

# Residential/Small C&I ESS

## CFE-XH User Manual



# Contents

|   |    |
|---|----|
| Definition of terms .....                                   | 1  |
| 1 Summary .....   | 2  |
| 1.1 Scope of application .....                              | 2  |
| 1.2 Applicable objects .....                                | 2  |
| 1.3 Description of users .....                              | 2  |
| 1.4 Disclaimer .....  | 2  |
| 2 Safety Instructions .....                                 | 3  |
| 2.1 Labeling instructions .....                             | 3  |
| 2.2 Installation tools .....                                | 4  |
| 2.3 Precautions .....                                       | 4  |
| 2.3.1 Custody of manuals .....                              | 4  |
| 2.3.2 Protection of product characteristics .....           | 4  |
| 2.3.3 Operator requirements .....                           | 4  |
| 2.3.4 Security warnings .....                               | 5  |
| 2.3.5 Electrical measurements .....                         | 5  |
| 2.3.6 Measuring tools .....                                 | 5  |
| 2.3.7 Maintenance .....                                     | 5  |
| 3 Main Components .....                                     | 6  |
| 4 Product Description .....                                 | 7  |
| 4.1 Product introduction .....                              | 7  |
| 4.2 System specifications .....                             | 7  |
| 5 Battery Pack Introduction .....                           | 9  |
| 5.1 Battery pack specifications .....                       | 9  |
| 5.2 Illustrations and panel descriptions .....              | 9  |
| 5.2.1 Appearance and interface description .....            | 9  |
| 5.3 Communication Interface Diagrams and Descriptions ..... | 10 |
| 6 System Installation .....                                 | 12 |
| 6.1 Handling, transportation, storage .....                 | 12 |
| 6.1.1 Handling .....  | 12 |
| 6.1.2 Transportation .....                                  | 12 |
| 6.1.3 Storage .....   | 12 |
| 6.2 Unpacking and inspection .....                          | 13 |
| 6.3 Mechanical Installation .....                           | 13 |
| 6.3.1 Installation requirements .....                       | 13 |
| 6.3.2 Installation steps .....                              | 13 |
| 6.3.3 Installation of high voltage box .....                | 16 |

|  |    |
|--|----|
| 6.3.4 Fixed installation of systems .....        | 17 |
| 6.4 Electrical Installation .....                | 17 |
| 6.4.1 Introduction to tools .....                | 17 |
| 6.4.2 Cable connections .....                    | 17 |
| 6.5 System Startup .....                         | 18 |
| 6.5.1 Start-up checks .....                      | 18 |
| 6.5.2 System startup .....                       | 18 |
| 6.5.3 System shutdown .....                      | 18 |
| 6.5.4 System charging .....                      | 19 |
| 7 Display and computer software .....            | 20 |
| 7.1 Introduction to Liquid Crystal Display ..... | 20 |
| 7.1.1 Introduction to the screen .....           | 20 |
| 7.1.2 Screen wakeup and shutdown .....           | 20 |
| 8. Maintenance .....                             | 21 |
| 8.1 Alarm description and handling .....         | 21 |
| 8.2 Faults and solutions .....                   | 21 |
| 8.3 Daily maintenance .....                      | 22 |
| 9 Notes and Warranty .....                       | 23 |
| 9.1 Notes .....                                  | 23 |
| 9.2 Warranty statement .....                     | 23 |

## Definition of terms

The following acronyms and abbreviations are used throughout this manual.

|                |                               |
|----------------|-------------------------------|
| BMS            | Battery Management System     |
| SOC            | Percentage of charge capacity |
| SOH            | State of health               |
| DOD            | Depth of discharge            |
| Battery Module | Battery pack                  |

## **1 Summary**

### **1.1 Scope of application**

This manual describes information about the Household/Small Commercial and Industrial Energy Storage System product, including product specifications, operating specifications, product maintenance, and other related information. For details on the operation, installation and use of the product, please refer to this user manual.

### **1.2 Applicable objects**

This manual is intended for specialized technicians who install, operate and maintain batteries, as well as for end users who may need to review relevant technical data. Any operator must be qualified for electrical work.

### **1.3 Description of users**

Before you operate an energy storage system installation, you should be well trained and read the manual carefully to make sure that the person using the product fully understands it. Eliminate any possible risk of metal short circuiting gems, watches, pens, metal bars, etc. Once you have read it, keep it in a safe place for future reference.

### **1.4 Disclaimer**

Failure to operate this product properly may result in serious injury to yourself or others, or damage to the product or property. Upon use, you will be deemed to have understood, recognized and accepted all the terms and contents of this document. The user undertakes to be responsible for his/her own behavior and all consequences arising therefrom. The Company is not responsible for all damages caused by the user's non-compliance with the provisions of this document and the User Manual.

The contents of this manual are subject to constant updating and revision and are updated, revised or terminated without prior notice. Therefore, please visit our official website or obtain the latest product manual through your local dealer.

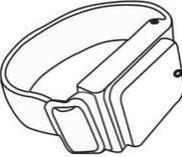
## 2 Safety Instructions

### 2.1 Labeling instructions

In order to ensure the user's personal safety when using this product, this manual provides relevant identifying information and uses appropriate symbols to alert the user, who should carefully read the following list of symbols used in this manual.

|   |   |
|---|---|
|    | Potentially low risk: may cause mild or moderate impairment if not avoided      |
|    | High risk: may result in serious injury or death if not avoided                 |
|    | The battery terminals must be disconnected before starting work on the battery  |
|    | If the battery is dropped or crushed, it may explode and/or be severely damaged |
|    | Batteries can explode if exposed to open flames or other extreme heat sources   |
|   | Grounding: For operator safety, the system must be securely grounded.           |
|  | This side should be up.   |
|  | Handle with care to avoid damage  |
|  | Keep it dry   |
|  | Keep batteries away from children   |
|  | Do not short-circuit  |
|  | Do not reverse the positive and negative terminals                              |

## 2.2 Installation tools

|  |  |  |   |
|--|--|--|---|
|   |   |    |  |
| Multimeter   | Protective gloves  | Vandal-resistant insulated shoes   | Protective clothing   |
|   |   |    |  |
| Safety glasses   | Antistatic Wrist Strap   | Electric screwdrivers  | Phillips screwdriver  |
|  |  |  |   |
| Socket wrench  | Zigzag screwdriver   | Wire stripper  |   |

## 2.3 Precautions

### 2.3.1 Custody of manuals

This manual contains important information about residential/small commercial and industrial energy storage systems. Careful reading of this manual will help you familiarize yourself with this product, and it should be kept in a safe place so that maintenance personnel have ready access to it when needed.

### 2.3.2 Protection of product characteristics

Warning labels, back panels and cabinet front doors contain important safety and protection information and are strictly prohibited from being torn or damaged.

### 2.3.3 Operator requirements

Only trained and qualified professionals should perform the various operations on the product: the product operator should be fully familiar with the system components and operating principles of the product and understand the product's user manual.

### 2.3.4 Security warnings

 During the installation, routine maintenance, overhaul and other operations of the product, in order to prevent misoperation, proximity or accidents of unrelated personnel, the following agreements should be observed: the front and rear switches of the product should be clearly labeled to prevent accidents caused by misoperation of the switches; warning signs or safety warning tapes should be set up near the operation area to prevent the proximity of unrelated personnel.

### 2.3.5 Electrical measurements

 Since the high voltage of the battery may jeopardize personal safety, and accidental contact may cause serious injury, when you need to perform measurement operations, please insulate well (e.g., insulated gloves).

### 2.3.6 Measuring tools

 Ensure that the electrical installation meets the requirements, use relevant electrical measuring equipment such as a multi-meter, wattmeter, etc.

### 2.3.7 Maintenance

 During maintenance and repair operations, it should be ensured that the storage battery cabinet is not accidentally charged; a multi-meter should be used to ensure that there is no electricity in the storage battery cabinet; insulating materials should be used to insulate possible electrical parts of the system; and it should be ensured that the system has the necessary grounding connections.

### 3 Main Components

The core components of the battery pack are shown in Table 3-1 below:

Table 3-1 Main Component

| NO. | Project name        | Photos   |
|-----|---------------------|--|
| 1   | Pack 102.V/100Ah    |    |
| 2   | Battery system      |   |
| 3   | Cable               |  |
| 4   | Communication Cable |  |

## 4 Product Description

### 4.1 Product introduction

Stackable residential energy storage products are modular products designed for energy storage applications and are widely used in small and medium sized energy storage systems. A single module consists of batteries, BMS and housing, and the BMS in each module has independent voltage, current, temperature detection and protection functions. By changing the number of modules in series, the optimal configuration of the entire energy storage system can be realized.

### 4.2 System specifications



Figure 4-1 Modular Stacked Illustration

Table 4-1 Stacked Battery System Parameters

| Model                         | XH-20                                   | XH-30        | XH-40        | XH-50        | XH-60        |
|-------------------------------|---|--------------|--------------|--------------|--------------|
| <b>Stacked PDU</b>            |   |              |              |              |              |
| Model                         | CFE-PDU750-100-GR                       |              |              |              |              |
| Communication method          | CAN/RS485/WiFi (Optional)               |              |              |              |              |
| Installation method           | Racks                                   |              |              |              |              |
| Humidity                      | 0 ~ 95% RH                              |              |              |              |              |
| Altitude                      | ≤2000m                                  |              |              |              |              |
| Withstanding voltage level    | 750V DC                                 |              |              |              |              |
| Rated current                 | 100A(Charge & Discharge Rate of 1C)     |              |              |              |              |
| Size                          | 442*580*133mm                           |              |              |              |              |
| <b>Rack batteries</b>         |   |              |              |              |              |
| Battery Type                  | LiFePO4                                 |              |              |              |              |
| Model                         | CFE-PA102-100-GR                        |              |              |              |              |
| Capacity                      | 20.48kWh                                | 30.72kWh     | 40.96kWh     | 51.20kWh     | 61.44kWh     |
| Battery voltage               | 204.8V                                  | 307.2V       | 409.6V       | 512.0V       | 614.4V       |
| Capacity                      | 100Ah                                   |              |              |              |              |
| Size(mm)                      | 442*580*222                             |              |              |              |              |
| <b>Electrical parameters</b>  |   |              |              |              |              |
| Voltage range                 | 172.8-230.4V                            | 259.2-345.6V | 345.6-460.8V | 432-576V     | 518.4-691.2V |
| Rating charging current       | 50A                                     |              |              |              |              |
| Max. charging current         | 100A                                    |              |              |              |              |
| Rated discharge current       | 100A                                    |              |              |              |              |
| Max. discharge current        | 120A                                    |              |              |              |              |
| <b>Other parameters</b>       |   |              |              |              |              |
| Size(mm)                      | 576*582*804                             | 576*582*1034 | 576*582*1264 | 576*582*1494 | 576*582*1724 |
| Communication method          | CAN/RS485                               |              |              |              |              |
| Charging temperature range    | 0 ~ +45℃                                |              |              |              |              |
| Discharging temperature range | -10 ~ +45℃                              |              |              |              |              |
| Humidity                      | 5 ~ 95% RH                              |              |              |              |              |
| Altitude                      | ≤2000m                                  |              |              |              |              |
| Installation method           | Racks & cabinet                         |              |              |              |              |
| Cycle life                    | ≥8000 Cycles (@25±2℃, 0.5C/0.5C,80%DOD) |              |              |              |              |

## 5 Battery Pack Introduction

### 5.1 Battery pack specifications

The household/small industrial and commercial energy storage system adopts lithium iron phosphate batteries with the highest safety performance. Each battery pack has a built-in independent fire protection system. The system can realize real-time monitoring of voltage, current and temperature, and has a passive balancing function, which can effectively improve the battery performance.

Table 5-1 Module parameters

| Model            | Voltage | Capacity | Energy  | Size(W*D*H)   | Weight |
|------------------|---------|----------|---------|---------------|--------|
| CFE-PA102-100-GR | 102.4V  | 100Ah    | 10240Wh | 442*580*225mm | 85kg   |

### 5.2 Illustrations and panel descriptions

#### 5.2.1 Appearance and interface description

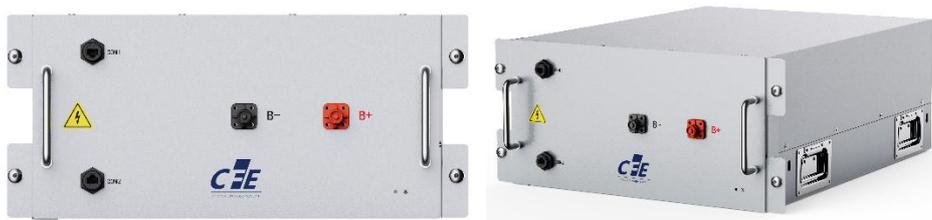


Figure 5-1 Battery Pack Appearance

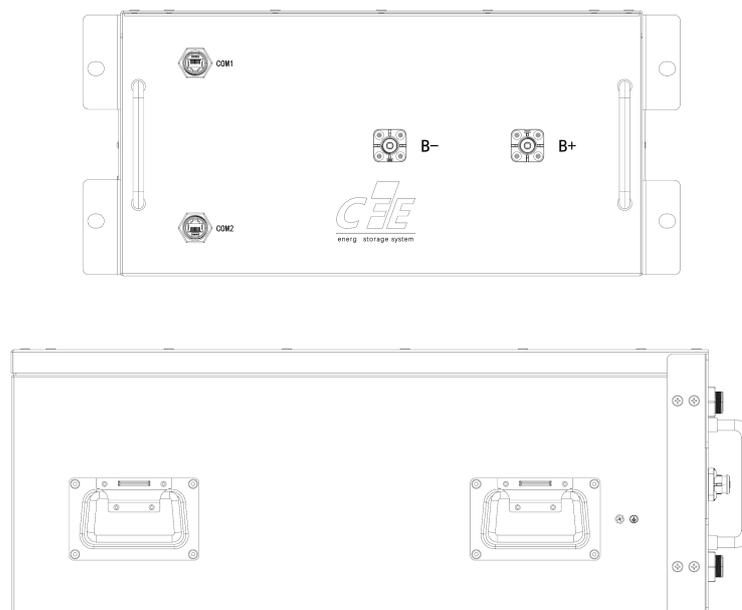


Figure 5-2 Battery Module Interface

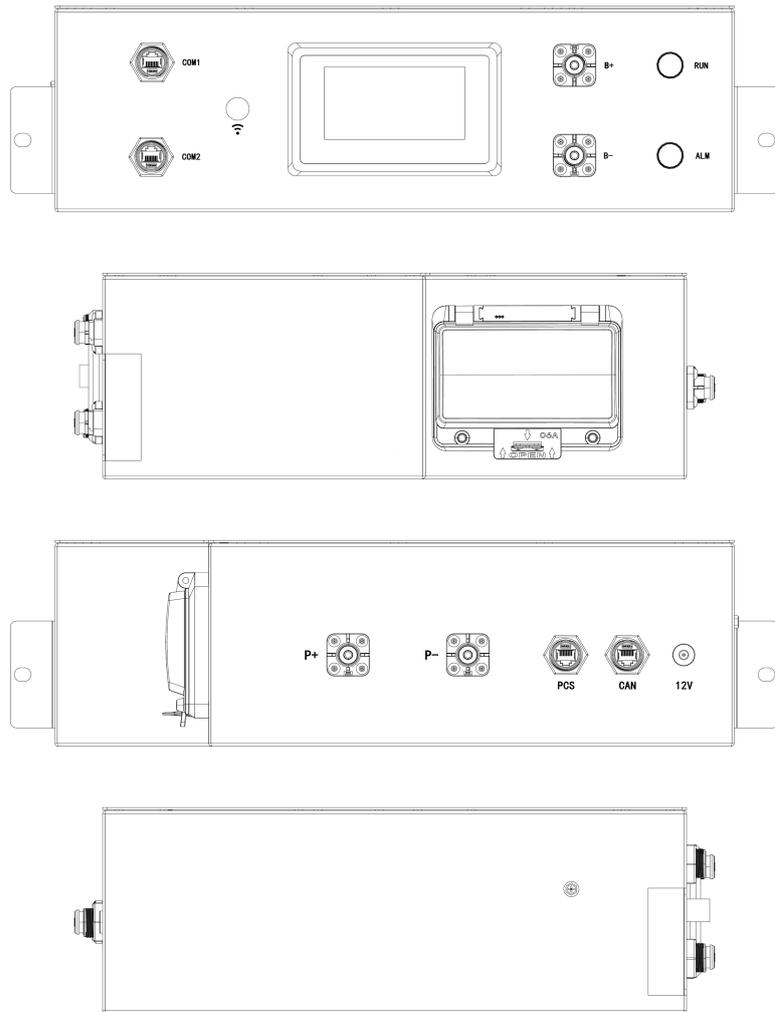


Figure 5-3 High Voltage Box Interface

### 5.3 Communication Interface Diagrams and Descriptions

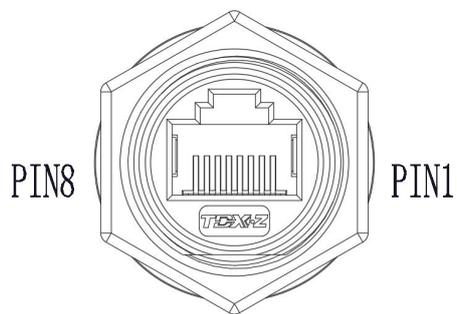


Figure 5-4 Communication Interface Diagram

Table 5-2 Communication Interface Definitions

| Interface definition |          |       |          |          |
|----------------------|----------|-------|----------|----------|
|                      | COM1     | COM2  | PCS      | CAN      |
| 1                    | PCS-485A | IP-IN | PCS-485A | PCS-485A |
| 2                    | PCS-485B | IM-IN | PCS-485B | PCS-485B |
| 3                    | CAN1G    |       | CAN1G    | CAN1G    |
| 4                    | CAN1H    |       | CAN1H    | CAN1H    |
| 5                    | CAN1L    |       | CAN1L    | CAN1L    |
| 6                    | PCS-485G |       | DIN-IN2  | HSS1     |
| 7                    | CAN0H    |       | GND      | GND      |
| 8                    | CAN0L    |       | GND      | GND      |

## 6 System Installation

### 6.1 Handling, transportation, storage

#### 6.1.1 Handling

 Rough handling may cause short-circuiting or damage to the battery pack, resulting in battery leakage or fire. Forklifts or carts should be used for handling. Transported materials should not exceed the width and height of aisles and doors, and should be transported at moderate speeds. Avoid inverted and stacked batteries when unloading.

#### 6.1.2 Transportation

 Due to the large weight of battery components, in order to ensure safety, it is recommended to use a forklift that meets the requirements for movement and transportation, and should avoid dropping and throwing; the transportation process should prevent equipment collision and strong vibration.



Figure 6-1 Diagram of Handling Tools

#### 6.1.3 Storage



Short-term storage (within 3 months). If the battery is not to be used for a short period of time, it can be stored fully charged in a dry, cool, non-corrosive gas, temperature 10-45°C, relative humidity 60±30%, and in a place free from strong electromagnetic fields and direct sunlight.



Long-term storage (more than 3 months). If the battery is not used for more than 3 months, please keep the SOC of the battery at 50%~70%, store it in a dry, cool, non-corrosive gas, temperature 20~35°C, relative humidity 50±15%, no strong electromagnetic field and direct sunlight, and make sure to recharge the battery every 6 months to avoid irreversible loss of capacity caused by long-term storage.

## 6.2 Unpacking and inspection

Table 6-1 Unpacking Tool List

|   |   |  |   |
|---|---|--|---|
|  |  |  |  |
| Zigzag screwdriver  | protective glove  | Wire stripper  | Hammers   |

**!** The products are strictly tested and inspected before leaving the factory. Please sign the receipt after inspection. If the product is damaged, please contact your local dealer. Please open the box and check: whether the outer package is intact or damaged; whether the internal equipment is damaged.

## 6.3 Mechanical Installation

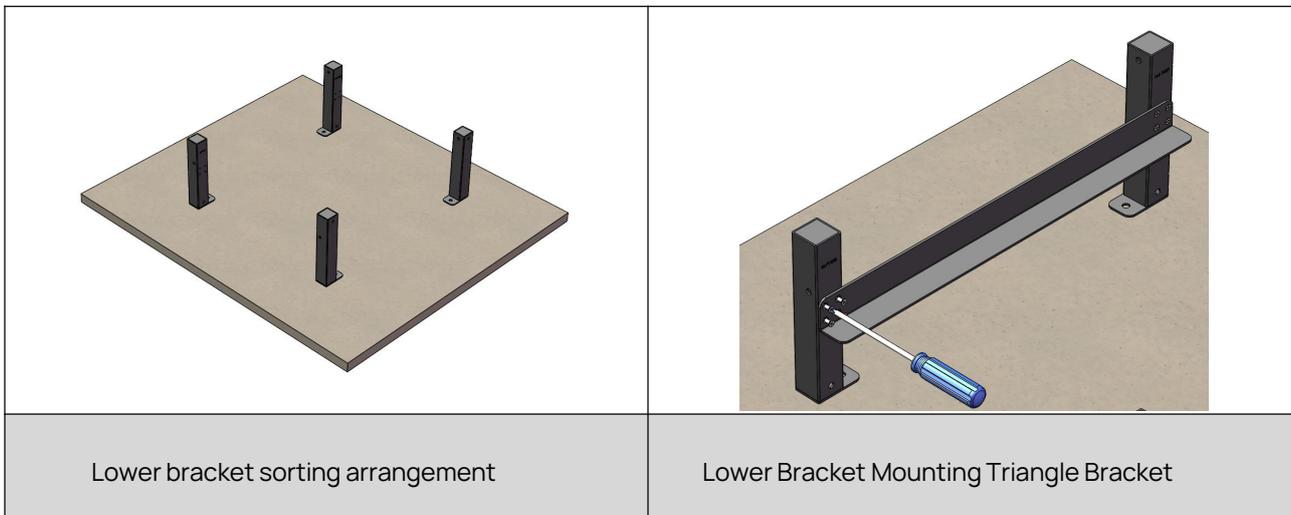
### 6.3.1 Installation requirements

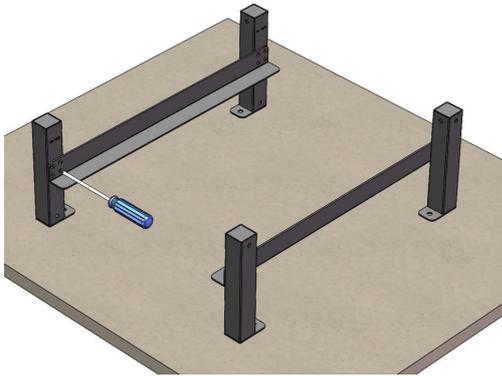
The mounting location of a household/small commercial and industrial energy storage system has a direct impact on its safety, service life and performance. It should be ensured that the system is conveniently wired for easy maintenance and operation, and it should be avoided that the energy storage system mounting base is placed in a high temperature and high humidity environment. The levelness of the installation floor should be ensured.

### 6.3.2 Installation steps

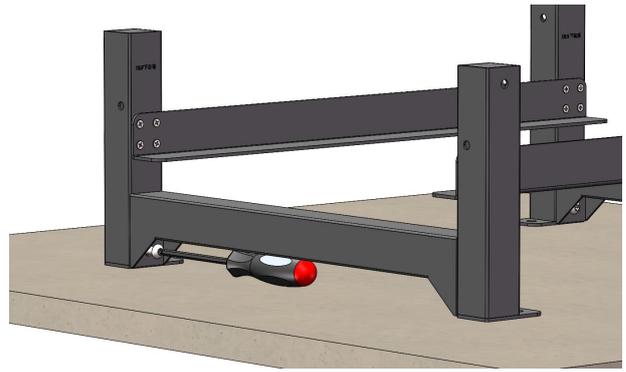
**!** Remove the lower stand from the box and place it on a flat surface. The product's structural design requires that the base be secured to the ground with screws.

Use manual or machine to carry the module according to the actual situation of the installation site; it is recommended that at least four people lift it together and wear anti-smash shoes and non-slip gloves during installation.

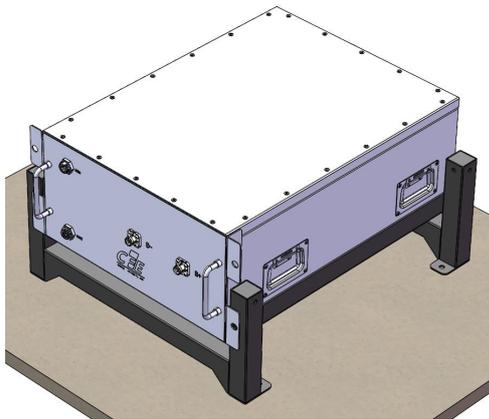




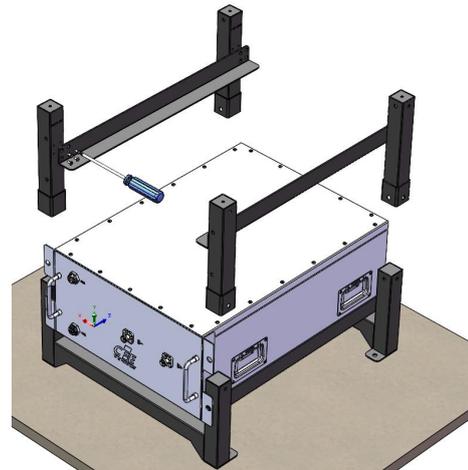
Lower bracket mounting triangle bracket \*2



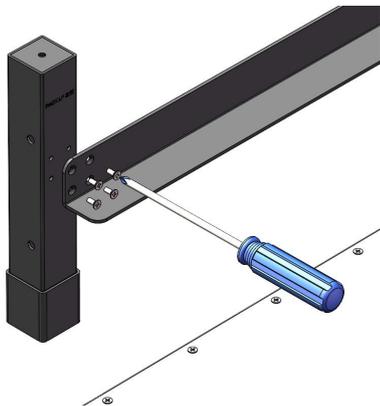
Mounting crossbeam\*2 connects left and right combination assemblies



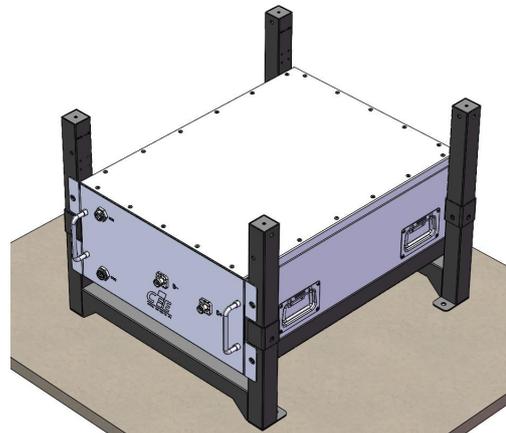
Install the battery pack



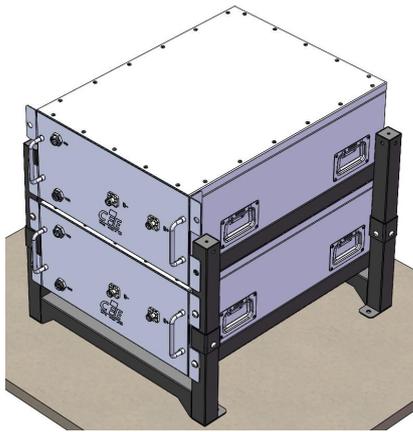
Use the battery pack holder to categorize the arrangement



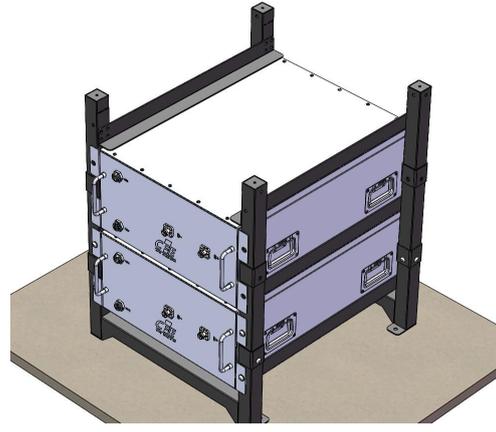
Repeat step 2



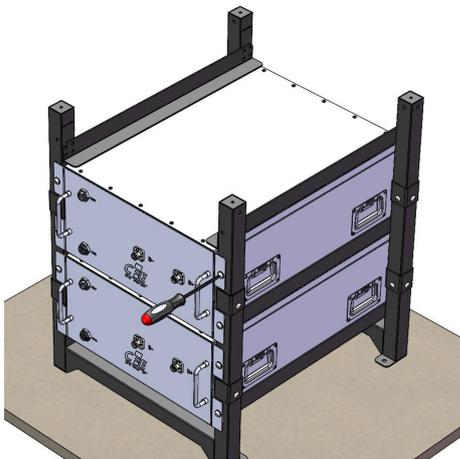
Installation of battery pack left and right brackets



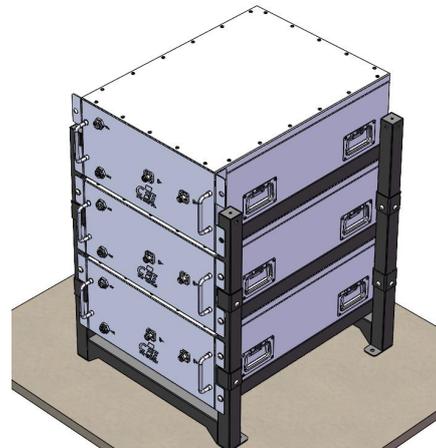
Mounting Bracket Set Screws



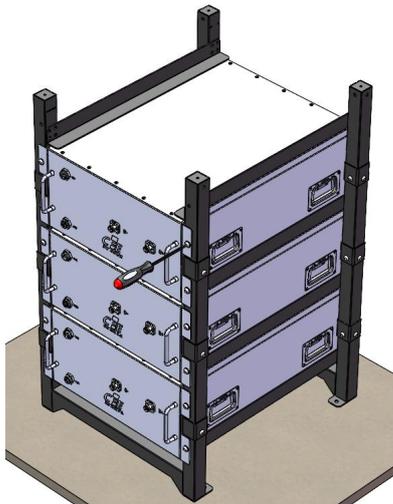
Installing the Battery Pack Retaining Screws



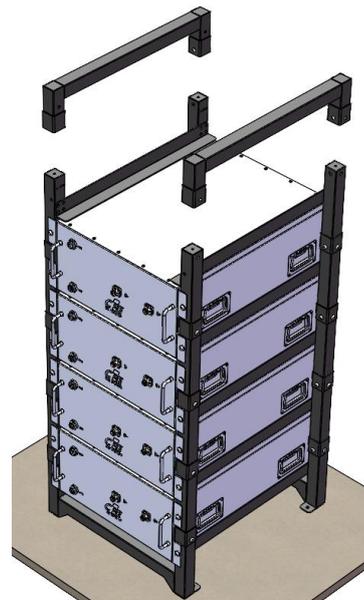
Installing the Battery Pack Retaining Screws



Installing the third battery pack



Install the battery pack retaining screws, and do the same for other battery packs



Mounting the upper bracket

### 6.3.3 Installation of high voltage box

After the battery pack is installed, the final step is to install the high voltage box. Place the high voltage box on top of the whole system and make sure the fixing holes are aligned, then fasten it to the bracket with screws.

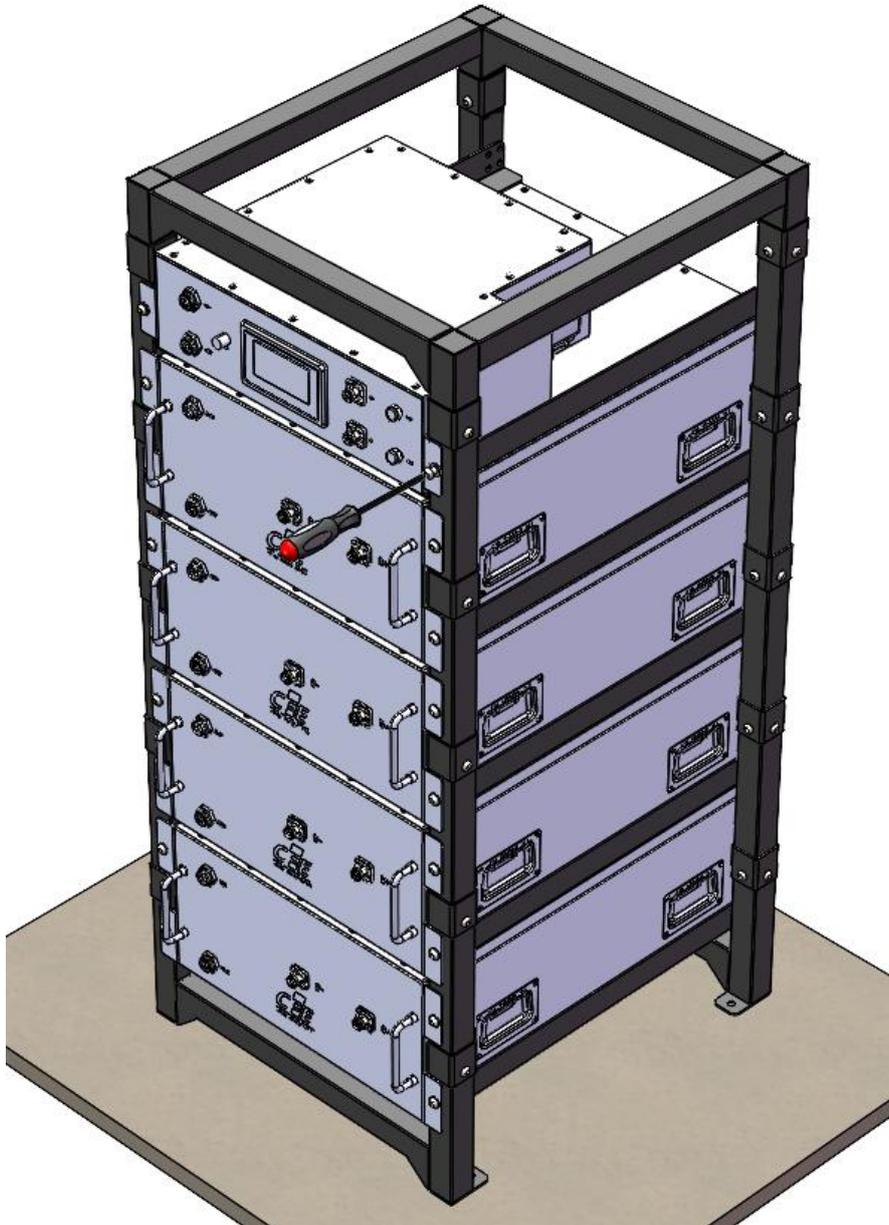


Figure 6-2 Installing the High Voltage Box

### 6.3.4 Fixed installation of systems

**⚠** Considering that the mounting bracket is mounted in an assembled manner, it is necessary to confirm the stability of the battery system after the high-voltage box and battery pack are installed. Otherwise, there is a danger of the battery system tipping over.

## 6.4 Electrical Installation

### 6.4.1 Introduction to tools

The following tools are required for electrical connections as shown in Table 6-2.

Table 6-2 Schematic diagram of electrical installation tools

|  |  |  |
|--|--|--|
|   |   |   |
| Multimeter   | Protective gloves  | Zigzag screwdriver   |
|  |  |  |
| Electric screwdrivers  | Phillips screwdriver   | Socket wrench  |

### 6.4.2 Cable connections

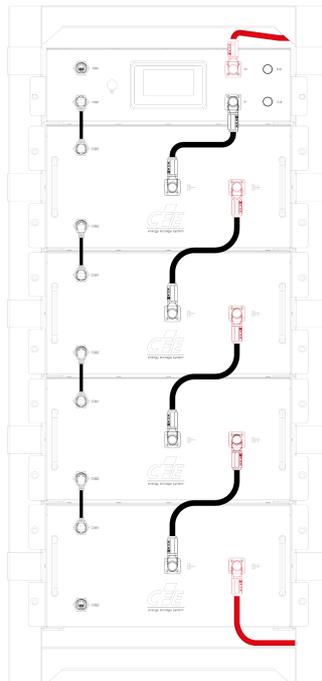


Figure 6-3 System Connection Diagram



(1) Grounding. The side ground wires are closed and connected, the bottom pack is connected to the long ground wire and is secured to earth ground.



(2) Communication cable installation. When multiple batteries are connected in series, use the matching connecting network cable COM1 to connect COM2 head to tail in sequence.



(3) Power cord installation. Connect each battery in series with the power cord as shown above. Avoid short circuits and reverse connections of positive and negative terminals.



(4) Connect the high voltage box. The positive and negative terminals of all battery packs are connected in series to eventually gather in the high voltage box, and the total positive and negative terminals of the system are wired from the back of the high voltage box.



(5) Connect the device. Before connecting, make sure the battery and the power of the device are off. Clearly identify the location of the positive and negative terminals of the system, red to the positive terminal and black to the negative terminal, to ensure that there is no connection error.

## 6.5 System Startup

### 6.5.1 Start-up checks



After installation or maintenance, it is necessary to start the lithium battery system. Before starting, please double check the following precautions to make sure there are no errors. All electrical connections must be made in accordance with the electrical apparatus diagram in the manual; the DC high voltage box must be open; the cables are correctly distributed, free of mechanical damage, and correctly connected and fastened; the internal protection devices in the high voltage box must be securely mounted; and there are no redundant parts or conductive materials left behind.

### 6.5.2 System startup



After completing the above steps, first ensure that the miniature circuit breaker is switched on, then press RUN on the control panel to switch on the power to the whole system and complete the installation.

Steps to turn on the system:

- (1) Double-check that all cables are connected correctly and that the grounding is correct.
- (2) Turn on the switch on the battery side of the inverter or between the inverter and the battery.
- (3) Turn on the battery system.
- (4) Turn on the inverter.

### 6.5.3 System shutdown

When a malfunction occurs or before servicing, the battery system must be shut down, the procedure for doing so is:

- (1) Turn off the inverter.
- (2) Turn off the air switch between the battery and the inverter (if present).

(3) Turn off the batteries.

#### 6.5.4 System charging

 When the battery system is transported or stored for a long period of time, the SOC of the battery may be low due to cell self-discharge and system consumption, and the lithium battery will need to be recharged after normal startup and before use. When the storage inverter has no external power source, such as photovoltaic, grid or engine power, and the unit is not in use for a long period of time, turn off the battery microform circuit breaker main switch. Avoid low battery level caused by battery self-drain.

## 7 Display and computer software

There is a built-in LCD display on the high voltage box and the PC software is for maintenance and overhaul use only.

### 7.1 Introduction to Liquid Crystal Display

The high voltage box is embedded with an LCD display to show some important information about the battery, such as voltage, current, SOC, operation status, etc. The LCD display is also used to show the battery's temperature and temperature.

#### 7.1.1 Introduction to the screen

The first page of the display shows the battery system SOC, the second page shows various parameters and status, and the third page allows you to design the system time and adjust the screen brightness, as detailed in the following table.



SOC 0%-20%



SOC 21%-39%



SOC 40%-59%



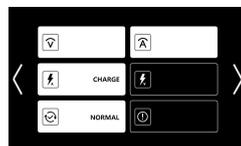
SOC 60%-79%



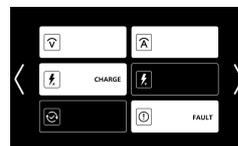
SOC 80%-100%



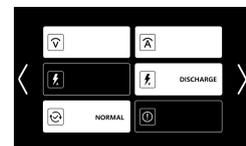
Discharge Alarm



Charging is normal



Charge Alarm



Discharge normal

#### 7.1.2 Screen wakeup and shutdown

Wake up the screen after power on, touch any position of the screen to wake up the screen, the display will automatically hibernate after a period of time.

## 8. Maintenance

### 8.1 Alarm description and handling

When the ALM light on the battery control panel is on, it means that the battery has issued an alarm or is protected, please check the cause of the fault through the cell phone APP or computer and take appropriate measures or go to the site directly to troubleshoot the problem. Common alarm conditions are shown in Table 8-1 below.

Table 8-1 Primary Alarms and Protection

| Status      | Model                   | Indicator | Methods of protection                           |
|-------------|-------------------------|-----------|---|
| Charging    | Over-current protection | ALM       | Stop charging, check settings and limits        |
|             | Temperature protection  | ALM       | Stop charging and wait for temperature recovery |
| Discharging | Over-current protection | ALM       | Stop discharging and check for overloads        |
|             | Temperature protection  | ALM       | Stop charging and wait for temperature recovery |

### 8.2 Faults and solutions

See Table 8-2 for common problems and solutions:

Table 8-2 Common Faults (Phenomena) and Solutions

| No. | Fault phenomenon                        | Analyze   | solution  |
|-----|---|---|---|
| 1   | Communication failure with the inverter | Wrong communication port connection or wrong battery ID setting | Refer to 5.3, 5.5 or 8.1  |
| 2   | No DC output                            | Failure to turn off circuit breaker or low voltage              | Turning off the circuit breaker or charging the battery   |
| 3   | Short supply time                       | Battery capacity is low or not fully charged                    | Repair or replacement   |
| 4   | Battery not fully charged               | Power system DC output voltage below minimum charging voltage   | Adjust the DC output voltage of the power supply to the proper charging voltage of the battery. |
| 5   | ALM LED always on                       | Shorted power cord connection                                   | Disconnect power cord and check all wires   |
| 6   | Unstable battery output voltage         | BMS not functioning properly                                    | Press the on/off key to reset the system, then reboot the system                                |

### 8.3 Daily maintenance

| Item   | Methodologies   | Maintenance Period            |
|--|---|-------------------------------|
| <p>Cable</p>                        | <ol style="list-style-type: none"> <li>1. Check for mechanical damage to the power cord and detachment of the terminal insulation sleeve; if so, turn off the machine for repair or replacement.</li> <li>2. Check the power cord for looseness; if there is any sign of looseness, tighten it with a standard torque wrench.</li> <li>3. Check the system for loose screws or discolored copper bus bars; if the screws are loose, tighten them with a standard torque wrench; if the screws are loose, tighten them with a standard torque wrench.</li> </ol> <p>standard torque wrench to tighten them; if the copper busbar is discolored, contact the manufacturer for after-sale replacement.</p> | <p>Once every 6 months</p>    |
| <p>Communication cable</p>         | <ol style="list-style-type: none"> <li>1. Check if the serial communication cable termination is loose, if loose, re-insert it tightly.</li> <li>2. Check if the color of the communication cable is visibly discolored, if so, turn off the machine and replace the communication cable.</li> </ol>  | <p>once a year</p>            |
| <p>Cleanliness</p>   | <p>Check the cleanliness of the front battery pack and high voltage box, if there is any visible dust, please clean it promptly.</p>  | <p>Once every 6-12 months</p> |
| <p>System Operational Status</p>  | <ol style="list-style-type: none"> <li>1. Check whether all parameters are normal when the system is running (system voltage, current, temperature, etc.).</li> <li>2. Check whether the main core components of the system are normal, including whether the system switch, contactor, etc. are normal</li> </ol>  | <p>Once every 6 months</p>    |
| <p>Charge and discharge maintenance</p>  | <p>Use light load and shallow charging and discharging to check whether the SOC and SOH status of the battery is normal (read with the software of the upper computer); it is recommended that the depth of discharge and the charging and discharging power should not exceed 20% of the rated value.</p>  | <p>Once every 6 months</p>    |

## 9 Notes and Warranty

### 9.1 Notes



Please read and comply with the following battery installation and use conditions, incorrect installation and use of the battery may cause personal injury or product damage.

- (1) Do not throw the battery into water. Please store the battery in a cool, dry environment.
- (2) Please do not put the battery into fire or heat the battery to avoid explosion or other dangerous events.
- (3) When charging the battery, please choose the specialized charging equipment and follow the correct procedures, do not use unqualified chargers.
- (4) Do not reverse the positive and negative terminals and do not connect the battery directly to an AC power source to avoid short-circuiting the battery.
- (5) Do not use batteries from different manufacturers or different types together, or mix old batteries with new ones.
- (6) Do not use the battery when it is hot, bulging, deformed or leaking.
- (7) Do not pierce the battery with nails or other sharp objects; do not throw, step on or strike the battery.
- (8) Do not open or attempt to repair the battery. The warranty is void if the battery is repaired or disassembled.
- (9) The battery has been half charged before shipment. If the battery is hot, bulging or has an unusual odor, etc., do not use it and report it to the after-sales department immediately.
- (10) If you need to store the battery for a long time, please charge and discharge the battery every three months to ensure the best performance of the battery, the best condition for storage is between 50%~60%.
- (11) Please use the battery within the temperature range specified in the manual.
- (12) The state of charge of the battery before shipment is 50%, please charge the battery before use.
- (13) It is strictly prohibited to disassemble a single cell in a battery pack that has already been put into service and recombine it with cells of different service cycles to form a new system.

### 9.2 Warranty statement

During the valid warranty period of the product, problems such as product damage or function failure caused by non-man-made or intentional damage will enjoy our free repair or replacement service. Customers are required to provide a valid purchase invoice or related product warranty information. If you can not provide valid proof, our company has the right to refuse to provide related services.



First-class power battery system supplier  
First-class supplier of energy storage and microgrid

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