **Setting LED 3** | | Green | Solid On | Output powered by battery |
| **Status indicators** | **AC / INV** | Green | Solid On | Output is available in line mode |
| | | | Flashing | Output is powered by battery in battery mode |
| | **CHG** | Green | Solid On | Battery is fully charged |
| | | | Flashing | Battery is charging. |
| | **FAULT** | Red | Solid On | Fault mode |
| | | | Flashing | Warning mode |

**Function Keys**

| Function Key | | Description |
|---|---|---|
| /↻ | ESC | Exit the setting |
| | USB function setting | Select USB OTG functions |
| ▲ | Up | To last selection |
| ▼ | Down | To next selection |
| ↵ | Enter | To confirm/enter the selection in setting mode |

# LCD Display Icons




| Icon | Function description |
|---|---|
| **Input Source Information** | |
| AC | Indicates the AC input. |
| INPUT BATT AC PV 888 M kWh VA % Hz | Indicate input voltage, input frequency, charger current, charger power, battery voltage. |
| **Configuration Program and Fault Information** | |
| 888 | Indicates the setting programs. |
| 888⚠ | Indicates the warning and fault codes.<br>Warning: 88⚠ flashing with warning code.<br>Fault: F88 lighting with fault code |
| **Output Information** | |
| OUTPUT BATT TEMP 888 M kWh VA % °C Hz | Indicate output voltage, output frequency, load percent, load in VA, load in Watt and discharging current. |
| **Battery Information** | |
| BATT | Indicates battery level by 0-24%, 25-49%, 50-74% and 75-100% in battery mode and charging status in line mode. |

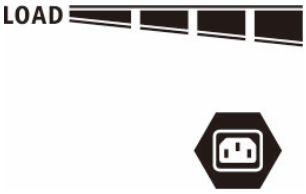
When battery is charging, it will present battery charging status.

| Status | Battery voltage | LCD Display |
|---|---|---|
| Constant Current mode / | <2V/cell | 4 bars will flash in turns. |
| | 2 ~ 2.083V/cell | Bottom bar will be on and the other three bars will flash in turns. |

| | | |
|---|---|---|
| Constant Voltage mode | 2.083 ~ 2.167V/cell | Bottom two bars will be on and the other two bars will flash in turns. |
| | > 2.167 V/cell | Bottom three bars will be on and the top bar will flash. |
| Floating mode. Batteries are fully charged. | | 4 bars will be on. |

In battery mode, it will present battery capacity.

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

| **Load Information** | | |
|---|---|---|
|  | Indicates overload. | |
|   | Indicates the load level by 0-24%, 25-49%, 50-74% and 75-100%. | |
| | 0%~24% | 25%~49% |
| |   |   |
| | 50%~74% | 75%~100% |
| |   |   |

| **Mode Operation Information** | |
|---|---|
|  | Indicates unit connects to the mains. |
|   | Indicates load is supplied by utility power. |
|   | Indicates the utility charger circuit is working. |
|   | Indicates the DC/AC inverter circuit is working. |
|  | Indicates unit alarm is disabled. |
|  | Indicates Bluetooth is ready to connect. |
|   | Indicates USB disk is connected. |
|  | Indicates timer setting or time display |

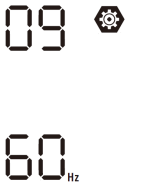
# LCD Setting

## General Setting

After pressing and holding "↵" button for 3 seconds, the unit will enter the Setup Mode. Press "▲" or "▼" button to select setting programs. Press "↵" button to confirm you selection or "⏻/↻" button to exit.

**Setting Programs:**

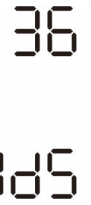
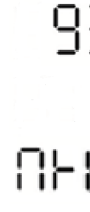
| Program | Description | Selectable option | |
|---|---|---|---|
| 00 | Exit setting mode | Escape   | |
| 01 | Output source priority: To configure load power source priority | Utility first (default): OPU   | Utility will provide power to the loads as first priority. Battery energy will provide power to the loads only when utility power is not available. |
| | | Battery first: OPB   | Battery energy provides power to the loads as first priority. Utility provides power to the loads only when battery voltage drops to either low-level warning voltage or the setting point in program 12. |
| 03 | AC input voltage range | Appliances (default)   | If selected, acceptable AC input voltage range will be within 90-280VAC. |
| | | UPS   | If selected, acceptable AC input voltage range will be within 170-280VAC. |
| 05 | Battery type | AGM (default)   | Flooded   |

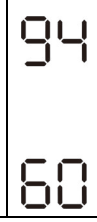
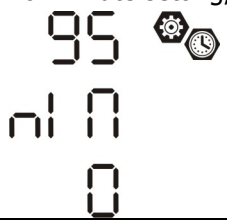
| | | | |
|---|---|---|---|
| | | User-Defined<br>  <br> | If "User-Defined" is selected, battery charge voltage and low DC cut-off voltage can be set up in program 26, 27 and 29. |
| | | Pylontech battery | If selected, programs of 02, 26, 27 and 29 will be automatically set up. No need for further setting. |
| | | LIb-protocol compatible battery<br>  <br> | Select " LIb" if using Lithium battery compatible to Lib protocol. If selected, programs of 02, 26, 27 and 29 will be automatically set up. No need for further setting. |
| | | 3rd party Lithium battery<br>  <br> | If selected, programs of 02, 26, 27 and 29 will be automatically set up. No need for further setting. Please contact the battery supplier for installation procedure. |
| 06 | Auto restart when overload occurs | Restart disable (default)<br>  <br> | Restart enable<br>  <br> |
| 07 | Auto restart when over temperature occurs | Restart disable (default)<br>  <br> | Restart enable<br>  <br> |
| 09 | Output frequency | 50Hz (default)<br>  <br> | 60Hz<br>  <br> |
| 10 | Output voltage | 220V<br>  <br> | 230V (default)<br>  <br> |

| | | | |
|---|---|---|---|
| | | 240V<br>  | |
| 11 | Maximum utility charging current | 40A (default)<br>  | Setting range is 2A, then from 10A to 100A. Increment of each click is 10A. |
| 12 | Setting voltage point back to utility source when selecting "OPB" (Battery priority) in program 01. | 11.5V (default)<br>  | Setting values is from 10.5V to 12.0V. Increment of each click is 0.1V. |
| | | 10% (default)<br>  | If any type of lithium battery is selected in program 5, this setting will change to SOC automatically. Adjustable range is from 5% to 100% |
| 13 | Setting voltage point back to battery mode when selecting "OPU" (Utility priority) in program 01. | Battery fully charged<br>  | Setting values are FUL, 12.0V, 12.3V, 12.5V, 12.8V, 13.0V, 13.3V, 13.5V, 13.8V, 14.0V, 14.3V and 14.5V. |
| | | 13.5V (default)<br>  | |
| | | 80% (default)<br>  | If any lithium battery is selected in program 5, this parameter will refer to the SOC of battery and adjustable from 10% to 100%. Increment of each click is 5%. |

| | | | |
|---|---|---|---|
| 18 | Alarm control | Alarm on (default)<br>  | Alarm off<br>  |
| 19 | Auto return to default display screen | Return to default display screen (default)<br>  | If selected, no matter how users switch display screen, it will automatically return to default display screen (Input voltage /output voltage) after no button is pressed for 1 minute. |
| | | Stay at latest screen<br>  | If selected, the display screen will stay at latest screen user finally switches. |
| 20 | Backlight control | Backlight on (default)<br>  | Backlight off<br>  |
| 22 | Beeps while primary source is interrupted | Alarm on (default)<br>  | Alarm off<br>  |
| 23 | Overload bypass:<br>When enabled, the unit will transfer to line mode if overload occurs in battery mode. | Bypass disable (default)<br>  | Bypass enable<br>  |

| | | | |
|---|---|---|---|
| 25 | Record Fault code | Record enable (default)<br>  | Record disable<br>  |
| 26 | Bulk charging voltage (C.V voltage) | default setting: 14.1V<br>  | If self-defined is selected in program 5, this program can be set up. Setting range is from 12.0V to 15.0V. Increment of each click is 0.1V. |
| 27 | Floating charging voltage | default setting: 13.5V<br>  | If self-defined is selected in program 5, this program can be set up. Setting range is from 12.0V to 15.0V. Increment of each click is 0.1V. |
| 29 | Low DC cut-off voltage:<br>● If battery power is only power source available, inverter will shut down.<br>● If battery power and utility are available, inverter will transfer to line mode and provide output power to loads. | default setting: 10.5V<br>  | If self-defined is selected in program 5, this program can be set up. Setting range is from 10.5V to 12.0V. Increment of each click is 0.1V. Low DC cut-off voltage will be fixed to setting value no matter what percentage of load is connected. |
| | | SOC 10% (default)<br>  | If any type of lithium battery is selected in program 5, this program can be set up. Setting range is from 5% to 90% |
| 30 | Battery equalization | If "Flooded" or "User-Defined" is selected in program 05, this program can be set up. | |
| | | Battery equalization<br>  | Battery equalization disable (default)<br>  |

| | | | |
|---|---|---|---|
| 31 | Battery equalization voltage | default setting: 14.6V<br>  | Setting range is from 12.0V to 15.0V. Increment of each click is 0.1V. |
| 33 | Battery equalized time | 60min (default)<br>  | Setting range is from 5min to 900min. Increment of each click is 5min. |
| 34 | Battery equalized timeout | 120min (default)<br>  | Setting range is from 5min to 900 min. Increment of each click is 5 min. |
| 35 | Equalization interval | 30days (default)<br>  | Setting range is from 0 to 90 days. Increment of each click is 1 day |
| 36 | Equalization activated immediately | Enable<br>  | Disable (default)<br>  |
| | | If equalization function is enabled in program 30, this program can be set up. If "Enable" is selected in this program, it's to activate battery equalization immediately and LCD main page will shows "E9". If "Disable" is selected, it will cancel equalization function until next activated equalization time arrives based on program 35 setting. At this time, "E9" will not be shown in LCD main page. | |
| 93 | Erase all data log | Not reset(Default)<br>  | Reset<br>  |

<table>
<tr><td rowspan="3">94</td><td rowspan="3">Data log recorded interval<br>*The maximum data log number is 1440. If it's over 1440, it will re-write the first log.</td><td>3 minutes<br>  </td><td>5 minutes<br>  </td></tr>
<tr><td>10 minutes (default)<br>  </td><td>20 minutes<br>  </td></tr>
<tr><td>30 minutes<br>  </td><td>60 minutes<br>  </td></tr>
<tr><td>95</td><td>Time setting – Minute</td><td colspan="2">For minute setting, the range is from 0 to 59.<br>  </td></tr>
<tr><td>96</td><td>Time setting – Hour</td><td colspan="2">For hour setting, the range is from 0 to 23.<br>  </td></tr>
<tr><td>97</td><td>Time setting– Day</td><td colspan="2">For day setting, the range is from 1 to 31.<br>  </td></tr>
<tr><td>98</td><td>Time setting– Month</td><td colspan="2">For month setting, the range is from 1 to 12.<br>  </td></tr>
<tr><td>99</td><td>Time setting – Year</td><td colspan="2">For year setting, the range is from 17 to 99.<br>  </td></tr>
</table>

## USB Functional Setting

There are three function keys on the display panel to implement USB OTG setting.

Insert an OTG USB disk into the USB port ( ). Press and hold "/↻" button for 3 seconds to enter USB Setting Mode. These functions including inverter firmware upgrade, data log export and internal parameters re-write from the USB disk.

| **Procedure** | LCD Screen |
|---|---|
| **Step 1:** Press and hold "/↻" button for 3 seconds to enter USB function setting mode. |  |
| **Step 2:** Press "/↻", "" or "" button to enter the selectable setting programs (detail descriptions in Step 3). | |

**Step 3:** Please select setting program by following the procedure.

| **Program#** | **Operation Procedure** | **LCD Screen** |
|---|---|---|
| /↻: Upgrade firmware | This function is to upgrade inverter firmware. If firmware upgrade is needed, please check with your dealer or installer for detail instructions. | |
| : Re-write internal parameters | This function is to over-write all parameter settings (TEXT file) with settings in the On-The-Go USB disk from a previous setup or to duplicate inverter settings. Please check with your dealer or installer for detail instructions. | |
| : Export data log | Press "" button to export data log from the inverter to USB disk. If the selected function is ready, LCD will display "rdy". Press "/↻" button to confirm the selection again. |  |
| | ● Press "" button to select "Yes", LED 1 will flash once every second during the process. It will only display and all LEDs will be on after this action is complete. Then, press "/↻" button to return to main screen.<br>● Or press "" button to select "No" to return to main screen. |  |

If no button is pressed for 1 minute, it will automatically return to main screen.

**Error message for USB On-The-Go functions:**

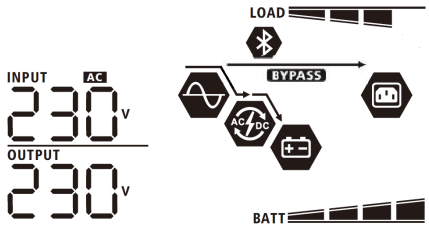
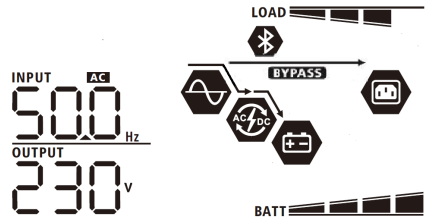
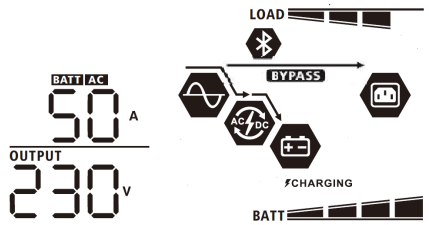
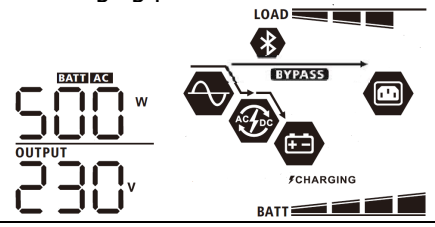
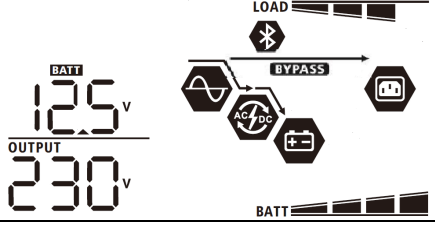
| **Error Code** | **Messages** |
|---|---|
|  | No USB disk is detected. |
|  | USB disk is protected from copying. |

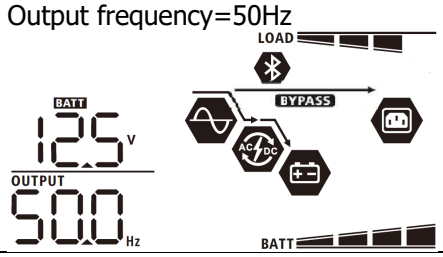
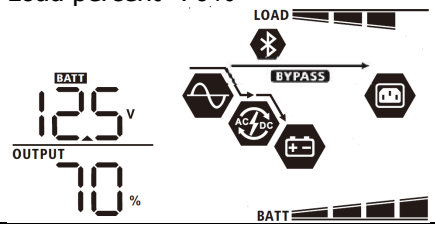
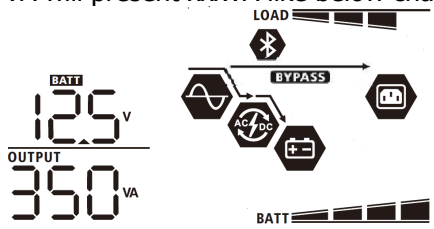
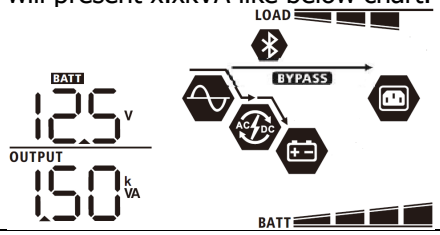
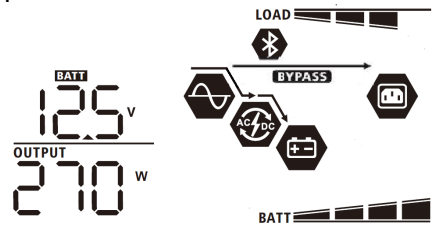
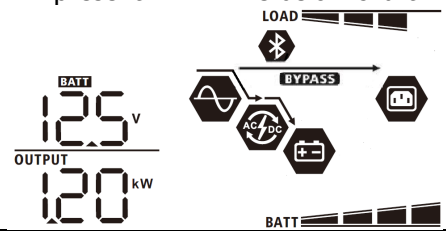
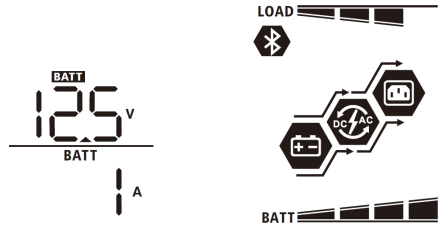
| | |
|---|---|
| U03 | Document inside the USB disk contains the wrong format. |

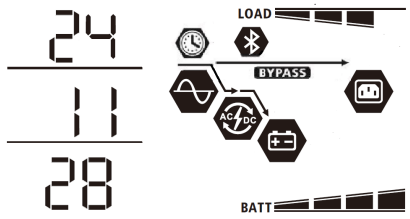
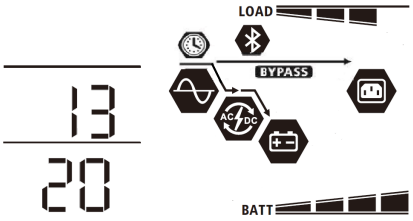
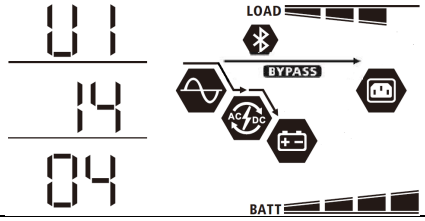
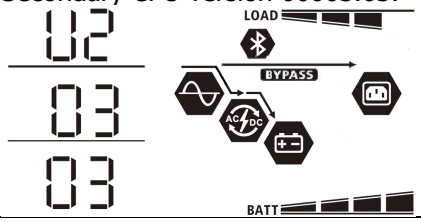
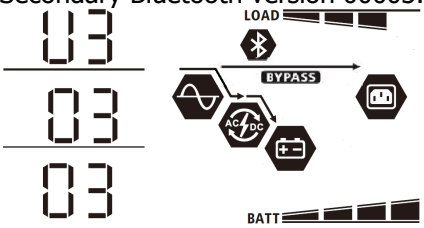
If any error occurs, error code will only show for 3 seconds. After 3 seconds, it will automatically return to the main screen.

## Display Setting

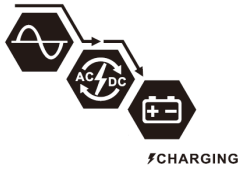
The LCD display information will be switched in turns by pressing "▲" or "▼" key. The selectable information is switched as the following table in order.

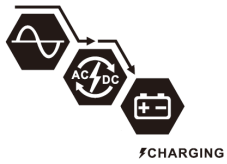
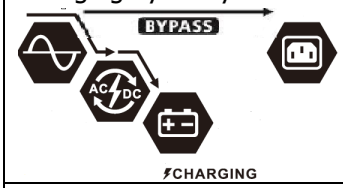
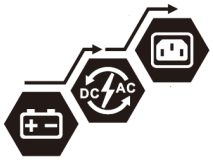
| Selectable information | LCD display |
|---|---|
| Input voltage/Output voltage<br>(Default Display Screen) | Input Voltage=230V, output voltage=230V<br>  |
| Input frequency | Input frequency=50Hz<br>  |
| Charging current | AC charging current=50A<br>  |
| Charging power | AC charging power=500W<br>  |
| Battery voltage and output voltage | Battery voltage=12.5V, output voltage=230V<br>  |

| | |
|---|---|
| Output frequency | Output frequency=50Hz<br>  |
| Load percentage | Load percent=70%<br>  |
| Load in VA | When connected load is lower than 1kVA, load in VA will present xxxVA like below chart.<br>  <br>When load is larger than 1kVA (≧1KVA), load in VA will present x.xkVA like below chart.<br>  |
| Load in Watt | When load is lower than 1kW, load in W will present xxxW like below chart.<br>  <br>When load is larger than 1kW (≧1KW), load in W will present x.xkW like below chart.<br>  |
| Battery voltage/DC discharging current | Battery voltage=25.5V, discharging current=1A<br>  |

| | |
|---|---|
| Real date. | Real date Nov 28, 2024.<br>  |
| Real time. | Real time 13:20.<br>  |
| Main CPU version checking. | Main CPU version 00014.04.<br>  |
| Secondary CPU version checking. | Secondary CPU version 00003.03.<br>  |
| Secondary Bluetooth version checking. | Secondary Bluetooth version 00003.03.<br>  |

## Operating Mode Description

| Operation mode | Description | LCD display |
|---|---|---|
| Standby mode<br>**Note:**<br>*Standby mode: The inverter is not turned on yet but at this time, the inverter can charge battery without AC output. | No output is supplied by the unit but it still can charge batteries. | Charging by utility.<br>  |
| | | No charging.<br>  |
| Fault mode | Utility can charge batteries. | Charging by utility. |

<table>
<tr><td rowspan="2">Note:<br>*Fault mode: Errors are caused by inside circuit error or external reasons such as over temperature, output short circuited and so on.</td><td rowspan="2"></td><td> 
</td></tr>
<tr><td>No charging.<br>  </td></tr>
<tr><td rowspan="2">Line Mode</td><td rowspan="2">The unit will provide output power from the mains. It will also charge the battery at line mode.</td><td>Charging by utility.<br> 
</td></tr>
<tr><td>Power from utility.<br> 
</td></tr>
<tr><td>Battery Mode</td><td>The unit will provide output power from battery.</td><td>Power from battery.<br> 
</td></tr>
</table>

## Battery Equalization Description

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

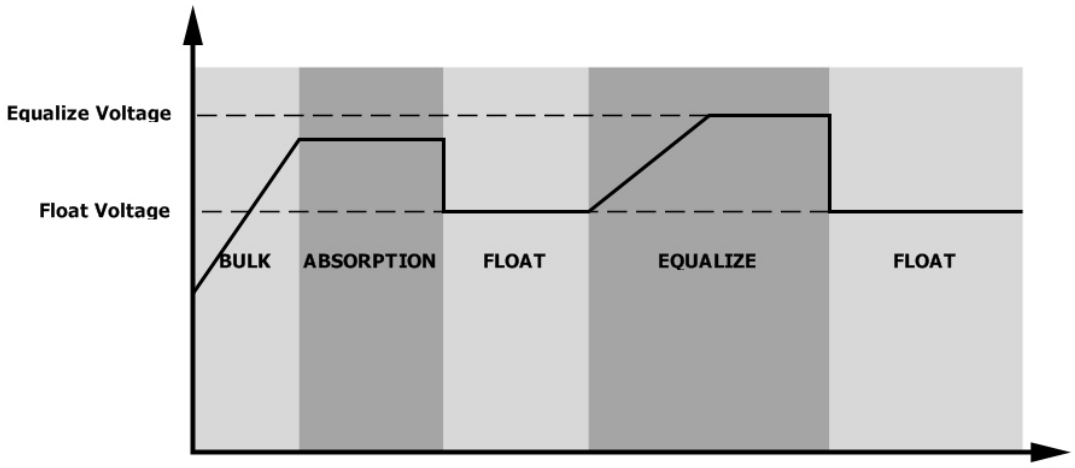
- **How to Activate Equalization Function**

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

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

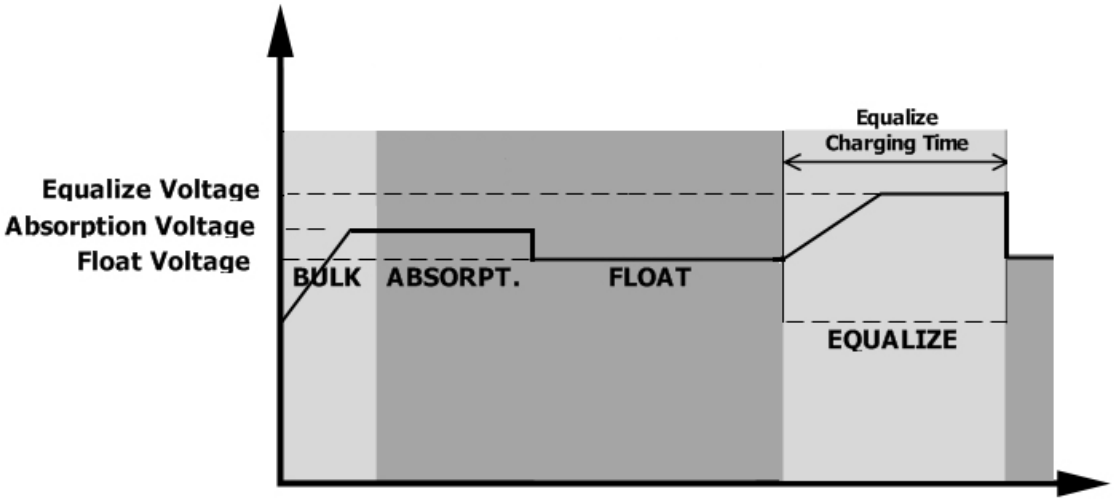
- **When to Equalize**

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

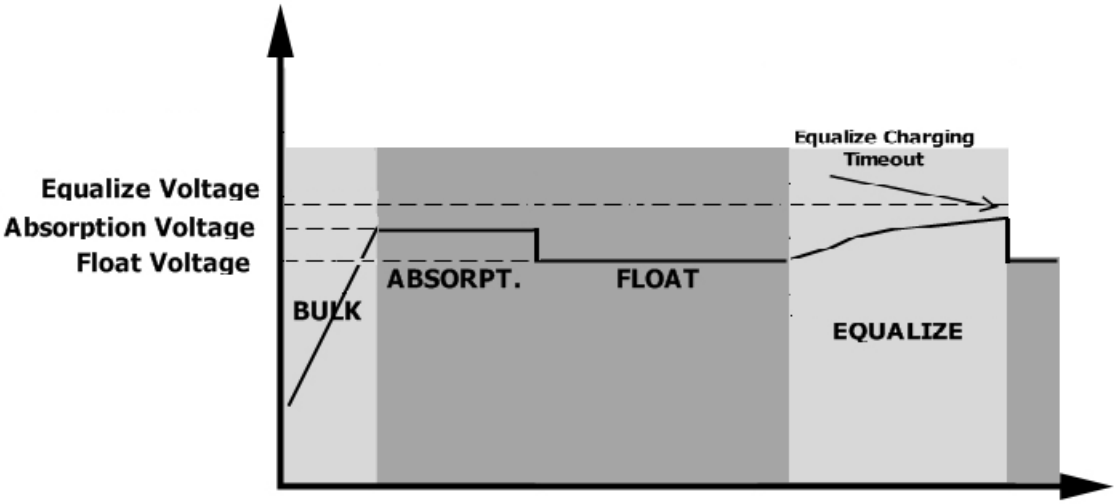



- **Equalize Charging and Timeout**

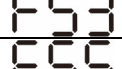
In Equalize Mode, the controller will supply power to charge battery as much as possible until battery voltage reach the equalization voltage. Then, constant-voltage regulation is applied to maintain battery voltage at the equalization level. The battery will remain in the Equalize Mode until the equalization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



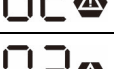
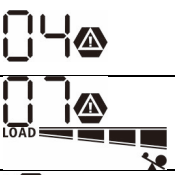

However, in Equalize Mode, if the battery equalization timer runs out and the battery voltage doesn't recover to the battery equalization voltage point, the charge controller will extend the battery equalized time until battery voltage achieves equalization voltage. If the battery voltage is still lower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



## Fault Reference Code

| Fault Code | Fault Event | Icon on |
|---|---|---|
| 01 | Fan is locked when inverter is off. |  |
| 02 | Over temperature |  |
| 03 | Battery voltage is too high |  |
| 04 | Battery voltage is too low |  |
| 05 | Output short circuited or over temperature is detected by internal converter components. |  |
| 06 | Output voltage is too high. |  |
| 07 | Overload time out |  |
| 08 | Bus voltage is too high |  |
| 09 | Bus soft start failed |  |
| 51 | Over current or surge |  |
| 52 | Bus voltage is too low |  |
| 53 | Inverter soft start failed |  |
| 55 | Over DC voltage in AC output |  |
| 57 | Current sensor failed |  |
| 58 | Output voltage is too low |  |

## Warning Indicator

| Warning Code | Warning Event | Audible Alarm | Icon flashing |
|---|---|---|---|
| 01 | Fan is locked when inverter is on. | Beep three times every second |  |
| 02 | Over temperature | None |  |
| 03 | Battery is over-charged | Beep once every second |  |
| 04 | Low battery | Beep once every second |  |
| 07 | Overload | Beep once every 0.5 second |  |
| 10 | Output power derating | Beep twice every 3 seconds |  |
| 16 | High AC input (>280VAC) during BUS soft start | None |  |
| 32 | Communication failure between inverter and remote display panel | None |  |
| E9 | Battery equalization | None |  |
| bP | Battery is not connected | None |  |

# SPECIFICATIONS

Table 1 Line Mode Specifications

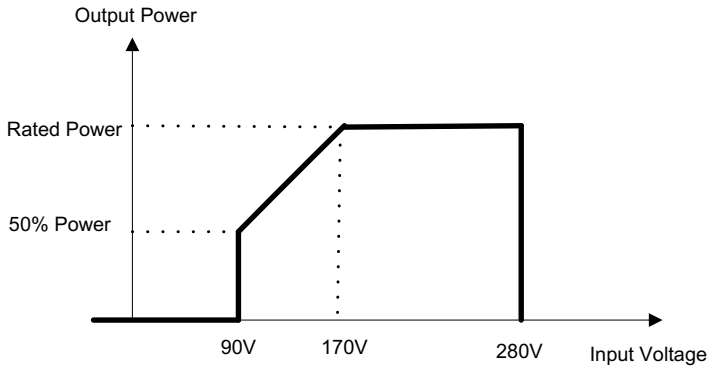
| MODEL | ICY-2K-12 |
|---|---|
| **Input Voltage Waveform** | Sinusoidal (utility or generator) |
| **Nominal Input Voltage** | 230Vac |
| **Low Loss Voltage** | 170Vac±7V (UPS);<br>90Vac±7V (Appliances) |
| **Low Loss Return Voltage** | 180Vac±7V (UPS);<br>100Vac±7V (Appliances) |
| **High Loss Voltage** | 280Vac±7V |
| **High Loss Return Voltage** | 270Vac±7V |
| **Max AC Input Voltage** | 300Vac |
| **Nominal Input Frequency** | 50Hz / 60Hz (Auto detection) |
| **Low Loss Frequency** | 40±1Hz |
| **Low Loss Return Frequency** | 42±1Hz |
| **High Loss Frequency** | 65±1Hz |
| **High Loss Return Frequency** | 63±1Hz |
| **Output Short Circuit Protection** | Circuit Breaker |
| **Efficiency (Line Mode)** | >95% ( Rated R load, battery full charged ) |
| **Transfer Time** | 10ms typical (UPS);<br>20ms typical (Appliances) |
| **Output power derating:**<br>When AC input voltage drops to 170V, the output power will be derated. |  |

Table 2 Inverter Mode Specifications

| INVERTER MODEL | ICY-2K-12 |
|---|---|
| **Rated Output Power** | 2KVA/2KW |
| **Output Voltage Waveform** | Pure Sine Wave |
| **Output Voltage Regulation** | 230Vac±5% |
| **Output Frequency** | 50Hz |
| **Peak Efficiency** | 93% |
| **Overload Protection** | 5s@≥130% load; 10s@105%~130% load |
| **Surge Capacity** | 2* rated power for 5 seconds |
| **Nominal DC Input Voltage** | 12Vdc |
| **Cold Start Voltage** | 11.5Vdc |
| **Low DC Warning Voltage**<br>@ load < 50%<br>@ load ≥ 50% | <br>11.5Vdc<br>11.0Vdc |
| **Low DC Warning Return Voltage**<br>@ load < 50%<br>@ load ≥ 50% | <br>11.7Vdc<br>11.5Vdc |
| **Low DC Cut-off Voltage**<br>@ load < 50%<br>@ load ≥ 50% | <br>10.7Vdc<br>10.5Vdc |
| **High DC Recovery Voltage** | 15Vdc |
| **High DC Cut-off Voltage** | 16Vdc |
| **No Load Power Consumption** | <35W |

Table 3 Charge Mode Specifications

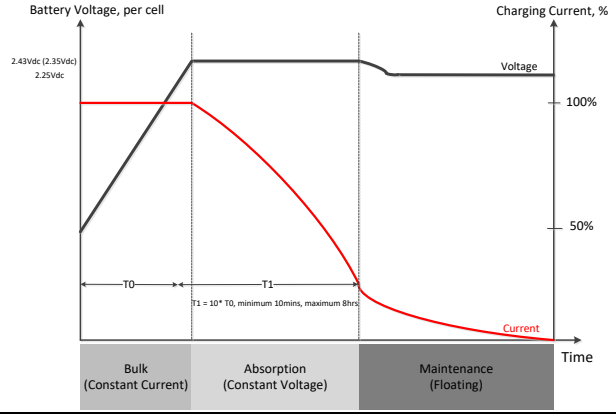
| **Utility Charging Mode** | | |
|---|---|---|
| **MODEL** | | **ICY-2K-12** |
| **Charging Algorithm** | | 3-Step |
| **AC Charging Current (Max)** | | 100Amp<br>(@$V_{I/P}$=230Vac) |
| **Bulk Charging Voltage** | **Flooded Battery** | 14.6Vdc |
| | **AGM / Gel Battery** | 14.1Vdc |
| **Floating Charging Voltage** | | 13.5Vdc |
| **Charging Curve** | |  |

Table 4 General Specifications

| **MODEL** | **ICY-2K-12** |
|---|---|
| **Operating Temperature Range** | -10°C to 50°C |
| **Storage temperature** | -15°C~ 60°C |
| **Humidity** | 5% to 95% Relative Humidity (Non-condensing) |
| **Dimension (D*W*H), mm** | 100 x 300 x 390 |
| **Net Weight, kg** | 8.2 |

# TROUBLE SHOOTING

| Problem | LCD/LED/Buzzer | Explanation / Possible cause | What to do |
|---|---|---|---|
| Unit shuts down automatically during startup process. | LCD/LEDs and buzzer will be active for 3 seconds and then complete off. | The battery voltage is too low (<1.91V/Cell) | 1. Re-charge battery.<br>2. Replace battery. |
| No response after power on. | No indication. | 1. The battery voltage is far too low. (<1.4V/Cell)<br>2. Internal fuse tripped. | 1. Contact repair center for replacing the fuse.<br>2. Re-charge battery.<br>3. Replace battery. |
| Mains exist but the unit works in battery mode. | Input voltage is displayed as 0 on the LCD and green LED is flashing. | Input protector is tripped | Check if AC breaker is tripped and AC wiring is connected well. |
| | Green LED is flashing. | Insufficient quality of AC power. (Shore or Generator) | 1. Check if AC wires are too thin and/or too long.<br>2. Check if generator (if applied) is working well or if input voltage range setting is correct. (UPS→Appliance) |
| When the unit is turned on, internal relay is switched on and off repeatedly. | LCD display and LEDs are flashing | Battery is disconnected. | Check if battery wires are connected well. |
| Buzzer beeps continuously and red LED is on. | Fault code 07 | Overload error. The inverter is overload 110% and time is up. | Reduce the connected load by switching off some equipment. |
| | Fault code 05 | Output short circuited. | Check if wiring is connected well and remove abnormal load. |
| | | Temperature of internal converter component is over 120°C. | Check whether the air flow of the unit is blocked or whether the ambient temperature is too high. |
| | Fault code 02 | Internal temperature of inverter component is over 100°C. | |
| | Fault code 03 | Battery is over-charged. | Return to repair center. |
| | | The battery voltage is too high. | Check if spec and quantity of batteries are meet requirements. |
| | Fault code 01 | Fan fault | Replace the fan. |
| | Fault code 06/58 | Output abnormal (Inverter voltage below than 190Vac or is higher than 260Vac) | 1. Reduce the connected load.<br>2. Return to repair center |
| | Fault code 08/09/53/57 | Internal components failed. | Return to repair center. |
| | Fault code 51 | Over current or surge. | Restart the unit, if the error happens again, please return to repair center. |
| | Fault code 52 | Bus voltage is too low. | |
| | Fault code 55 | Output voltage is unbalanced. | |

# Appendix I: BMS Communication Installation

## 1. Introduction

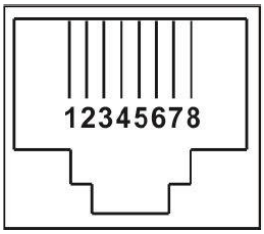
If connecting to lithium battery, it is recommended to purchase a custom-made RJ45 communication cable. Please check with your dealer or integrator for details.

This custom-made RJ45 communication cable delivers information and signal between lithium battery and the inverter. These information are listed below:

- Re-configure charging voltage, charging current and battery discharge cut-off voltage according to the lithium battery parameters.
- Have the inverter start or stop charging according to the status of lithium battery.

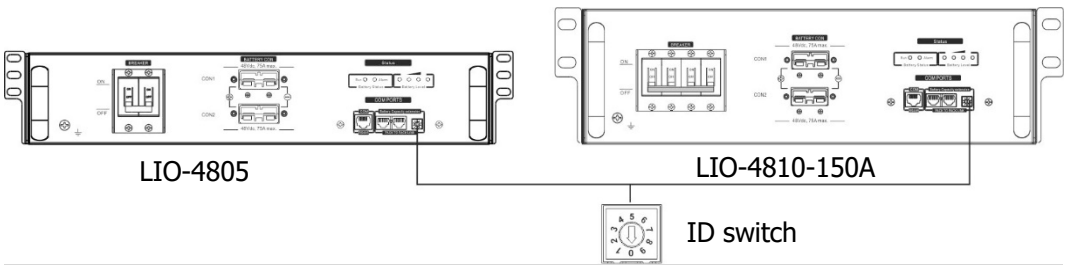
## 2. Pin Assignment for BMS Communication Port

| | Definition |
|---|---|
| PIN 1 | RS232TX |
| PIN 2 | RS232RX |
| PIN 3 | RS485B |
| PIN 4 | NC |
| PIN 5 | RS485A |
| PIN 6 | CANH |
| PIN 7 | CANL |
| PIN 8 | GND |

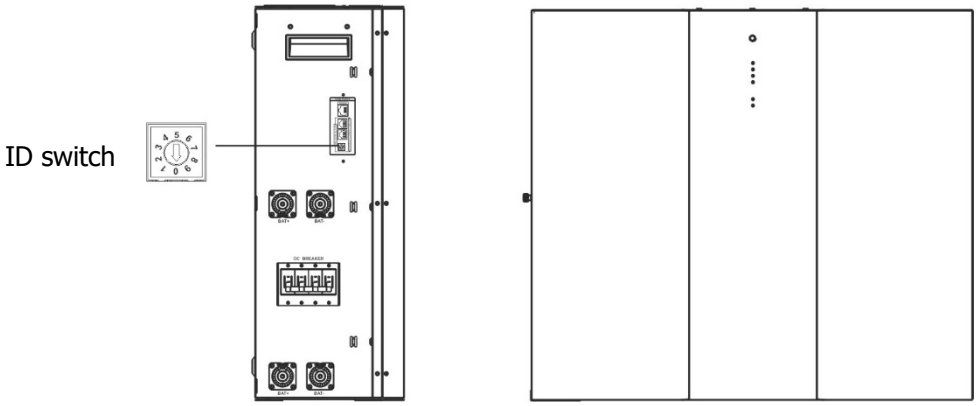



## 3. Lithium Battery Communication Configuration

**LIO-4805/LIO-4810-150A**

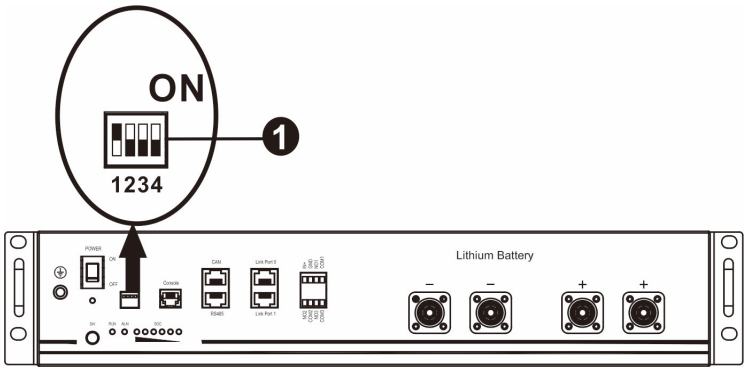



**LIO II-4810**




ID Switch indicates the unique ID code for each battery module. It's required to assign an identical ID to each battery module for normal operation. We can set up the ID code for each battery module by rotating the PIN number on the ID switch. From number 0 to 9, the number can be random; no particular order. Maximum 10 battery modules can be operated in parallel.

**PYLONTECH**




□ Dip Switch: There are 4 Dip Switches that sets different baud rate and battery group address. If switch position is turned to the "OFF" position, it means "0". If switch position is turned to the "ON" position, it means "1".

Dip 1 is "ON" to represent the baud rate 9600.

Dip 2, 3 and 4 are reserved for battery group address.

Dip switch 2, 3 and 4 on master battery (first battery) are to set up or change the group address.

**NOTE:** "1" is upper position and "0" is bottom position.

| Dip 1 | Dip 2 | Dip 3 | Dip 4 | Group address |
|---|---|---|---|---|
| 1: RS485<br>baud rate=9600<br><br>**Restart to take effect** | 0 | 0 | 0 | Single group only. It's required to set up master battery with this setting and slave batteries are unrestricted. |
| | 1 | 0 | 0 | Multiple group condition. It's required to set up master battery on the first group with this setting and slave batteries are unrestricted. |
| | 0 | 1 | 0 | Multiple group condition. It's required to set up master battery on the second group with this setting and slave batteries are unrestricted. |
| | 1 | 1 | 0 | Multiple group condition. It's required to set up master battery on the third group with this setting and slave batteries are unrestricted. |
| | 0 | 0 | 1 | Multiple group condition. It's required to set up master battery on the fourth group with this setting and slave batteries are unrestricted. |
| | 1 | 0 | 1 | Multiple group condition. It's required to set up master battery on the fifth group with this setting and slave batteries are unrestricted. |

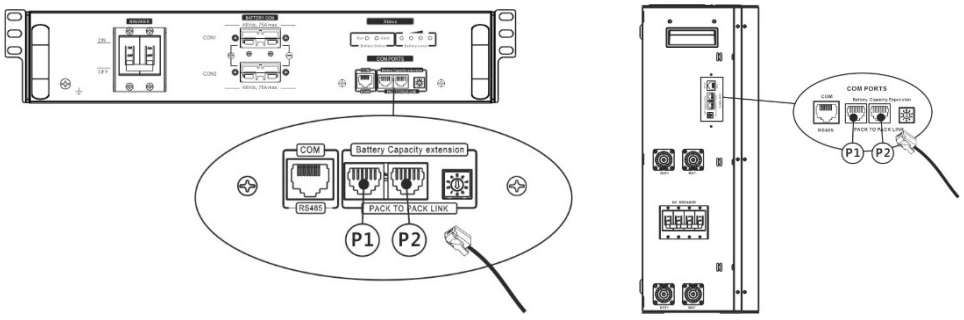
**NOTE:** The maximum groups of lithium battery is 5 and for maximum number for each group, please check with battery manufacturer.

### 4. Installation and Operation

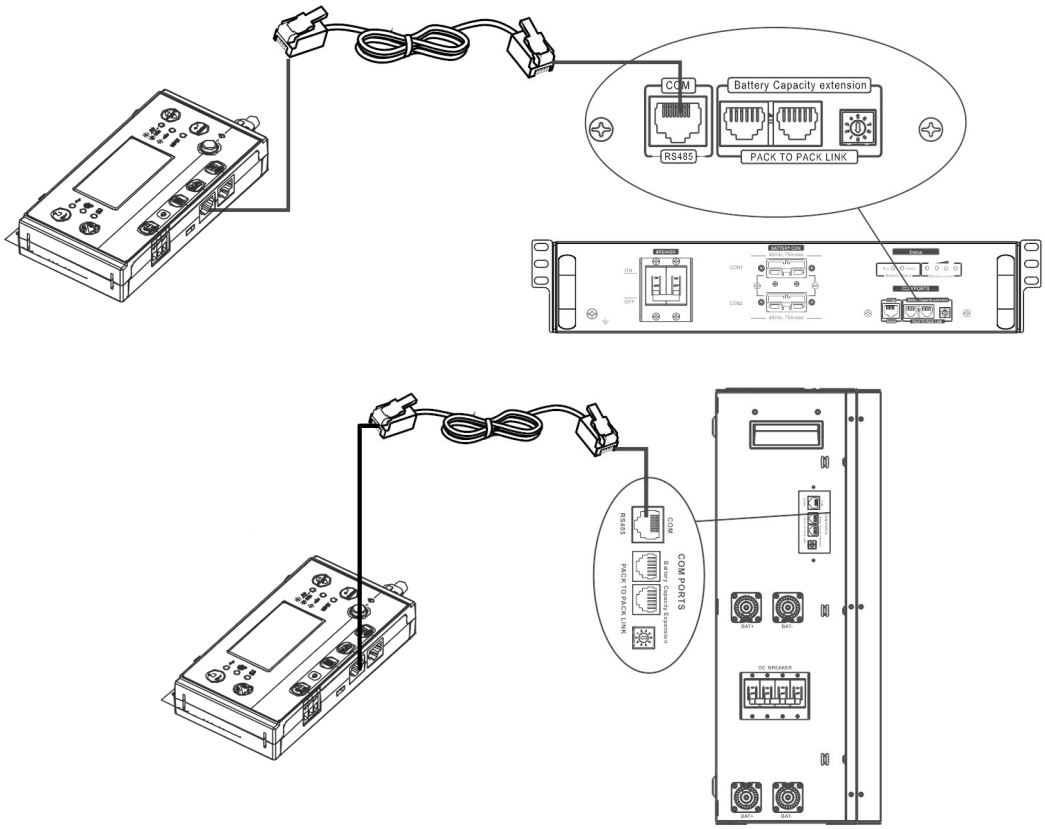
**LIO-4805/LIO-4810-150A/ESS LIO II-4810**

After ID no. is assigned for each battery module, please set up LCD panel in inverter and install the wiring connection as following steps.

Step 1: Use supplied RJ11 signal cable to connect into the extension port (P1 or P2).



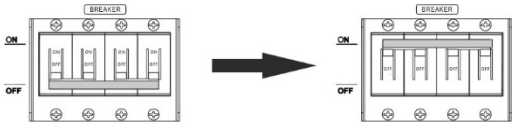
Step 2: Use supplied RJ45 cable (from battery module package) to connect inverter and Lithium battery.




**Note for parallel system:**

1. Only support common battery installation.
2. Use custom-made RJ45 cable to connect any inverter (no need to connect to a specific inverter) and Lithium battery. Simply set this inverter battery type to "LIB" in LCD program 5. Others should be "USE".

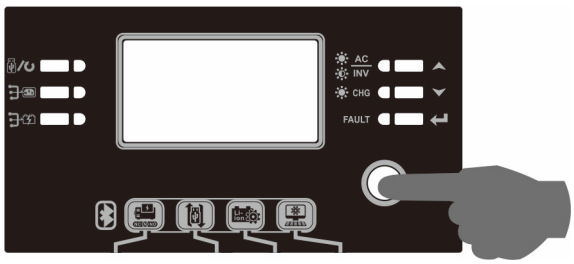
Step 3: Turn the breaker switch "ON". Now, the battery module is ready for DC output.




Step 4: Press Power on/off button on battery module for 5 secs, the battery module will start up.

*If the manual button cannot be approached, just simply turn on the inverter module. The battery module will be automatically turned on.

Step 5. Turn on the inverter.



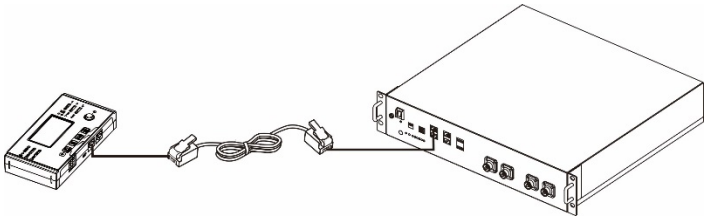

Step 6. Be sure to select battery type as "LIB" in LCD program 5.

If communication between the inverter and battery is successful, the battery icon on LCD display will flash. Generally speaking, it will take longer than 1 minute to establish communication.

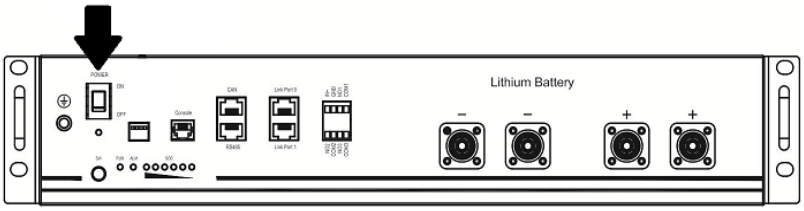
**PYLONTECH**

After configuration, please install LCD panel with inverter and Lithium battery with the following steps.

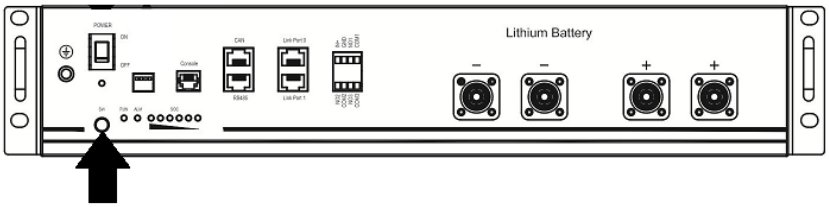
Step 1. Use custom-made RJ45 cable to connect inverter and Lithium battery.



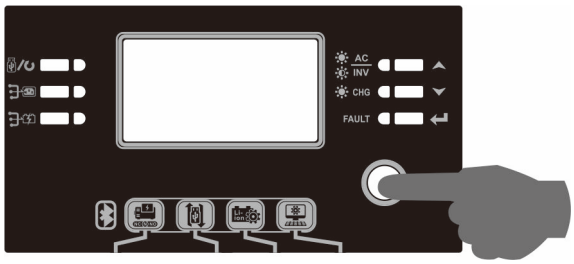
Step 2. Switch on Lithium battery.



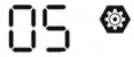

Step 3. Press more than three seconds to start Lithium battery. Output power is ready.




Step 4. Turn on the inverter.




Step 5. Be sure to select battery type as "PYL" in LCD program 5.

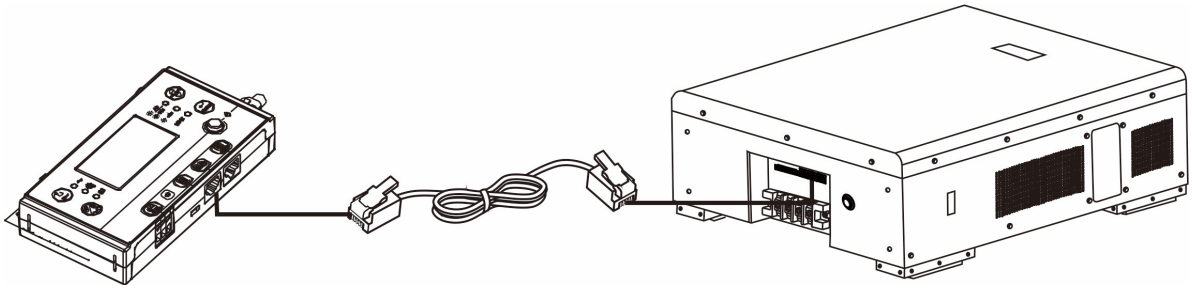




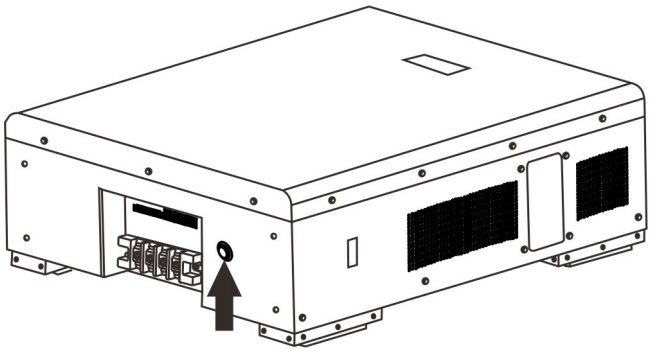
If communication between the inverter and battery is successful, the battery icon on LCD display will flash. Generally speaking, it will take longer than 1 minute to establish communication.

**WECO**

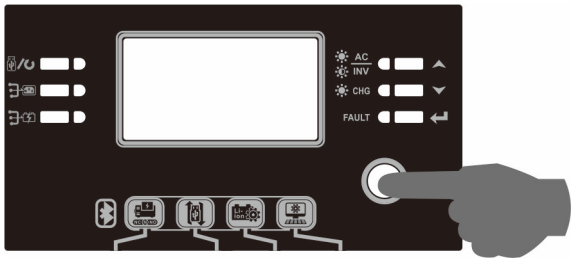
Step 1. Use a custom-made RJ45 cable to connect inverter and Lithium battery.



Step 2. Switch on Lithium battery.



Step 3. Turn on the inverter.

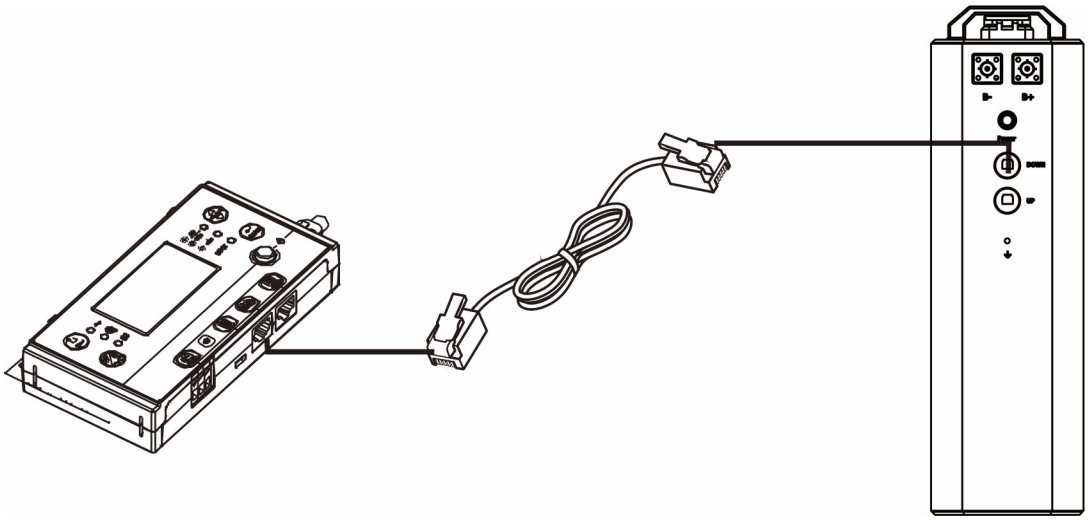



Step 4. Be sure to select battery type as "WEC" in LCD program 5.

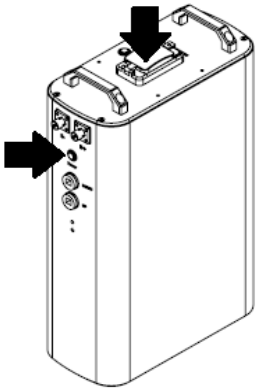
If communication between the inverter and battery is successful, the battery icon  on LCD display will "flash". Generally speaking, it will take longer than 1 minute to establish communication.

**SOLTARO**

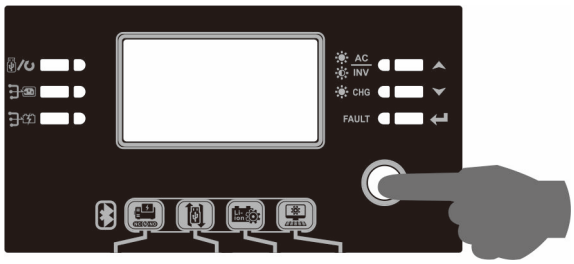
Step 1. Use a custom-made RJ45 cable to connect inverter and Lithium battery.



Step 2. Open DC isolator and switch on Lithium battery.



Step 3. Turn on the inverter.



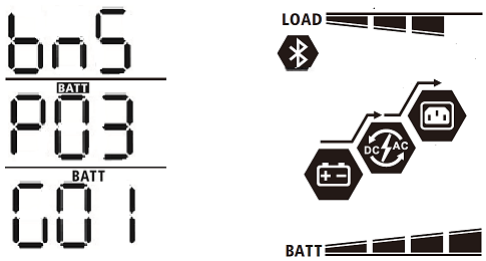

Step 4. Be sure to select battery type as "SOL" in LCD program 5.



If communication between the inverter and battery is successful, the battery icon  on LCD display will "flash". Generally speaking, it will take longer than 1 minute to establish communication.

## 5. LCD Display Information

Press "▲" or "▼" button to switch LCD display information. It will show battery pack and battery group number before "Main CPU version checking" as shown below.

| Selectable information | LCD display |
|---|---|
| Battery pack numbers & Battery group numbers | Battery pack numbers = 3, battery group numbers = 1   |

Active Function

This function is to activate lithium battery automatically while commissioning. After battery wiring and commissioning is successfully, if battery is not detected, the inverter will automatically activate battery if the inverter is powered on.

## 5. Code Reference

Related information code will be displayed on LCD screen. Please check inverter LCD screen for the operation.

| Code | Description |
|---|---|
| | If battery status is not allowed to charge and discharge after the communication between the inverter and battery is successful, it will show code 60 to stop charging and discharging battery. |
| | Communication lost (only available when the battery type is setting as any type of lithium-ion battery.)<br>● After battery is connected, communication signal is not detected for 3 minutes, buzzer will beep. After 10 minutes, inverter will stop charging and discharging to lithium battery.<br>● Communication lost occurs after the inverter and battery is connected successfully, buzzer beeps immediately. |
|  | If battery status is not allowed to charge after the communication between the inverter and battery is successful, it will show code 69 to stop charging battery. |
|  | If battery status must to be charged after the communication between the inverter and battery is successful, it will show code 70 to charge battery. |
|  | If battery status is not allowed to discharge after the communication between the inverter and battery is successful, it will show code 71 to stop discharging battery. |