HOMEGRID

POWERED BY LITHION


# Stack'd Series

## Reference Manual

Rev 2.1
September 2022

# 1. Safety Precautions

It is very important to read this user manual carefully before installing or using the battery. Failure to do so or to follow any of the instructions or warnings in this document can result in electrical shock, severe injury, or death. Installing the battery incorrectly can permanently damage the battery or render it inoperable.

For more information about this product, please visit the official website: http://www.homegridenergy.com

Only qualified personnel should work on a Li-Ion battery.

## 1.1. General warnings

While working on a Li-ion battery wear protective eyeglasses and clothing.

Any internal lithium-ion cell material such as electrolyte or powder on the skin or in the eyes must be flushed with plenty of clean water immediately. Then seek medical assistance. Any material spilled on clothing should be rinsed out with water.

Explosion and fire hazard. Terminals of the Li-ion Battery are always live. Therefore, do not place items or tools on the Li-ion Battery. Avoid short circuits, over discharges and high charge currents. Use insulated tools. Do not wear any metallic items such as watches, bracelets, etc. In case of fire, you must use a type D, foam, or CO2 fire extinguisher.

Do not open or dismantle the battery. Electrolyte is very corrosive. In normal working conditions you will not have any contact with the electrolyte. If the battery casing is damaged do not touch the exposed electrolyte or powder because it is corrosive.

Li-ion batteries are heavy. If involved in a traffic accident, it can become a projectile! Ensure adequate and secure mounting and always use suitable handling equipment for transportation.

A lithium-ion battery is sensitive to mechanical shock. Handle with care.

Do not expose bare cables ends. All the battery terminals must be disconnected for maintenance.

Do not place in an area used by children or pets.

Do not use cleaning solvents to clean the battery.

Do not expose the battery to flammable or harsh chemicals or vapors.

Do not paint any part of the battery; include any internal or external

Do not drop, deform, impact, or cut with a sharp object.

Do not power wash the battery or get it wet. Direct sunlight must be always avoided.

Do not use a damaged battery.

Please contact the supplier within 24 hours if there is something abnormal.

Do not place any foreign objects into any part of battery.

The warranty will be void for direct or indirect damage due to items above.

## 1.2. Charge and discharge warnings

If the battery is to be stored for a long time, recharge it to 90% SOC every 6 months.

Recharge a fully discharged battery within 12 hours.

Do not connect the battery directly to a solar array. The array must be connected through an inverter

Use only with BMS approved by the supplier.

If charged after the Lithium Battery was discharged below the “Discharge cut-off voltage,” or when the Lithium Battery was damaged or overcharged, the battery can release a harmful gas.

The temperature range for battery charging is 0°C to 55°C. Charging the battery at temperatures outside this range may cause severe damage to the battery or reduce battery life expectancy.

The temperature range for battery discharging is -20°C to 55°C. Discharging the battery at temperatures outside this range may cause severe damage to the battery or reduce battery life expectancy.

## 1.3. Transportation warnings

The battery must be transported in its original or equivalent package and in an upright position. If the battery is in its package, use soft slings to avoid damage.

Do not stand underneath a battery on any sort of hoist. Keep hands and feet clear.

***NOTE：***

●*Batteries are tested according to UN Handbook of Tests and Criteria, part III, sub section 38.3 (ST/SG/AC.10/11/Rev.5).*

●*For transport the batteries belong to the category UN3480, Class 9, Packaging Group II and must be transported according to this regulation. This means that for land and sea transport (ADR, RID & IMDG) they must be packed according to packaging instruction P903 and for air transport (IATA) according to packaging instruction P965. The original packaging complies with these instructions.*

## 1.4. Disposal of lithium batteries

Batteries marked with the recycling symbol must be processed via a recognized recycling agency. By agreement, they may be returned to the manufacturer.

Batteries must not be mixed with domestic or industrial waste.

Do not throw a battery into fire.

## 1.5. Before Connecting

- After unpacking, please check the product and packing list. If the product is damaged or parts are missing, please contact your distributor.
- Before installation, be sure to turn off the grid power and make sure the battery is in off mode.
- Do not connect the battery to AC power directly. An inverter must be used.
- The embedded BMS in the battery is designed for 48V DC. DO NOT connect batteries in series.
- Make sure that the battery system is grounded.
- Please make sure the inverter and other equipment are compatible.
- Keep the battery away from water and fire.

## 1.6. During Use

If the battery system needs to be moved or repaired, the power must be turned off on the controller and each battery module switched off.

Do not connect the Stack'd battery to any other type of battery.

Do not connect the battery to an incompatible inverter.

Do not attempt to disassemble the battery.

In case of fire, only dry powder fire extinguisher can be used. Do not use liquid fire extinguishers.

# 2. Introduction

The Stack'd Series lithium iron phosphate battery is an energy storage product developed and produced by HomeGrid. It can provide reliable power for several types of equipment and systems. The Stack'd Series is especially suitable for home energy storage systems.
The Stack'd Series can do the following:

1. Store energy from solar arrays or wind turbines for use later when it's dark or the wind isn't blowing.
2. Peak shaving: power from the battery is used to reduce the maximum power drawn from the utility. This can result in cost savings in some jurisdictions.
3. Load shifting: power from the battery can be used to reduce the power drawn from the utility during peak hours when rates are high. The battery is recharged during off-peak hours when the rates are lower.
4. Demand response: in some areas the local utility will pay users to provide power to the grid when demand is high. This is called "net metering." Power flows from the battery to the grid when demand is high, then the battery is recharged when demand is lower and grid power is cheaper.
5. The battery can provide power when the local utility has experienced an outage.

The Stack'd Series has a built-in battery management system (BMS). The BMS manages and monitors information including voltage, current and temperature from the cells inside the battery. The BMS will balance the battery cells to maximize the energy that can be stored and recovered.

Multiple battery stacks can be connected in parallel to expand capacity and power to meet the requirements of longer power supporting duration and higher power consumption.

## 2.1. Lithium iron phosphate Battery

The lithium iron phosphate battery (LiFePO4 or LFP) is the safest of the mainstream lithium battery types. A single LFP cell has a nominal voltage of 3.2V. A 48V LFP battery consists of 15 cells connected in series.

LFP is the chemistry of choice for very demanding applications. Some of its features are:

- Safety- LFP is the safest Li-Ion battery chemistry and does not experience thermal runaway.
- High round trip efficiency.
- High energy density - More capacity with less weight and volume.
- High charge and discharge currents - Fast charge and discharges are possible.
- Flexible charge voltages.

The lithium iron phosphate battery is the chemistry of choice for a range of very demanding applications.

## 2.2. Stack'd Series Features

- LFP modules are non-toxic, pollution-free, and environment-friendly.
- Cathode material is made from Lithium Iron Phosphate for safety, performance, and long cycle life.
- The Battery management system (BMS) has many protection functions including over-discharge, over-charge, over-current, and high/low temperature.

- The system will automatically manage charging and discharging and balance the current and voltage of each cell.
- Flexible configuration, multiple battery modules can be internal for expanding voltage and Capacity.
- Adaptative self-cooling reduced system noise.
- The module has low self-discharge, up to 6 months without charging it on shelf, no memory effect, excellent performance of low discharge.
- Working temperature range is from -20℃ to 55℃, (Charging 0℃~55℃; discharging -20℃~55℃) with excellent discharge performance and cycle life.
- Small volume, plug-in embedded design module, easy to install and maintain.

## 2.3. Specifications


*Figure 2.3.1 Assembled System with 5 Battery Modules*

| No. | Items | | Parameters | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Model | | PF5-LFP***00-2A01 | | | | | | |
| 2 | Main Controller Module | | HG-MC100-200M2 | | | | | | |
| 3 | Battery Module Type | | HG-FS48100-15OSJ1 | | | | | | |
| 4 | Battery Module Chemistry | | LiFePO4 | | | | | | |
| 5 | Battery Module QTY | | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 6 | Nominal Capacity (Ah) | | 200 | 300 | 400 | 500 | 600 | 700 | 800 |
| 7 | Nominal Energy(kWh)*** | | 9.60 | 14.4 | 19.2 | 24.0 | 28.8 | 33.6 | 38.4 |
| 8 | Voltage | Nominal(V) | 48.0 | | | | | | |
| | | Bulk (V) | 52.0 | | | | | | |
| | | Absorbing (V) | 52.5 | | | | | | |
| | | Float (V) | 52.3 | | | | | | |
| | | Discharge (V) | 44.0 | | | | | | |
| 9 | Current | Max.Charging(A) | 180 | 270 | 300 | 300 | 300 | 300 | 300 |
| | | Max.Discharging(A) | 180 | 270 | 300 | 300 | 300 | 300 | 300 |
| | | Peak for 10s(A) | 300 | 300 | 500 | 500 | 500 | 500 | 500 |
| 10 | Weight (Approx.) | | 230 lbs. | 325 lbs. | 420 lbs. | 515 lbs. | 610 lbs. | 705 lbs. | 800 lbs. |
| 11 | Dimensions (H*W=29” *D=15.75”) | | 24.2” | 29.4 | 35.2” | 41” | 46.8” | 52.6” | 58.4” |
| 12 | Communication | | RS485, CAN | | | | | | |
| 13 | Cycle Life | | 6000 times@80%DOD | | | | | | |
| 14 | Designed Calendar Life | | ≥10 years | | | | | | |
| 15 | Safety Function | | Over-charge, Over-discharge, Over-current, Low/High-temperature, Low-voltage, Short-circuit Protections | | | | | | |
| 16 | Parallel Capability | | Maximum 15Stacks (Recommended 6 Stacks) | | | | | | |

## 2.4. Front Panel Display

The front of the controller module includes a display that shows the status of the system.

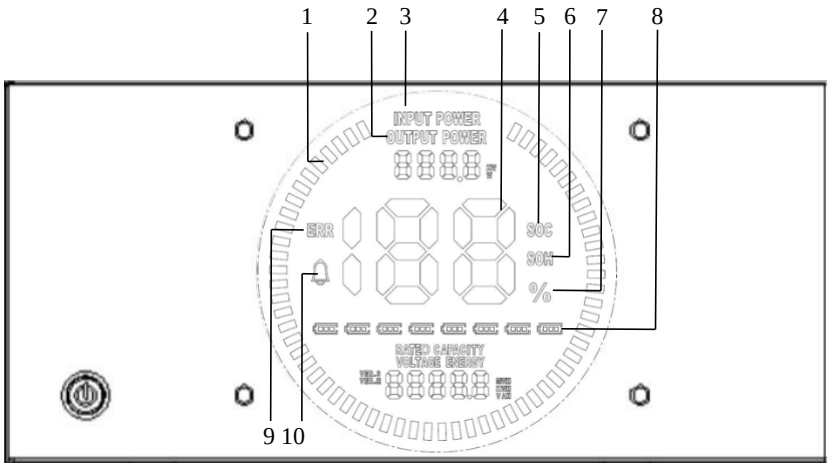



*Figure2.4.1 Controller module display*

| No. | Instructions | NO. | Instructions |
|---|---|---|---|
| 1 | Animated streamline | 6 | Battery state of health (SOH) |
| 2 | Discharge power | 7 | Numerical percentage |
| 3 | Charging power | 8 | Number of modules |
| 4 | Numerical information | 9 | Fault (error) |
| 5 | Battery state of charge (SOC) | 10 | Alarm (warning) |

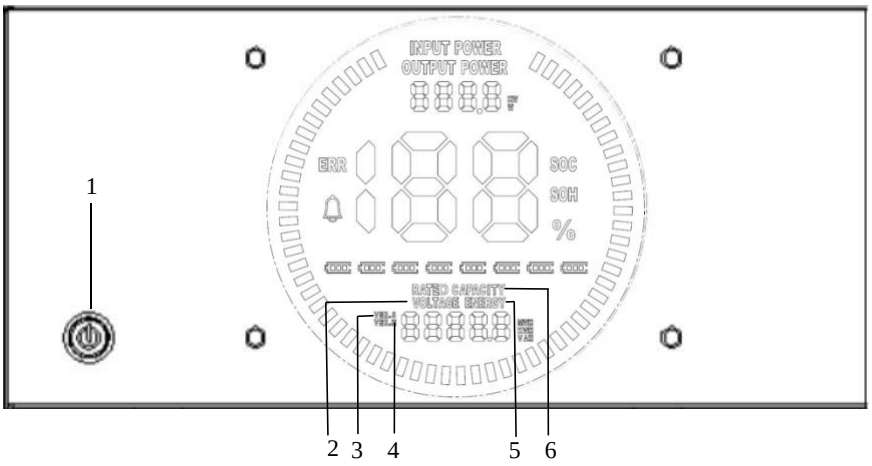



*Figure2.4.2 Controller module display details*

| No. | Instructions | NO. | Instructions |
|---|---|---|---|
| 1 | Power switch | 4 | Hardware version |
| 2 | Current voltage level | 5 | Energy throughput |
| 3 | Software version | 6 | Capacity of a new battery |

## Power switch

The power switch turns the entire system on and off.

## Display screen

Display screen: Displays the State of Charge (SOC), State of Health (SOH), charging/discharging power, alarm fault indication, charging and discharging status, and overall system status.

## Status code

Status code: The code will only be displayed if a fault occurs. If the system is operating normally the code will not be shown. The alarm codes are shown in the table below：

| Numerical value | Alarm indication | Numerical value | Alarm indication |
|---|---|---|---|
| 000 | Normal | 014 | Charging circuit fault |
| 002 | Low voltage protection | 015 | Cell failure |
| 003 | Charging over current protection | 016 | NTC failure |
| 004 | Discharge over current protection | 019 | External equipment communication fault |
| 005 | Short circuit protection | 020 | Internal equipment communication fault |
| 006 | Charging high temperature | 022 | Relay over temperature protection |
| 007 | High discharge temperature | 023 | Copper bus over temperature protection |
| 008 | Low charging temperature | 025 | Lost communication between screen and device |
| 009 | Low discharge temperature | 051 | Total pressure overcharge protection |
| 011 | High ambient temperature | 052 | Total pressure over discharge protection |
| 012 | Excessive differential pressure | 053 | Low ambient temperature protection |
| 013 | Discharge circuit failure | 054 | MOS over temperature protection |

***NOTE:***

●*When the system is charged the display streamline gathers in the middle. When it is discharged the display streamline disperses to both sides*

## 2.5. Control Module Switches and Connectors

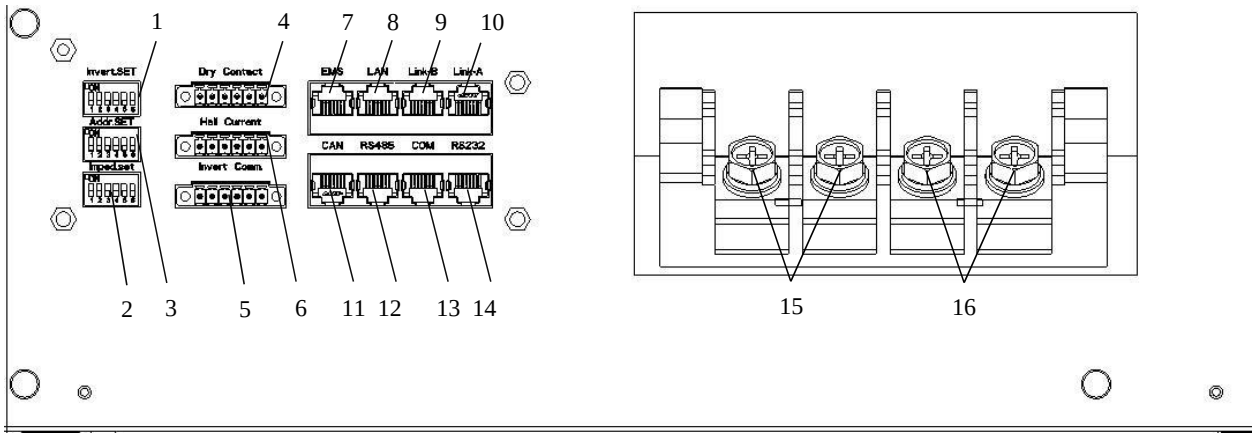



*Figure2.4.3 Control Module Terminals and Connectors*

| No. | Instructions | No. | Instructions |
|---|---|---|---|
| 1 | Inverter protocol selection switch | 9 | Parallel communication port B |
| 2 | Imped. SET (Reserved) | 10 | Parallel communication port A |
| 3 | Controller Address Dial Switch | 11 | Inverter CAN communication port |
| 4 | Dry Contact (Reserved) | 12 | Inverter RS485 communication port |
| 5 | Inverter CAN/ RS485communication port | 13 | CAN upgrade communication port |
| 6 | Hall Current (Reserved) | 14 | RS232 communication interface |
| 7 | Reserved | 15 | Charge/discharge negative electrode |
| 8 | Reserved | 16 | Charge/discharge positive electrode |

## Controller address dial switch

The Controller Address Dial Switch sets the address of the controller module of a given stack. It is possible to have up to 15 stacks connected in parallel and controlled by one Master Controller.

The Master Controller should have its address set to 1 as shown in the table below. The slave controllers should be set to address 2, then 3 and so on. The controllers will be connected by CAN bus cables shown later. Each stack has its own controller module on top.

| Address Coding | Dial Code Switch Position | | | | | | Definition |
|---|---|---|---|---|---|---|---|
| | #1 | #2 | #3 | #4 | #5 | #6 | |
| 1 | ON | OFF | OFF | OFF | N/A | N/A | Address 1, the Master Controller |
| 2 | OFF | ON | OFF | OFF | N/A | N/A | Address 2, the first slave controller |
| 3 | ON | ON | OFF | OFF | N/A | N/A | Address 3, the second slave controller |
| 4 | OFF | OFF | ON | OFF | N/A | N/A | Address 4, the third slave controller |
| 5 | ON | OFF | ON | OFF | N/A | N/A | Address 5, the fourth slave stack controller |
| 6 | OFF | ON | ON | OFF | N/A | N/A | Address 6, the fifth slave controller |
| 7 | ON | ON | ON | OFF | N/A | N/A | Address 7, the sixth slave controller |
| 8 | OFF | OFF | OFF | ON | N/A | N/A | Address 8, the seventh slave controller |
| 9 | ON | OFF | OFF | ON | N/A | N/A | Address 9, the eighth slave controller |
| 10 | OFF | ON | OFF | ON | N/A | N/A | Address 10, the ninth slave controller |
| 11 | ON | ON | OFF | ON | N/A | N/A | Address 11, the tenth slave controller |
| 12 | OFF | OFF | ON | ON | N/A | N/A | Address 12, the eleventh slave controller |
| 13 | ON | OFF | ON | ON | N/A | N/A | Address 13, the twelfth slave controller |
| 14 | OFF | ON | ON | ON | N/A | N/A | Address 14, the thirteenth slave controller |
| 15 | ON | ON | ON | ON | N/A | NG | Address 15, the fourteenth slave controller |

## Inverter protocol dialing switch

The master controller communicates with the inverter to set proper parameters for charging and discharging. HomeGrid has programmed the controller to work with different inverters from several different manufacturers.

Set the Inverter Protocol Selection Switch to match the inverter you wish to use according to the table below.

| Inverter Protocol Setting | Dial Code Switch Position | | | | | | Definition |
|---|---|---|---|---|---|---|---|
| | #1 | #2 | #3 | #4 | #5 | #6 | |
| 0 | OFF | OFF | OFF | OFF | OFF | OFF | Monitoring Software setting mode |
| 1 | ON | OFF | OFF | OFF | OFF | OFF | ZRGP |
| 2 | OFF | ON | OFF | OFF | OFF | OFF | Studer_Xtender |
| 3 | ON | ON | OFF | OFF | OFF | OFF | Sofar_LV |
| 4 | OFF | OFF | ON | OFF | OFF | OFF | Solis_LV |
| 5 | ON | OFF | ON | OFF | OFF | OFF | Goodwe_LV |
| 6 | OFF | ON | ON | OFF | OFF | OFF | Victron_color_control |
| 7 | ON | ON | ON | OFF | OFF | OFF | SMA_LV |
| 8 | OFF | OFF | OFF | ON | OFF | OFF | Sermatec_HV |
| 9 | ON | OFF | OFF | ON | OFF | OFF | Reserved |
| 10 | OFF | ON | OFF | ON | OFF | OFF | Growatt_SPF |
| 11 | ON | ON | OFF | ON | OFF | OFF | Li_PLUS |
| 12 | OFF | OFF | ON | ON | OFF | OFF | Schneider Gateway |
| 13 | ON | OFF | ON | ON | OFF | OFF | SOL-ARK_LV |
| 14 | OFF | ON | ON | ON | OFF | OFF | Reserved |
| 15 | ON | ON | ON | ON | OFF | OFF | Reserved |
| 16 | OFF | OFF | OFF | OFF | ON | OFF | Reserved |
| 17 | ON | OFF | OFF | OFF | ON | OFF | SUNSYNK |
| 18 | OFF | ON | OFF | OFF | ON | OFF | Growatt_SPH&SPA |
| 19 | ON | ON | OFF | OFF | ON | OFF | Reserved |
| 20 | OFF | OFF | ON | OFF | ON | OFF | Reserved |
| 21 | ON | OFF | ON | OFF | ON | OFF | Reserved |
| 22 | OFF | ON | ON | OFF | ON | OFF | Reserved |
| 23 | ON | ON | ON | OFF | ON | OFF | Reserved |
| 24 | OFF | OFF | OFF | ON | ON | OFF | Reserved |
| 25 | ON | OFF | OFF | ON | ON | OFF | Reserved |
| 26 | OFF | ON | OFF | ON | ON | OFF | Reserved |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 27 | ON | ON | OFF | ON | ON | OFF | GreenCell |
| 28 | OFF | OFF | ON | ON | ON | OFF | Reserved |
| 29 | ON | OFF | ON | ON | ON | OFF | Must |
| | | | | | | | |

| Inverter Protocol Setting | Dial Code Switch Position | | | | | | Definition |
|---|---|---|---|---|---|---|---|
| | #1 | #2 | #3 | #4 | #5 | #6 | |
| 50 | OFF | ON | OFF | OFF | ON | ON | Reserved |
| 51 | ON | ON | OFF | OFF | ON | ON | |
| 52 | OFF | OFF | ON | OFF | ON | ON | |
| 53 | ON | OFF | ON | OFF | ON | ON | |
| 54 | OFF | ON | ON | OFF | ON | ON | |
| 55 | ON | ON | ON | OFF | ON | ON | |
| 56 | OFF | OFF | OFF | ON | ON | ON | |
| 57 | ON | OFF | OFF | ON | ON | ON | |
| 58 | OFF | ON | OFF | ON | ON | ON | |
| 59 | ON | ON | OFF | ON | ON | ON | |
| 60 | OFF | OFF | ON | ON | ON | ON | Reserved |
| 61 | ON | OFF | ON | ON | ON | ON | Reserved |
| 62 | OFF | ON | ON | ON | ON | ON | Reserved |
| 63 | ON | ON | ON | ON | ON | ON | Find the number of modules attached to the system. |

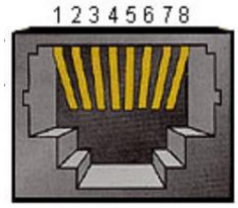
## Inverter CAN/RS485 communication port

Inverter CAN/RS485 communication port: (3.81mm port) follows the CAN and RS485 protocols. The system master uses this interface to communicate with some external inverters and other equipment.

| Port definitions | RJ45Pin | Function |
|---|---|---|
| Invert Comm<br>  <br>123456 | 1 | RS485-B |
| | 2 | RS485-A |
| | 3 | RS485-GND |
| | 4 | CAN-L |
| | 5 | CAN-H |
| | 6 | CAN-GND |

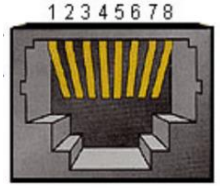
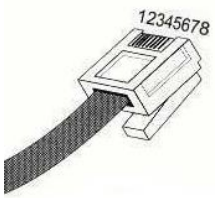
## RS232 communication port

RS232 communication port (RJ45 Port) with a baud rate of 9600 bps for debugging or service.

| Port definitions | RJ11 Pin | Function |
|---|---|---|
|  <br>  | 1 | NC (No connect) |
| | 2 | NC (No connect) |
| | 3 | RS232-GND |
| | 4 | RS232-TX |
| | 5 | RS232-RX |
| | 6 | RS232-GND |
| | 7 | NC (No connect) |
| | 8 | NC (No connect) |
| | | |

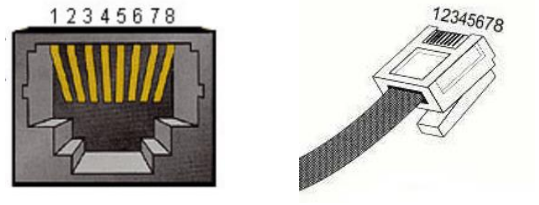
## COM communication port

COM communication port:(RJ45 port) Connect the monitoring host computer to query the data and monitor the running status of the system.

| **Port definitions** | **RJ45 Pin** | **Function** |
|---|---|---|
|  <br>  | 1 | RS485-B |
| | 2 | RS485-A |
| | 3 | CAN -GND |
| | 4 | RS485-GND |
| | 5 | RS485-GND |
| | 6 | CAN -GND |
| | 7 | CAN-L |
| | 8 | CAN-H |

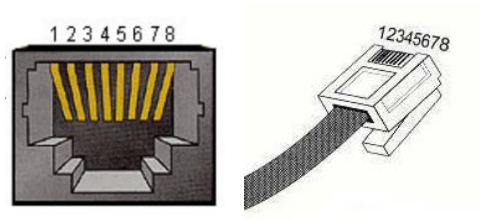
## Inverter RS485 communication port

Rear panel RS485 communication port: follows CAN protocol and RS485 protocol. For the output system information, the system master uses this interface to communicate with External inverter PC and other equipment.

| Port definitions | RJ45 Pin | Function |
|---|---|---|
|  | 1 | RS485-B |
| | 2 | RS485-A |
| | 3 | RS485-GND |
| | 4 | NC (No connect) |
| | 5 | NC (No connect) |
| | 6 | RS485-GND |
| | 7 | RS485-A |
| | 8 | RS485-B |

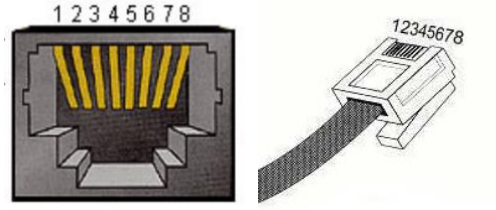
## Inverter CAN communication port

Rear panel CAN communication port: (RJ45 port) follows CAN protocol and RS485 protocol. For the output system information, the system master uses this interface to communicate with External inverter PC and other equipment.

| Port definitions | RJ45 Pin | Function |
|---|---|---|
|  | 1 | CAN-H |
| | 2 | CAN-L |
| | 3 | CAN -GND |
| | 4 | CAN-H |
| | 5 | CAN-L |
| | 6 | CAN -GND |
| | 7 | CAN-H |
| | 8 | CAN-L |

### Rear panel Link A / Link B communication port

Link A / B communication port:(RJ45 port) the definition of link A and B on the rear panel of the interface main control module is the same. This RS485 interface is used for parallel communication between the main control modules, and up to 15 devices can be connected in parallel.

| Port definitions | RJ45 Pin | Function |
|---|---|---|
|  | 1 | RS485-B |
| | 2 | RS485-A |
| | 3 | RS485-GND |
| | 4 | NC (No connect) |
| | 5 | NC (No connect) |
| | 6 | RS485-GND |
| | 7 | RS485-A |
| | 8 | RS485-B |

## 1.1. Battery Module Controls

This panel is under the cover on the right side of each battery module. The “Addr” switches define the address of this module. Each module in a stack must have its own address. The module directly below the controller should be set to 1, the one below it set to 2, and so on down the stack.

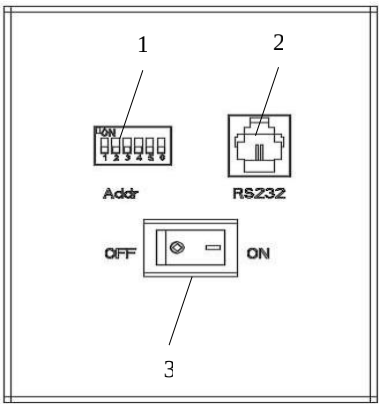



*Figure 2.4. Battery module interface definition*

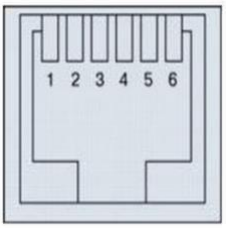
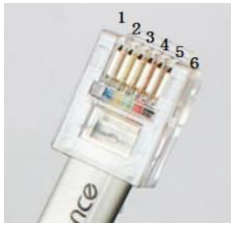
| No. | Instructions | NO. | Instructions |
|---|---|---|---|
| 1 | Address Dial Switch | 2 | RS232 communications interface |
| 3 | Power switch | | |

### Power switch

Power switch: turns the battery module on and off.

### RS232 communication port

RS232 communication port: (RJ11 port) with a baud rate of 9600 bps for debugging or service.

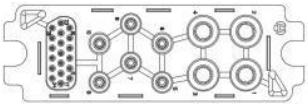
| Port definitions | RJ11 Pin | Function |
|---|---|---|
|   | 1 | NC (NO CONNECT) |
| | 2 | RS232-GND |
| | 3 | RS232-TX |
| | 4 | RS232-RX |
| | 5 | RS232-GND |
| | 6 | NC (NO CONNECT) |

## Address dial switch

Each battery module must have its own ID. The modules should be numbered from 1 to N where N is the number of modules. Module 1 should be the top module in the stack and module N the bottom one.

| Address Coding | Dial Code Switch Position | | | | | | Definition |
|---|---|---|---|---|---|---|---|
| | #1 | #2 | #3 | #4 | #5 | #6 | |
| 1 | ON | OFF | OFF | OFF | OFF | OFF | Module 1 |
| 2 | OFF | ON | OFF | OFF | OFF | OFF | Module 2 |
| 3 | ON | ON | OFF | OFF | OFF | OFF | Module 3 |
| 4 | OFF | OFF | ON | OFF | OFF | OFF | Module 4 |
| 5 | ON | OFF | ON | OFF | OFF | OFF | Module 5 |
| 6 | OFF | ON | ON | OFF | OFF | OFF | Module 6 |
| 7 | ON | ON | ON | OFF | OFF | OFF | Module 7 |
| 8 | OFF | OFF | OFF | ON | OFF | OFF | Module 8 |

## Battery anode and Battery cathode



Positive and negative connection: the battery modules are connected in parallel through the connecting terminals, and finally the main control module is connected in parallel.

# 3. How to use the Monitoring Software Ems Tools

## 3.1. Monitoring Software Ems Tools connection

1) ConnecttheRS232interfaceofthebatterytothecomputerusingtheRS232communicationline (this accessory is an optional accessory, need to be purchased separately from the manufacturer).

2) Unzip the package file of the Monitoring Software Ems Tools in the same file directory.

Pay attention to the directory - do not store other files.

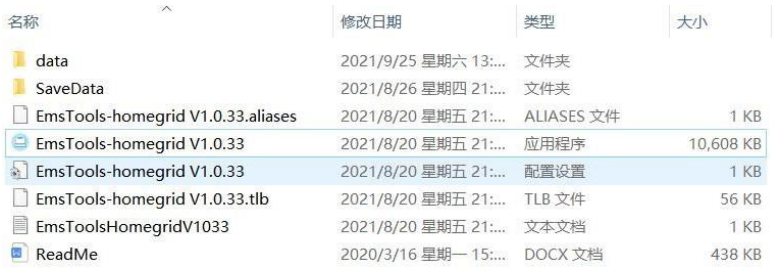



*Figure3.1.1. Unzip of Monitoring Software Ems Tools*

3) Open the Monitoring Software Ems tools icon, enter the protocol selection interface, select the EMS Low Voltage Protocol version, and enter the password (please contact the manufacturer for the password) to log in the software.

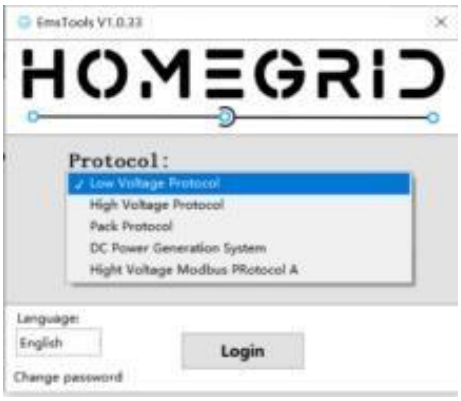



*Figure3.1.2.Protocol selection interface*

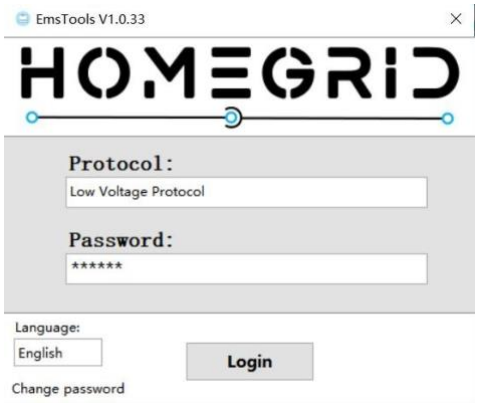



*Figure3.1.3.Enter the password*

4) Users can set different languages according to their own needs. We support four languages, which are Simplified Chinese, English, Japanese and Spanish.

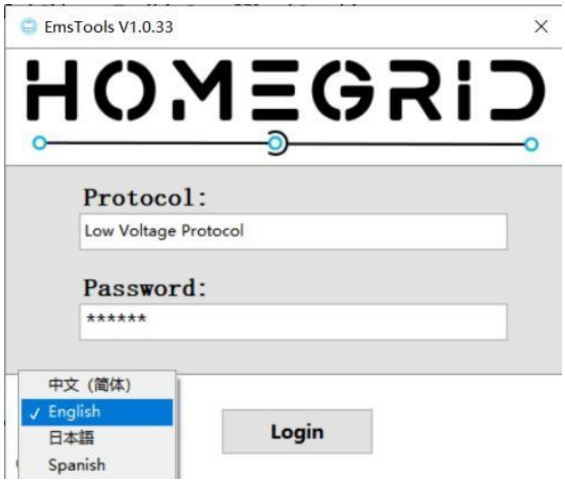



*Figure3.1.4.Monitoring Software Ems language selection*

5) Select the serial port number in the EMS low voltage version of the Monitoring Software EMS tool. The default baud rate is 9600. Click the open com and monitor open buttons.

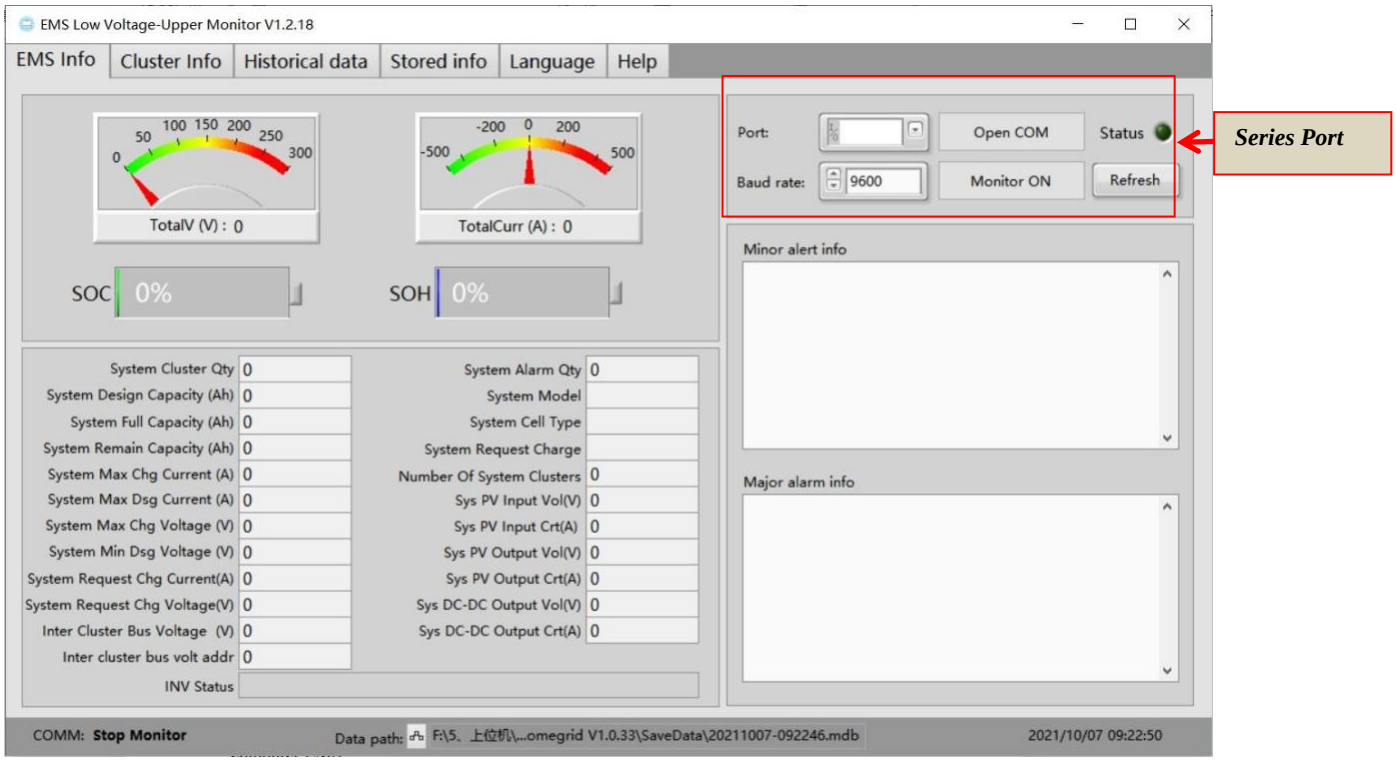



*Figure3.1.5 Monitoring Software Ems serial port settings*

6) The corresponding functions can be selected through the navigation bar of the Monitoring Software EMS.

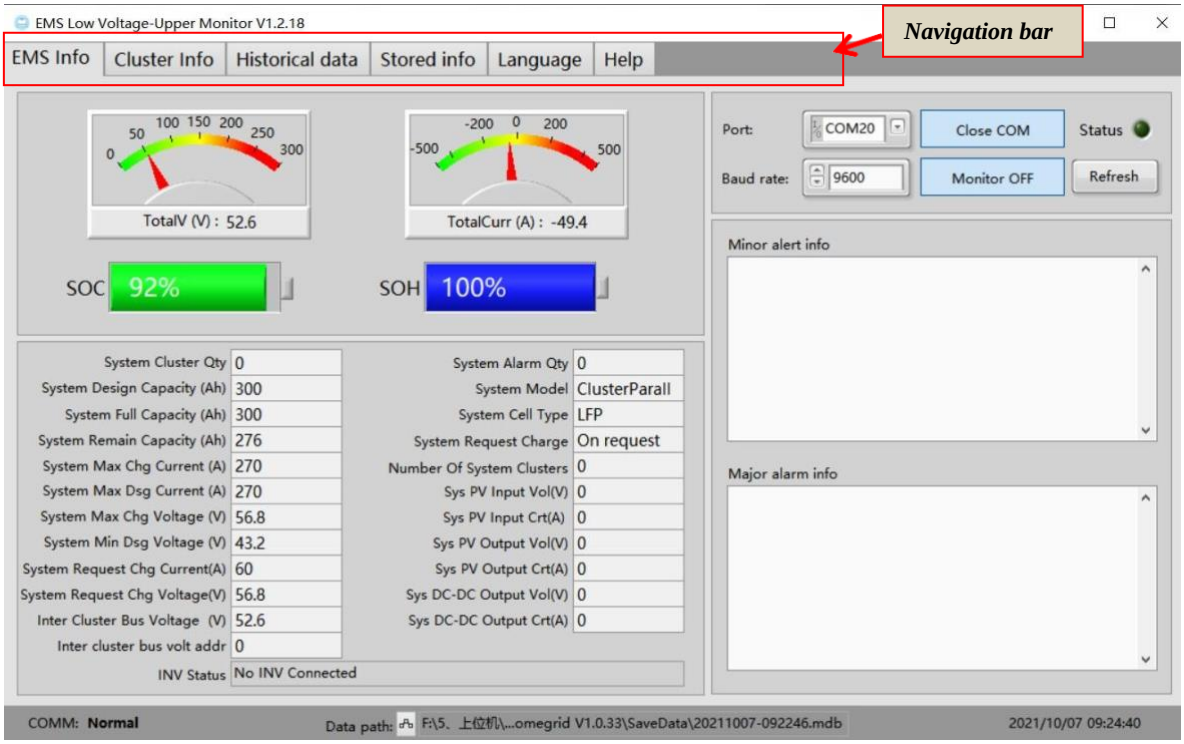



*Figure3.1.6 Monitoring Software Ems data acquisition*

7) Cluster information operation information: You can select the corresponding operation information through the navigate on bar. A total of 15 clusters can be monitored.

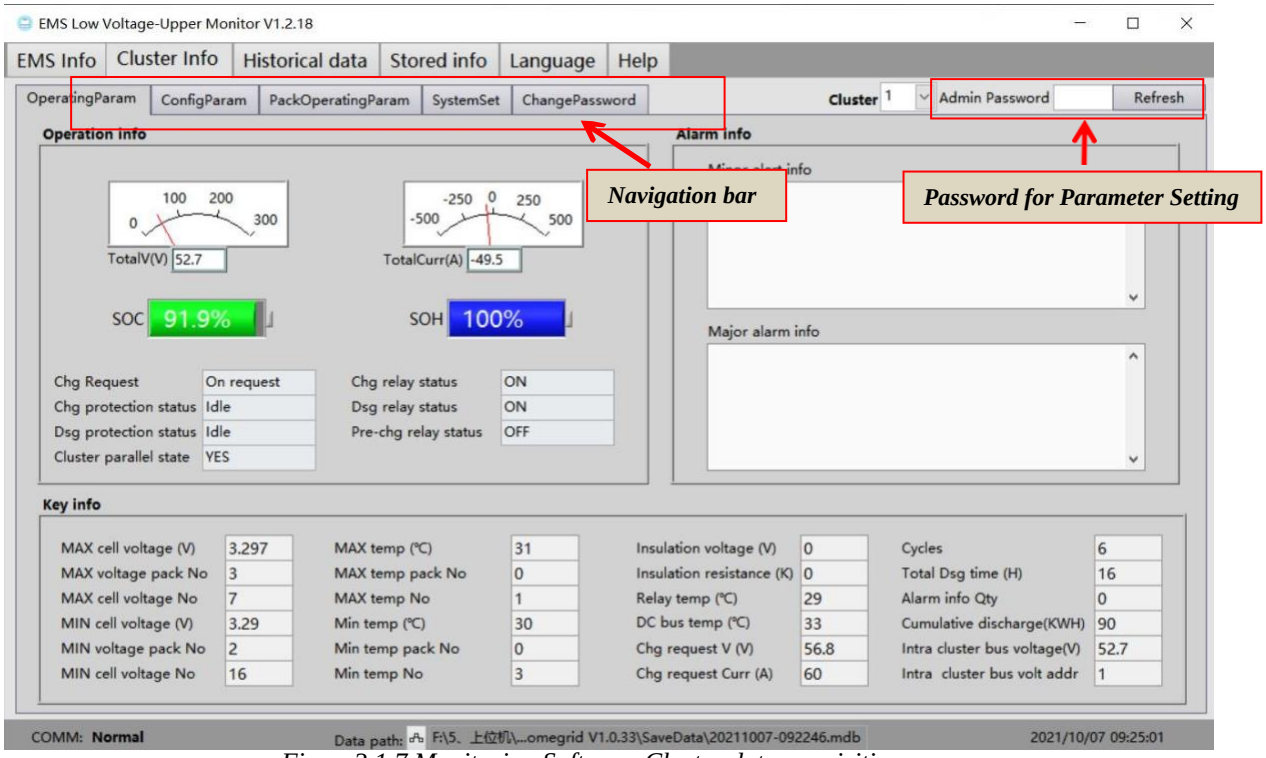



*Figure3.1.7 Monitoring Software Cluster data acquisition*

8) The configuration parameter interface displays the manufacturer identification, software version, hardware version, production serial number, temperature quantity and module battery quantity of a cluster in real time.

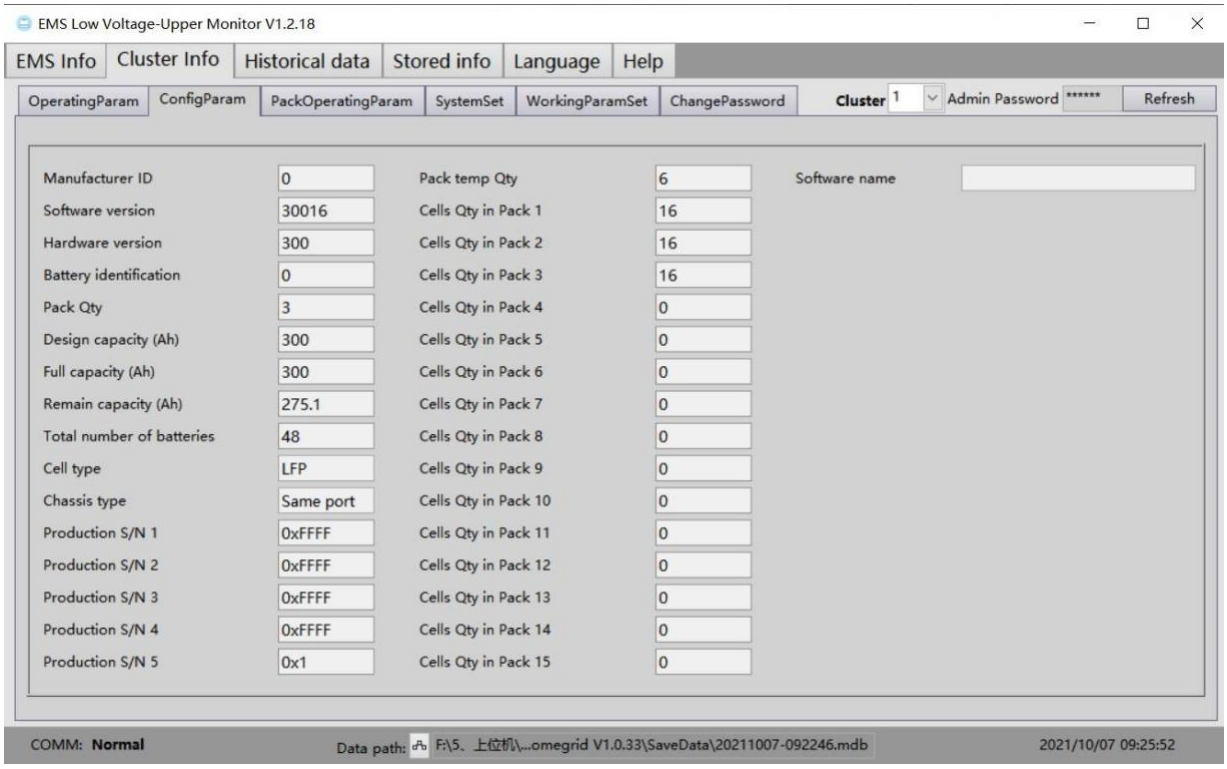



*Figure3.1: Monitoring Software Cluster Matching parameters*

NOTE:

- *The above contents only show the basic functions and operations of the monitoring software EMS tool. For more information contact HomeGrid..*

# 4. Matching the Controller to the Inverter

## 4.1. Supported brands

A Stack'd system must be connected to an inverter to convert the DC power from the batteries to AC current to run things like lights, appliances, and HVAC units. At other times, the inverter will provide DC power to recharge the batteries. The Stack'd Controller Module can exchange information with a smart inverter regarding desired voltages, currents, and other information.

HomeGrid has programmed the Stack'd system to work with smart inverters from several companies. All the installers must do is connect the controller to the inverter with the proper cable and select the proper inverter protocol as shown in Section 2.5.

HomeGrid will program future Stack'd systems to work with more inverters. Check our official website for the up-to-date list.


## 4.2. Inverter matching list

The list tab only lists the inverter manufacturers one of the same series products, general inverter manufacturers in the same series of other products, the communication protocol are the same, so our battery can be communicated with the other products of same series inverter, if encounter a series of products can't communication, please contact us.

The following inverter matching list may not be up to date. The list may change according to the software version upgrade, and the reference manual may does not change immediately according to the software version upgrade. Therefore, if the user wants to get the latest inverter matching support, please browse the official website to check the relevant documents。

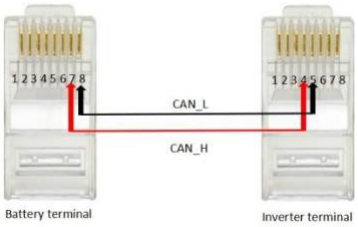
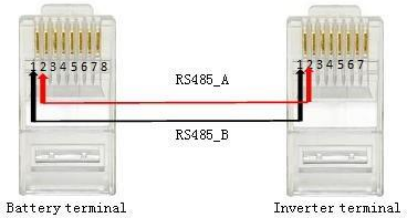
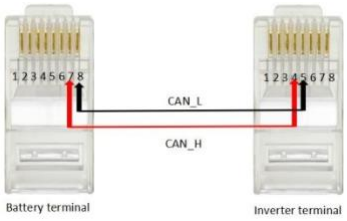
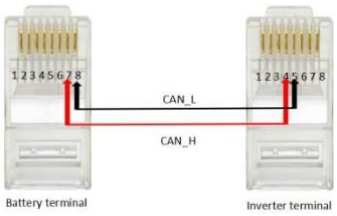
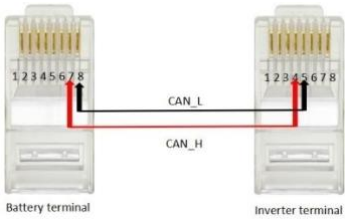
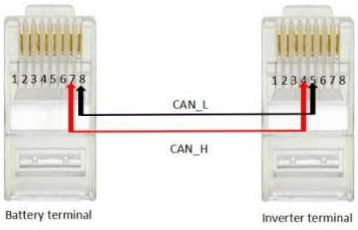
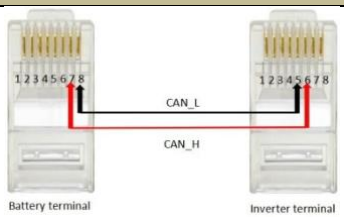
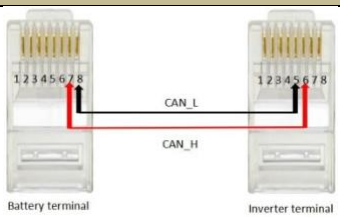
The inverter manufacturer may upgrade its software version, which may cause problems in the communication between our battery and the inverter. Therefore, before communicating with the inverter, please confirm whether the software version of the inverter is consistent with the list. If not, please contact us.

| Inverter | | | Communication mode |
|---|---|---|---|
| **Brand** | **Type** | **Protocol Version** | |
| Growatt | SPF12KT HVM | V1.22 | RS485 |
| | SPH3000 | V1.26 | CAN |
| Studer | Xtender-XTH-8000-48 | V1.0.3 | Xcom-CAN |
| Sofar | HYD5000-ES | V6.0 | CAN |
| Solis | RHI-5K-48ES | V1.2 | CAN |
| Goodwe | GW5048-EM | V1.5 | CAN |
| Victron | MultiPlus-II | V6.0 | CAN |
| DEYE | SUNSYNK-5K-SG01LP1 | V1.5 | CAN |
| SMA | S16.0H-12 | V2.0 | CAN |
| Sermatec | SMT-5K-TL-UN | V1.2 | CAN |
| Schneider | Conext Gateway | V2.0 | CAN |
| Li_PLUS | ZR Standard | V1.2 | CAN |
| Sol-ark | Sol-ark-12k | V1.31 | CAN |
| GreenCell | PV1800VHM | V1.04.04 | CAN |
| Must | PV1800VHM | V1.04.04 | CAN |

## 4.3. Connection with the inverter

This section describes how to connect the Controller to inverters. Manufacturers may upgrade their products resulting in hardware communication interface changes. If communication is not possible in the application according to the following wiring method, please contact us.

The CAN/RS485 communication port of HomeGrid is connected to the communications interface of inverter.

<table>
<tr><th>Connect to the Victron inverter</th><th>Connect to the DEYE inverter</th></tr>
<tr><td></td><td> 
</td></tr>
<tr><th>Connect to the Growatt inverter</th><th>Connect to the Sofar inverter</th></tr>
<tr><td> 
</td><td></td></tr>
<tr><th>Connect to the Solis inverter</th><th>Connect to the  Goodwe inverter</th></tr>
<tr><td> 
</td><td> 
</td></tr>
<tr><th>Connect to the Sermatec inverter</th><th>Connect to the Sol-ark-12k inverter</th></tr>
<tr><td> 
</td><td> 
</td></tr>
<tr><th>Connect to the GreenCell inverter</th><th>Connect to the Must inverter</th></tr>
<tr><td> 
</td><td> 
</td></tr>
</table>

***NOTE:***

*●The above CAN and RS485 communication connections are not connected the ground wire. In the presence of high interference, adding a ground wire is recommended.*

# 5. Safe handling of lithium batteries Guide

## 5.1. Schematic Diagram of Solution

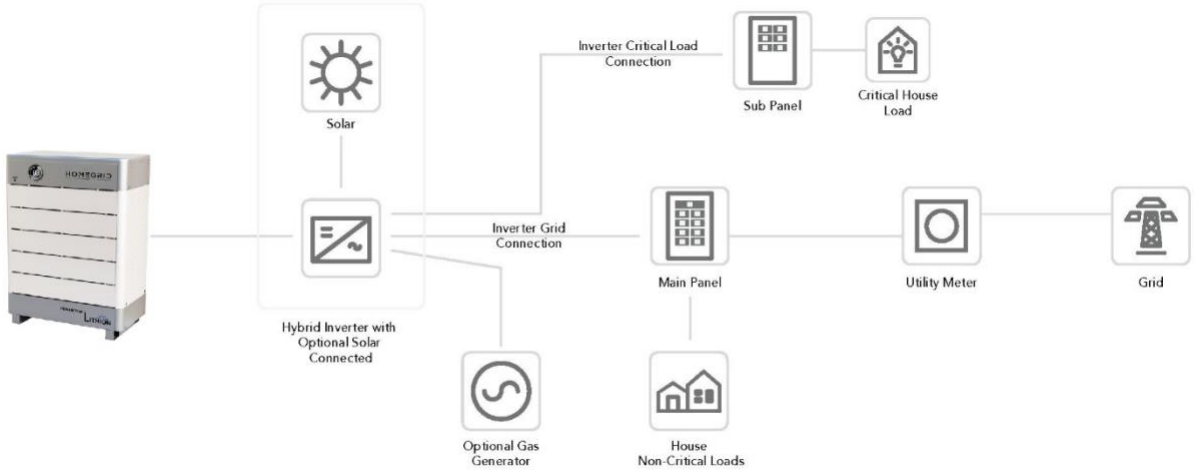



*Figure5.1.1.Schematic diagram of solution*

## 5.2. Unpacking the system

Be careful when unpacking the system. Each module is heavy and requires at least two people to lift.


*Figure5.2.1. Side view of the entire system*

## 5.3. Precautions before installation

Before installation, be sure to read the contents in Chapter 1 Safety Precautions, which is related to the operation Safety of installation personnel, please pay attention to.

## 5.4. Tools

The following tools are required to install the battery pack:

Wire cutter

Cable clamp

Screwdriver

***NOTE:***

●*Use properly insulated tools to prevent accidental electric shock or short circuits. If insulated tools are not available, cover the entire exposed metal surfaces of the available tools, except their tips, with electrical tape.*

## 5.5. Safety Gear

It is recommended to wear the following safety gear when dealing with the battery pack:


Insulated gloves

Safety goggles

Safety shoes

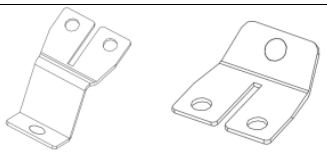
# 6. Installation

## 6.1. Package Items

Unpacking and check the Packing List:

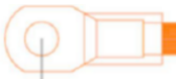
1）PACKING LIST

After receiving the system, please check to ensure that all the following components are not lost or damaged

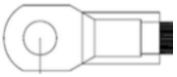
| | | |
|---|---|---|
|  ESSsystem×1 |  Positive negative terminals ×2 |  Battery terminal ×2 |
|  Main control fixing bracket×2 |  M8*16x2 |  M6*10x6 |
|  M4*10x8 |  M3*12x15 |  User's manual |

2) Connector

Each system will come with a positive connector and a negative connector. The two connectors are not connected to a cable, so users can use the appropriate cable for the actual application.

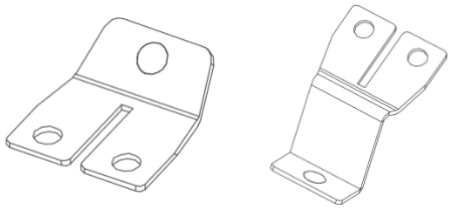


Positive connector



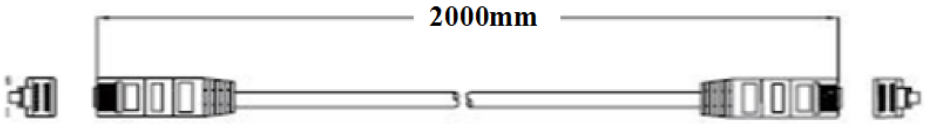
Negative connector

| Model | Nominal voltage (Vdc) | Cable specification | |
|---|---|---|---|
| | | AWG | mm² |
| PF5-LFP04800-2A01 | 51.2Vdc | 4 | 25 |
| PF5-LFP09600-2A01 | 51.2Vdc | 1/0 | 50 |
| PF5-LFP14400-2A01 | 51.2Vdc | 3/0 | 95 |
| PF5-LFP19200-2A01 | 51.2Vdc | 4/0 | 120 |



Positive Busbar Negative Busbar

3) Communication connecting line between system and inverter (Optional)




## 6.2. Installation Location

Make sure that the installation location meets the following conditions:

1. The location drains properly, there are no puddles.
2. The floor is flat and level, and capable of supporting the weight of the system. (See Section 2.3)
3. There are no flammable or explosive materials nearby.
4. The ambient temperature is between 0°C and 50°C.
5. The temperature and humidity are maintained at a constant level.
6. There is minimal dust and dirt in the area.
7. Any heat source is at least 2 meters away.
8. The distance from the exhaust air of the inverter is at least .5 meters.
9. The installation must be protected from the environment.
10. Do not cover or wrap the battery case or cabinet.
11. Do not place where there are children or pets.
12. Do not install in direct sunlight.

There is no ventilation required for the ESS, but due to the heat given off from the battery and inverters take note when installation in a small space or closed off area. Avoid areas of high salinity, humidity, or temperature.

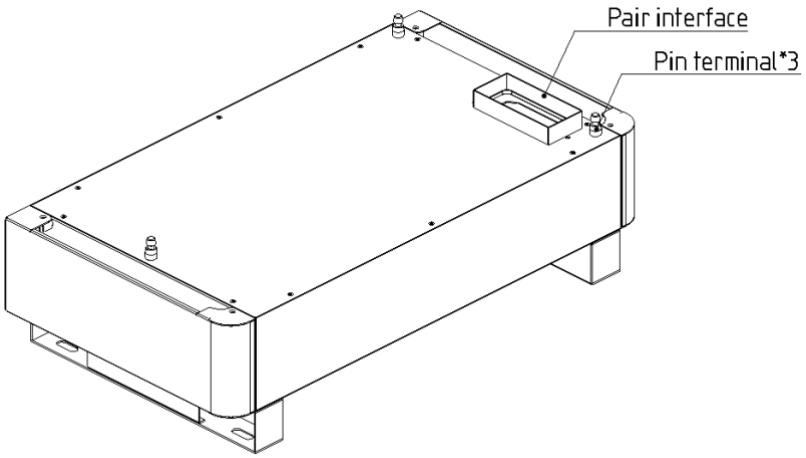
**CAUTION**

If the ambient temperature is outside the operating range the battery pack will stop operating to protect itself. The optimal temperature range for the battery pack to operate is 0°C to 55°C. Frequent exposure, to harsh temperatures may reduce the performance and life of the battery pack.

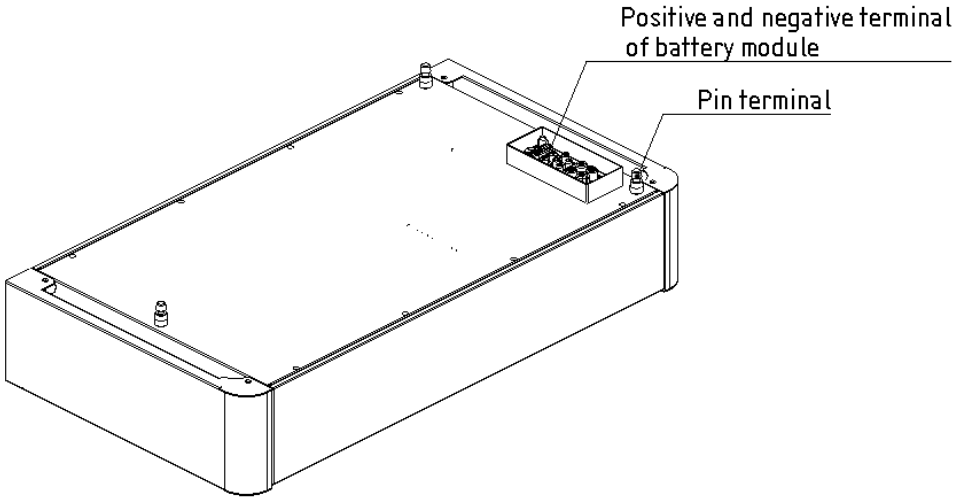
## 6.3. Installation

A. Stack the entire system. The modules are heavy and require at least two people to lift.

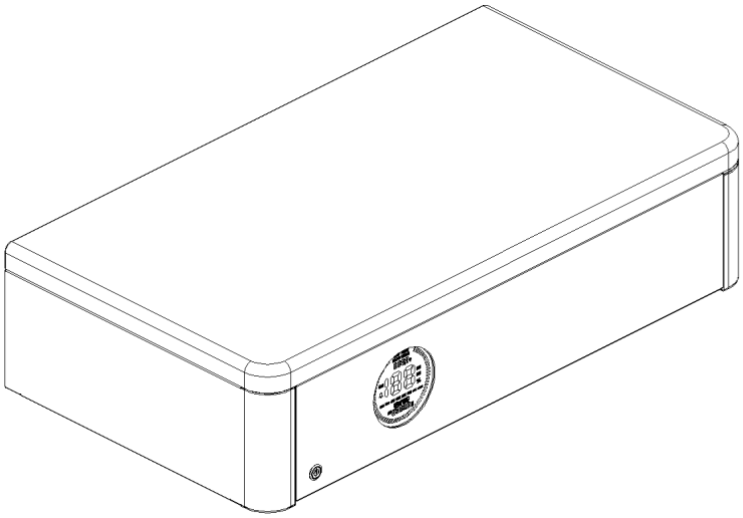
(1) Place the system base at the bottom



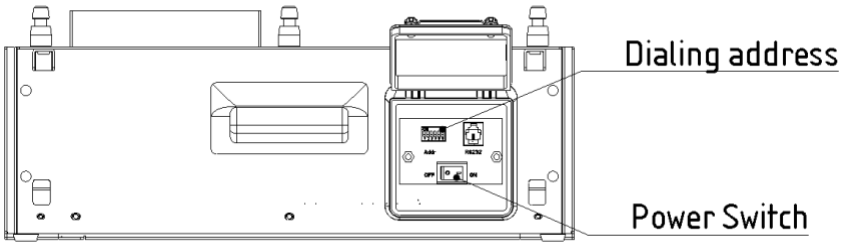

(2) Stack the battery modules one by one. The guide pins will make sure that the connectors mate properly.



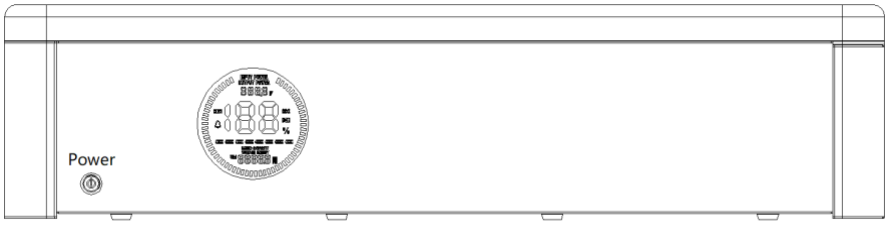

(3) Finally, place the main control module at the top of the system



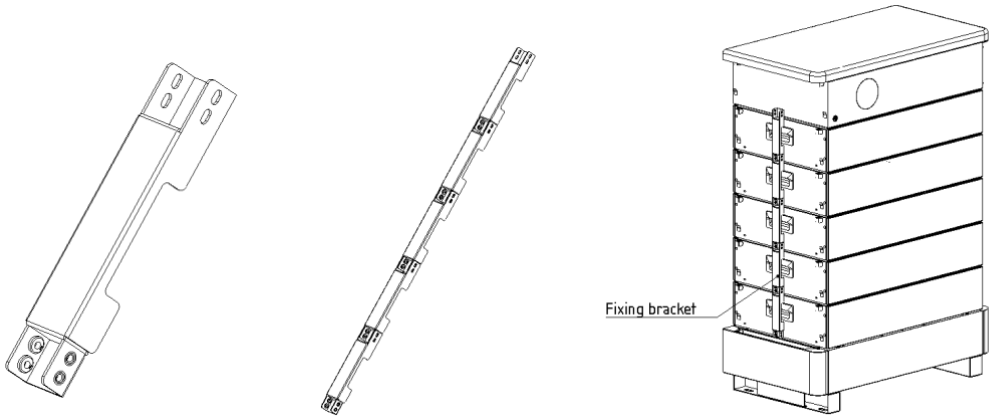
(4) When the stack is complete set the battery module addresses as described in Section 2. Turn on the power switch on each module, beginning with the one on the bottom.



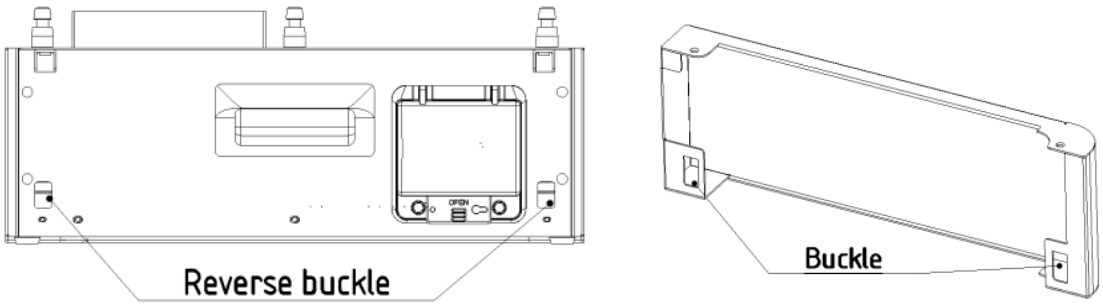

(5) Turn on the power switch on the controller module. Observe that the display screen has no alarm protection status, the number of battery modules has no loss and flicker, and the system parameters and status display are normal. The display will indicate the number of battery modules that the controller has found.




（6）Assemble the fixing brackets for the battery module accessories into a long strip and mount them in the middle of the left-hand side of the system.

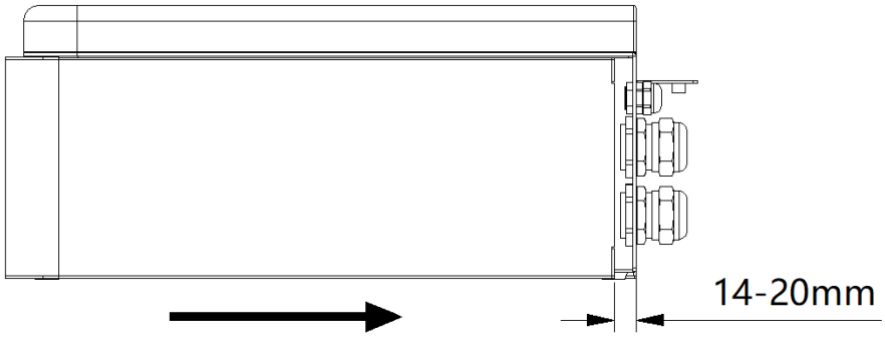



（7）After normal operation, the system protection side plate shall be installed on the battery module and the main control device to prevent scratches and bumps inside the battery Connect and fix the barbs at both ends of the battery module with the snap of the protective side plate




（8）Install the protective side plate and fix the screws, the right side of the main control board shall be 14~20mm away from the side of the main control box and put the side plate to the right against the box until it is closed. Finally, completing the installation of the main

control side plate.



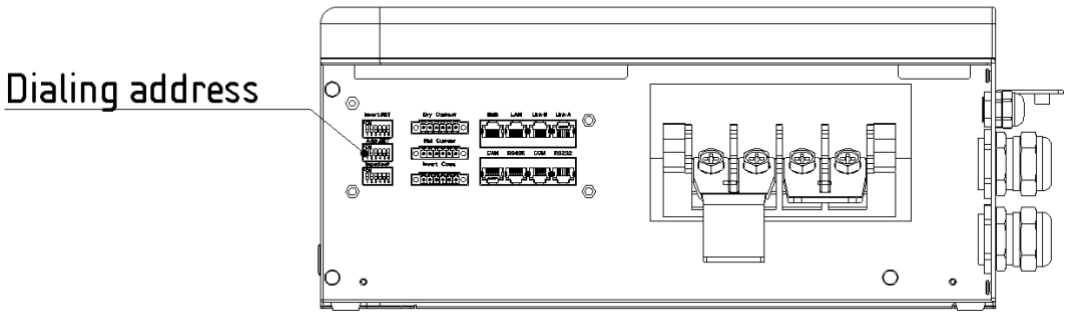

***NOTE:***

●*Before starting the system, the operator should strictly check the connection terminal to ensure that the terminal is firmly connected, check whether the battery address is set correctly, and whether the inverter switches are in the off state. Do a good job in safety protection and turn on the inverter in the following order. The battery module bottom insulation skin should be removed.*

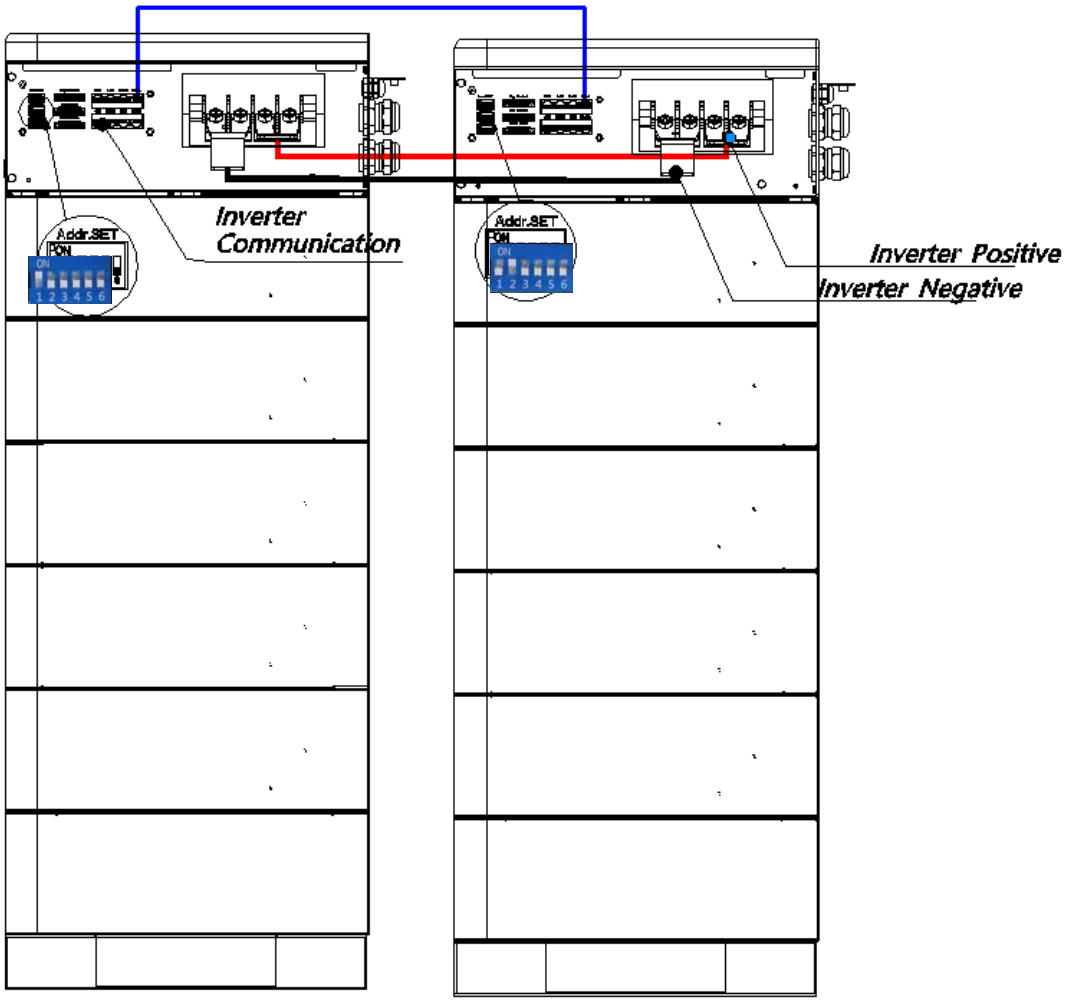
B. Parallel connection

Check all connection terminals and communication lines carefully.

(2) The main control address shall be set to "1" for communication between the main control and the inverter (a host system can be configured with up to 15 slave systems). Turn off the main control switch before connecting the inverter




(3) Connect the parallel port of the slave to the communication cable of the host, connect the positive pole of the slave to the positive pole of the host, connect the negative pole of the slave to the negative pole of the host, connect the parallel cable of the slave to the host, and finally connect the communication cable of the host to the frequency converter. Battery stack units should be installed a minimum of 6” apart.



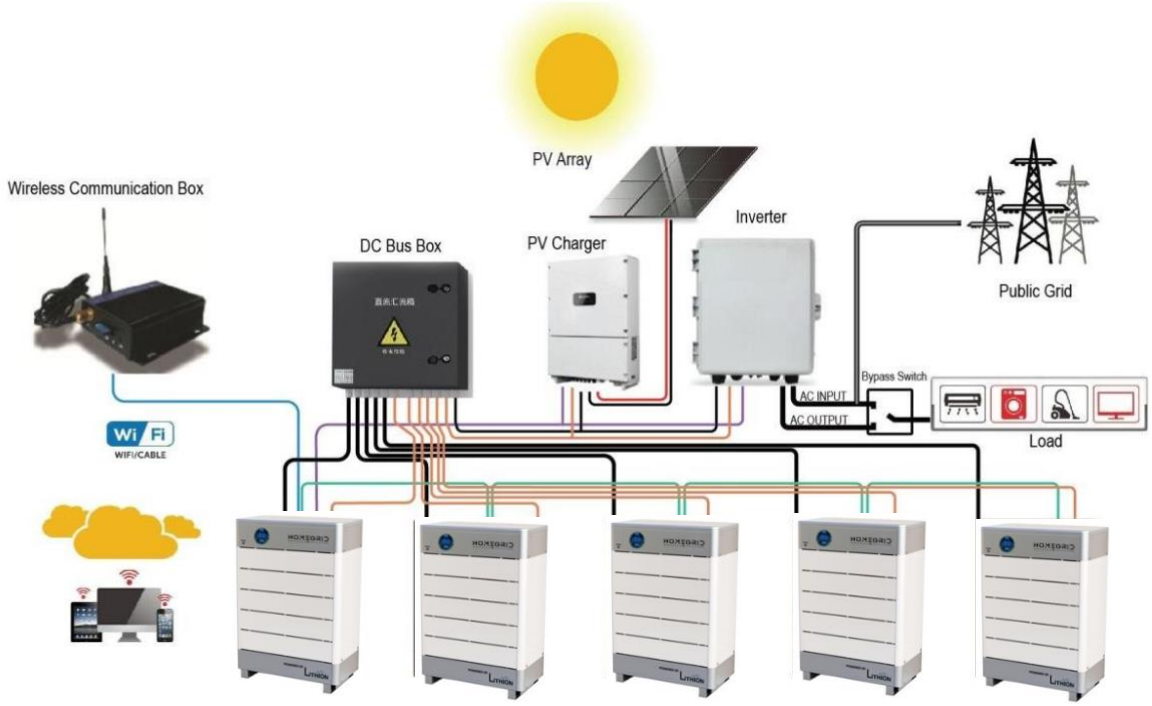




*Figure5.4. Schematic diagram of parallel solution*

*Note: after installation please contact the supplier to register online for full warranty.*

# 7. Trouble Shooting Steps

## 7.1. Problem determination based on

1) Whether the battery can be turned on or not.

2) If battery is turned on, check the red light is off, flashing or lighting.

3) If the red light is off, check whether the battery can be charged/discharged or not.

## 7.2. Preliminary determination steps

1) The system cannot be turned on and the system display is not illuminated. If the external switch of the system is turned on and the external power supply voltage exceeds 48V, the system still cannot be started and operated, please contact the dealer.

2) The system can be turned on, but the display shows a fault and cannot be charged or discharged. If the red light is on, it indicates that the system is abnormal. Please check the following values:

- Temperature: Above 55℃ or under -20℃ , the system could not work in discharging. Above 55℃ orunder0℃, the system could not work in charging.
- Current: If current is greater than300A, battery protection will turn on.

  Solution: Check whether current is too large or not, if it is, to change the settings on power Supply side.
- High Voltage: If charging voltage above 55.5V, battery protection will turn on.

  Solution: Check whether voltage is too high or not, if it is, to change the settings on power supply side.
- Low Voltage: When the battery discharges to 40.5V or less, battery protection will turn on.

  Solution: Charge the battery.

  Excluding the four points above, if the faulty is still cannot be located, turn off battery and repair.

## 7.3. The battery cannot be charged or discharged

1) Cannot be charged:

Disconnect the power cables, measure voltage on power side, if the voltage is 53~54V restart the battery, connect the power cable, and try again, if still not work, turn off battery and contact distributor.

2) Unable to discharge:

Disconnect the power cables and measure voltage on battery side, if it is under 44V please charge the battery; if voltage is above 48V and still cannot discharge, turn off battery and contact distributor.

# 8. Storage, Transportation and Emergency Situations

## 8.1. Storage

Recharge and maintain the battery pack regularly every three months to ensure the battery is in the best condition.

## 8.2. Emergency Situations

1) Leaking Batteries

If the battery pack leaks electrolyte, avoid contact with the leaking liquid or gas. If one is exposed to the leaked substance, immediately perform the actions described below. Inhalation: Evacuate the contaminated area and seek medical attention.

Contact with eyes: Rinse eyes with flowing water for 15 minutes and seek medical attention.

Contact with skin: Wash the affected area thoroughly with soap and water and seek medical attention.

Ingestion: Induce vomiting and seek medical attention.

2) Fire

NO WATER! Only dry powder fire extinguisher can be used; if possible, move the battery pack to a safe area before it catches fire.

3) Wet Batteries

Contact HomeGrid immediately if the if the battery pack is wet or submerged in water.

4) Damaged Batteries

Damaged batteries are dangerous and must be handled with extreme care. They are not suitable for use and may cause danger to persons or property. Contact HomeGrid immediately if the battery pack is damaged.

***NOTE:***

- Damaged batteries may leak electrolyte or produce flammable gas.
- In case a damaged battery needs recycling; follow the local recycling regulation (i.e. Regulation (EC) Nº 1013/2006 among European Union) to process and use the best available techniques to achieve a relevant recycling efficiency.
- Any further questions, please contact HomeGrid: info@homegridenergy.com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