# USER MANUAL

## 51.2V 314Ah Energy Storage Battery Pack

Model NO.: ZE24056

Version：D

Date：2025-11-28

## Contents

Please read the instruction manual before installing the battery. Please follow the instructions strictly during the installation process.

# 1. About This Manual

## 1.1. Description

This manual contains the following key elements.

| Content | Brief Description |
|---|---|
| Safety Instructions | It introduces the safety precautions to be taken when installing, operating, maintaining, and servicing the system. |
| Product Description | The system's appearance, performance characteristics, etc. are described. |
| Mounting | The installation of the system, electrical connection methods, etc. are described. |
| Fault Resolution | Simple fault finding and troubleshooting methods, etc. |
| Safeguard | The maintenance requirements of the system are described. |

## 1.2. Persons to Whom It Applies

This manual is intended for those who perform installation and other operations on this system. The reader needs to meet at least the following requirements:

1) Should have some electronic, electrical wiring and mechanical expertise and be familiar with electrical and mechanical schematics.

2) Shall have received specialized training related to the installation and commissioning of electrical equipment.

3) Emergency response capability should be available for hazardous or unexpected situations that arise during installation or commissioning.

4) Should be familiar with the relevant standards and codes of the country/region where the project is located.

5) Should be familiar with the contents described in this manual.

Only personnel who meet the above requirements may perform installation, operation and maintenance, and overhaul of the integrated energy storage system. Unauthorized personnel should not perform any operation on the system and should keep a sufficient safety distance from the system to avoid accidents.

# 2. Security Measures

## ⚠Reminder

1) Please read the user manual carefully before installing or using the battery. Failure to do so or follow any instructions or warnings in this document may result in electric shock, serious injury or death, or may damage the battery rendering it inoperable.

2) If the battery is stored for a long time, it is recommended to charge it once every 6 or 12 months (depends on shipping SOC), and the SOC should be 40%~50%, please refer to Section 6.

3) Batteries need to be recharged within 12 hours when discharged below 5% SOC.

4) Do not expose the communicaton interface to the foreign objects when the interface is not used/occupied. Keep the communication interface (RJ45) covered when not in use to prevent dust or dirt from entering. A protective cap or rubber stopper helps maintain reliable performance.

5) To maintain the battery, all power cord connectors must be disconnected from the battery to ensure personnel safety.

6) Do not use cleaning solvents to clean the battery.

7) Do not expose the battery to flammable or irritating chemicals or vapors.

8) Do not apply sprays to internal or external battery components, including buttons, breakers, fans, connectors, and other similar parts.

9) Do not directly connect the battery to the photovoltaic solar line.

10) Direct or indirect damages caused by the above items are not covered by the warranty.

## ⚠Warning

## 2.1. Precautions before Use

1) Please check the product and packing list after unpacking, if the product is damaged or missing, please contact the local retailer.

2) After unpacking, check the product and packing list first, and contact the local retailer if the product is damaged or missing parts. Before installation, be sure to cut off the power supply of the grid to ensure that the battery is in shutdown mode, please refer to Section 5.2.

3) The wiring must be correct. Do not connect the positive and negative lines by mistake to ensure that there is no short circuit with external devices.

4) Do not connect the battery directly to AC power.

5) The embedded BMS in the battery is designed for 51.2V DC, please do not connect it in series.

6) Please ensure that the electrical parameters of the battery system are compatible with related equipment.

7) The battery should be kept away from water and fire.

## 2.2. Precautions during Use

1) If the battery system needs to be moved or repaired, the power supply must be cut off to completely shut down the battery, please refer to Section 5.2, and it is not allowed to move or repair the battery while the battery is on.

2) It is forbidden to connect the battery with different models of batteries.

3) It is forbidden to work the battery with a faulty or incompatible Inverter.

4) It is forbidden to disassemble the battery.

5) In the event of a fire, only dry powder fire extinguishers can be used, and liquid fire extinguishers are prohibited.

6) Do not open, repair or disassemble the battery except authorized personnel. The company does not assume any consequences or related responsibilities caused by violation of safe operation or violation of design, production and equipment safety standards.

## 2.3. Damaged Battery

Damaged battery should not be used. If necessary, contact the supplier for assistance, or dispose of the battery in accordance with local recycling regulations.

## 2.4. Battery Module Transportation Requirements

1) According to the classification of dangerous goods in the UN Recommendations on the Transport of Dangerous Goods Model Regulations (TDG or Orange Book), the battery belongs to Class 9 UN3480 and has passed the relevant tests required by Chapter 38.3 of Part III of the UN

Recommendations on the Transport of Dangerous Goods Manual of Tests and Criteria.

2) Transportation and warehousing service providers must have the qualifications for hazardous materials related operations required by the regulations and standards of the place where the business takes place; rigid vans must be used for transportation, and the use of open-topped trucks is strictly prohibited.

3) Comply with the latest version of international and domestic rules related to the transportation and storage of dangerous goods, including but not limited to the International Maritime Dangerous Goods Code (IMDG Code) and Agreement concerning the International Carriage of Dangerous Goods by Road (ADR), and so on, and at the same time The transportation must meet the regulatory requirements of the transportation regulatory authorities of the country of origin, route and destination. Before transportation and warehousing, the products should be properly packed, labeled and marked according to the local regulations and standards of the country where the business is located, and the relevant product and packaging tests should be completed in advance.

4) Compliance and accurate declaration should be made before transportation, and the packaging and label markings of the batteries must be checked to be intact and undamaged, and there is no odor, liquid leakage, smoke, fire, etc. Otherwise, transportation is prohibited.

5) When handling the battery, hold it gently and put it down, do not bump the battery, and pay attention to personal safety.

6) If the regulations and standards of the country of operation allow the transportation of specific categories of dangerous goods among themselves and between dangerous goods and general cargoes in a carpool, segregation is required in accordance with the requirements of the local regulations and standards; if there is no explicit requirement in the country of operation, segregation can be referred to when the packages of dangerous goods and the general cargoes are loaded in the same vehicle or container:

·Use a barrier of equal height to the package.

·Maintain a minimum of 0.8m spacing around the perimeter.

7) When the battery is ready to enter transport mode, turn off the battery output completely. You can refer to Section 5.2.

8) When the battery is out of transport mode, the battery can be made to work by relevant operations. You can refer to Section 5.1.

## 2.5. Storage

The storage temperature of the battery is as below:

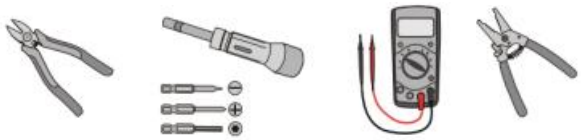
| | | |
|---|---|---|
| Storage Temperature Range (At 40%~50% SOC and specified temperature) | -20℃~25℃ ≤ 12 months | Max. 95%RH (non-condensing) |
| | 25℃~45℃ ≤ 3 months | Max. 95%RH (non-condensing) |
| | 45℃~60℃ ≤ 1 month | Max. 95%RH (non-condensing) |

The battery should be stored at half charged state in a dry, clean, no corrosive gas place with good ventilation, If the cell has to be stored for a long time (within 12 months), the environmental condition should be -20~25℃, low humidity, no corrosive gas atmosphere. The capacity for a long-time storage shall be 40%~50% range. For every twelve months, cycle the battery 1~3 times to keep the battery performance, and stored again at half charged.

## 2.6. Personal Protection

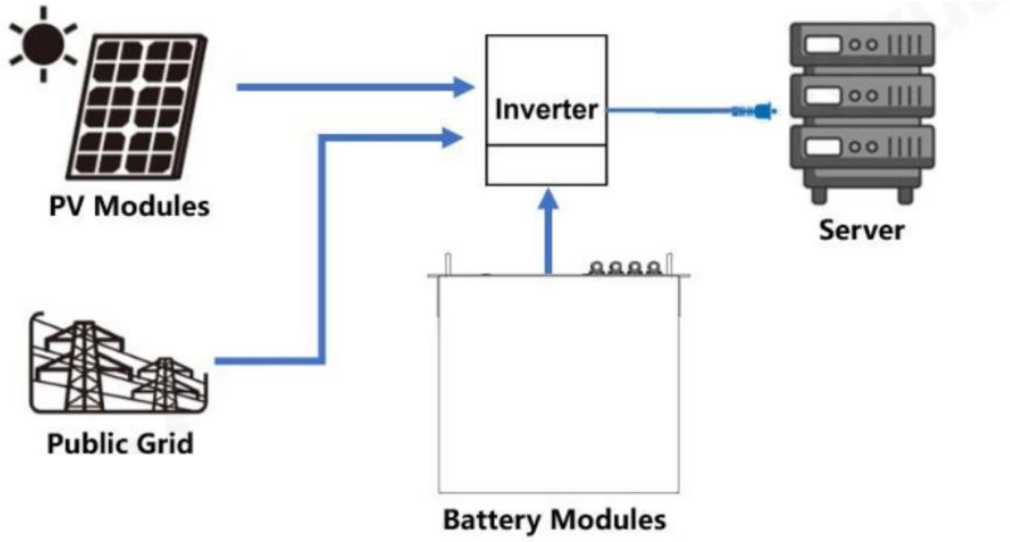
1) Vandal-proof shoe. Insulated gloves. Dust mask.

2) Tools with insulation intact.



# 3. Product Information

The ZE24056 Lithium Iron Phosphate is a Battery Pack for Battery Energy Storage System. It is designed for integration with reliable Inverter modules. The built-in intelligent BMS battery management system can manage and monitor battery voltage, temperature, current and other information. In addition, the BMS balances the charge and discharge of the battery to extend the cycle life. Battery modules can be used individually or in parallel to expand capacity as needed.




## 3.1. Characteristic

1) Non-toxic, non-polluting and environmentally friendly.

2) Lithium iron phosphate battery materials have good safety performance and long cycle life.

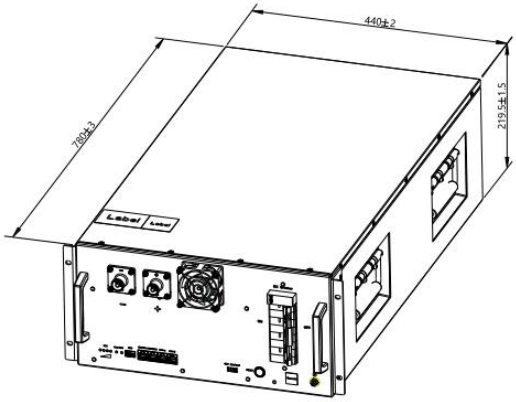
3) Intelligent BMS battery management system, with the protection function of battery over-discharge, high temperature, overcharge and over-current.

4) Flexible configuration, multiple battery modules can be easily stacked and added for capacity expansion.

5) The battery operates from 0°C to 60°C with excellent discharge performance and cycle life.

## 3.2. Specifications

| Items | Standard |
|---|---|
| Battery Model | ZE24056 |
| Cell Material | LFP |
| Cell Manufacture | ACE 72174204-Fe-314 |
| Number of Cells | 16pcs (16S1P) |
| Nominal Voltage (V) | 51.2 |
| Cycle Life | 7600 cycles, 70% SOH @ 0.5C/0.5C, 90%DoD (5%SOC~95%SOC), 25 ± 5℃ |
| Expected Cycle Life | 8000 cycles, 70% SOH @ 0.5C/0.5C, 90%DoD (5%SOC~95%SOC), 25 ± 5℃ |
| Calendar Life | 10 years |
| DC round Trip Efficiency at BOL | 93% (90% DOD with 0.5C) |
| DC Round Trip Efficiency at EOL | 92% (90% DOD with 0.5C) |
| Typical Capacity (Ah) | 314 |
| Minimum Capacity (Ah) | 314 |
| Nominal Energy Capacity (Wh) | 16076.8 |
| Weight (Kg) | 124 ± 2.0 |
| Dimension (W*D*H) (mm) | 440*780*219.5 |
| Max continuous Discharge Current (A) | 160 |
| Discharge Over Current | 185A ± 5A (6mins) & 210A ± 5A (1.5mins) & 250A ± 5A (2 secs) |
| Operating Voltage (V) | 44—56 |
| Recommended Charge Voltage (V) | 56 |
| Max Continuous Charge Current (A) | 160 |
| Charge Over Current | 170A ± 5A (6mins) & 180A ± 5A (1.5mins) & 200A ± 5A (2 secs) |
| Circuit Breaker Model | PEBS-L-125 |
| Cooling Method | Fan cooling |
| Operating Ambient Temperature Range | Charge: 0℃~60℃<br>Discharge: -20℃~60℃ |

| | |
|---|---|
| Recommended Operating Temperature Range | Charge: 15℃~35℃<br>Discharge: 15℃~35℃ |
| Storage Temperature Range | -20℃~60℃ |
| Recommended Storage Temperature Range | 15℃~25℃ |
| Communication | RS485, CAN |
| IP Rating | IP20 |
| Humidity Range | 0%RH-95%RH (Non-condensing) |
| Installation | Floor-mounted |
| Scalability | Max.20 modules in parallel (321.54kWh) |
| Protection | Voltage protection, Temperature protection, Current protection |
| Certification | UN38.3, CE EMC, IEC62619, EU Declaration of Conformity, UL1973, UL9540A, RoHS, REACH, RCM |
| Inner Resistance(mΩ) | ≤ 20 |
| Standard Charge Method | 0.2C CC (constant current) charge to FC, then CV (constant voltage FC) charge till charge current decline to ≤ 0.05C |
| Battery Pack Size |  |
| Material of enclosure | SGCC |
| Delivery Condition | The battery pack will be in shutdown mode when shipment. The battery pack need to be pressed manual ON/OFF button to wake up or charged to wake up.<br>Air Delivery Capacity: 20%-30%<br>Sea or Land Delivery Capacity: 40%-50% |

## 3.3. Key Feature Description

The battery pack is configured with 16S1P cells, and support up to 20 pcs batteries in parallel. The battery includes below function:

1) Support to detect the key parameters of the battery; like individual cell voltage, current, cell temperature, sum voltage on the pack terminal, Fuel Gauge, etc.

2) Support free paralleling, up to 20 pcs batteries.

3) Complete safety management, including charging over-voltage protection, discharging over-voltage protection, over-current protection and over-temperature protection.

4) Support CAN, RS485 communication with system to report battery status.

5) Support fan control for heat dissipation

## 3.4. Function Description of the Main Control Board

The main control board mainly consists with below parts:

1) Power Supply

A buck converter is used to step down the battery supply voltage to a constant voltage for the BMS. In addition, an isolated power supply was designed as a power source for the communication chip.

2) AFE Monitor and MCU

AFE monitor, to monitor the individual cell voltage, battery current and temperature.

3) Protection Function

Support reliable voltage, current, and temperature safety protection function.

4) Communication and Interface

Support CAN and RS485 communication function.

5) Fan Control

One fan is used and controlled by the BMS.

When the temperature reaches 36℃, the fan start with 15% of speed.

When the temperature increase to 37℃, the speed of fan will be increased to 20%.

When the temperature increase 1℃ from 37℃, the speed of fan will be increased by 10%.

When the temperature > 45℃, the fan will turn to full speed.

Fan stop hysteresis operates as follows: the speed rises to 90% at 42°C, then reduces to 80% at 41°C, and continues decreasing until it reaches 0% at 33°C.

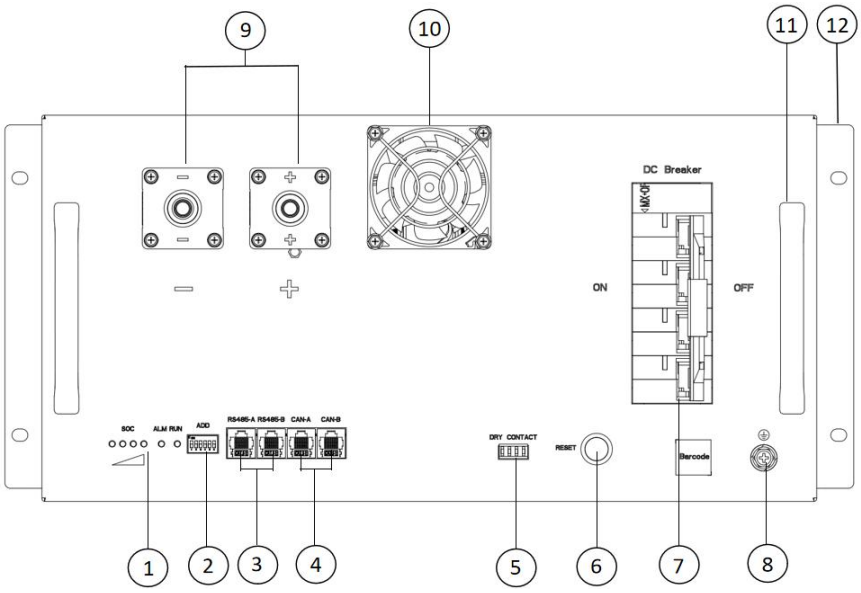
6) External Control

One DRY Connector is used to control Breaker by external control signal. When the external control signal active and last for 1s through Connector for the breaker control signal, the state of the Breaker will change from ON to OFF. Regarding the Pin definition of the dry contact, refer to section 3.5.

7) BMS communication

When the breaker is turned off but the manual on/off button is not pressed, BMS communication will still work for 30mins.

## 3.5. LED and Output Interface Pin Definitions




1) LEDs for SOC and ALARM / RUN Indication.

Displays the remaining charge of the battery pack and the battery status.

Battery level and status indicator.

| Reference Picture | PIN | Definition |
|---|---|---|
|   | LED1 | SOC and Charging Display |
| | LED2 | SOC and Charging Display |
| | LED3 | SOC and Charging Display |

| | | |
|---|---|---|
| | LED4 | SOC and Charging Display |
| | RUN | RUN LED (Green) |
| | ALARM | ALARM LED (Red) |

The LED indicators are described below:

| **State** | **Normal/Protection** | **Run** | **Alm** | **Capacity display LED** | | | | **Comments** |
|---|---|---|---|---|---|---|---|---|
| Power Off | Power Off | Off | Off | Off | Off | Off | Off | All Off |
| Idle<br>Do not connect Pres | Normal | Off | Blink1 | Display according to Capacity | | | | |
| | Protection (Can be recovered) | Off | Blink1 | | | | | |
| Idle<br>Connect Pres | Normal | Blink1 | Off | Display according to Capacity | | | | |
| | Protection (Can be recovered) | Off | Blink2 | | | | | |
| Charging | Normal | Blink2 | Off | Display according to Capacity | | | | |
| Discharging | Normal | On | Off | Display according to Capacity | | | | |
| Charging/ Discharging/ idle | BMS failure | Off | On | Display according to Capacity | | | | Safe under voltage protection, when cell voltage less than 1.55V |
| Breaker Off | Breaker Off | Off | On | Display according to Capacity | | | | |

Capacity display LED：

| **Capacity Stat** | **Capacity display LED** | | | |
|---|---|---|---|---|
| | ● | ● | ● | ● |
| | LED1 | LED2 | LED3 | LED4 |
| 0% | Off | Off | Off | Off |
| 0%~10% | Blink3 | Off | Off | Off |
| 10%~25% | On | Off | Off | Off |
| 25%~50% | On | On | Off | Off |
| 50%~75% | On | On | On | Off |
| 75%~100% | On | On | On | On |

Notes2:

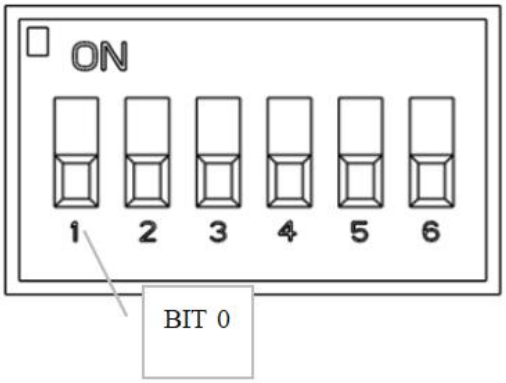
Blink1: LED on for 0.25s, and for 3.75s

Blink2: LED on for 0.5s, and for 0.5s

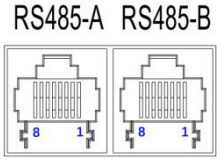
Blink3: LED on for 1s, off for 1s

2) Address Switch.

Used for identification of BMS parallel control, each Address Switch must be different between parallel batteries.

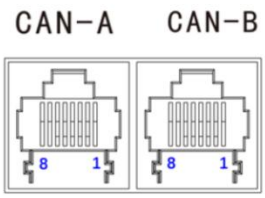
| Reference Picture | ID | BIT 0 | BIT 1 | BIT 2 | BIT 3 | BIT 4 |
|---|---|---|---|---|---|---|
|  | 0 | 0 | 0 | 0 | 0 | 0 |
| | 1 | 1 | 0 | 0 | 0 | 0 |
| | 2 | 0 | 1 | 0 | 0 | 0 |
| | 3 | 1 | 1 | 0 | 0 | 0 |
| | 4 | 0 | 0 | 1 | 0 | 0 |
| | 5 | 1 | 0 | 1 | 0 | 0 |
| | 6 | 0 | 1 | 1 | 0 | 0 |
| | 7 | 1 | 1 | 1 | 0 | 0 |
| | 8 | 0 | 0 | 0 | 1 | 0 |
| | 9 | 1 | 0 | 0 | 1 | 0 |
| | 10 | 0 | 1 | 0 | 1 | 0 |
| | 11 | 1 | 1 | 0 | 1 | 0 |
| | 12 | 0 | 0 | 1 | 1 | 0 |
| | 13 | 1 | 0 | 1 | 1 | 0 |
| | 14 | 0 | 1 | 1 | 1 | 0 |
| | 15 | 1 | 1 | 1 | 1 | 0 |
| | 16 | 0 | 0 | 0 | 0 | 1 |
| | 17 | 1 | 0 | 0 | 0 | 1 |
| | 18 | 0 | 1 | 0 | 0 | 1 |
| | 19 | 1 | 1 | 0 | 0 | 1 |

3) RS485 communication interface, dual RJ45 terminal, used to connect the system for RS485 communication.

| Reference Picture | PIN | Definition |
|---|---|---|
|  | 1 | RS485B |
| | 2 | RS485A |
| | 3 | GND |

| | | |
|---|---|---|
| | 4 | PRES1 |
| | 5 | PRES2 |
| | 6 | GND |
| | 7 | RS485A |
| | 8 | RS485B |

4) CANBUS communication interface, dual RJ45 terminals, for cascade CANBUS communication between battery packs.

| Reference Picture | PIN | Definition |
|---|---|---|
|  | 1 | CANH |
| | 2 | CANL |
| | 3 | GND |
| | 4 | PRES1 |
| | 5 | PRES2 |
| | 6 | GND |
| | 7 | NC |
| | 8 | NC |

5) Dry contact terminal reserved dry contact signal output interface.

| Reference Picture | PIN | Definition |
|---|---|---|
|  | 1 | Dry contact output A+ |
| | 2 | Dry contact output A- |
| | 3 | Dry contact output B+ |
| | 4 | Dry contact output B- |

Note：Either Pin1&2 or pin3&4 is used for inputing the external signal to trip the breaker.

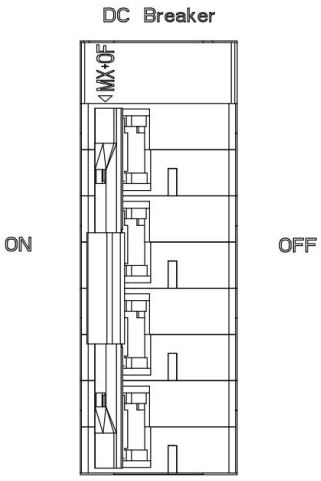
6) Manual on/off button for battery wake or shutdown.

When the battery pack is turned off, press and hold 1s to wake up the battery, and the LED is always on.

When the battery pack is in active mode, long press 3s to turn off the battery and the LED light goes off.

| Reference Picture | Description |
|---|---|
|  | RESET / Manual ON/OFF Button:<br>This button serves dual functions—it acts as both a reset and a power button. In this document, it is referred to as the Manual ON/OFF button, while on the battery front panel it is labeled RESET.<br>Function: Used to wake up or shut down the battery, as well as start the BMS. |

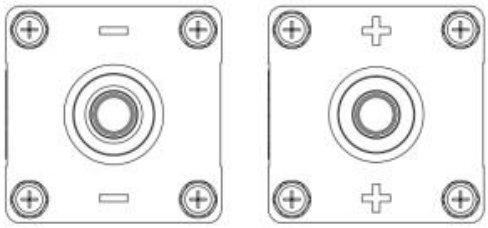
7) Air Breaker for connecting the module to the BMS or disconnect.

| Reference Picture | Description |
|---|---|
|  | Used to control power main circuit on/off (Model:PEBS-PEBS-L-80-125-C-2P+MX+OF) This can be disconnected through an external signal, either via dry contacts from an external system or through command using MODBUS communication. Note: Only disconnection (tripping OFF) can be performed remotely; the system must be turned ON manually. |

8) Protecting earthing terminal.

| Reference Picture | Description |
|---|---|
|  | For connecting the battery pack to ground.<br>PS: Connect this to the earth bar of the cabinet.<br>The actual ground connection should be considered by the installer from the system level. |

9) Power Port, Battery Power Ports.

| Reference Picture | PIN | Definition |
|---|---|---|
|  | P+ | Positive for charge and discharge |
| | P- | Negative for charge and discharge |

Remark: The power ports here are for DC connection, please use the corresponding plug to match with the below types. If the power port is successfully connected, you should hear the plug is lock in position and can not be unplugged without press the key of the plug.

P+:（DEGSON）：ESS-250A-70-B/S-OR-00

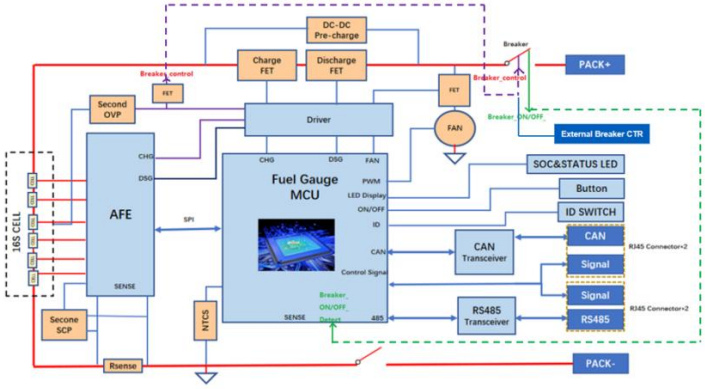
P-:（DEGSON）：ESS-250A-70-B/S-BK-00

10) FAN

| Reference Picture | Description |
|---|---|
|  | Used to cool the battery. |

## 3.6. BMS

### 3.6.1. Battery Pack Diagram Block




### 3.6.2. Parameters

| NO. | Item | | Standard |
|---|---|---|---|
| 1 | Voltages | Single Cell Charge Balance Voltage | 3.38 ± 0.1V |
| 2 | Current | Charge Balance Current For Single Cell | About 186mA |
| | | Balance Start Voltage Difference | Active: ≥50mV<br>Rest: ≥25mV |
| | | Balance Off Voltage Difference | Active: ≤15mV<br>Rest: ≤15mV |
| | | BMS Leak Current(Active Mode) | ≤30mA |
| | | BMS Leak Current(Shutdown Mode) | ≤50uA |
| | | Max Charge/Discharge Current | 160A/ 160A |
| | | Min Detected Current Parameter for Charge | 450mA |
| | | Min Detected Current Parameter for Discharge | 80mA |
| 3 | Over Charge Protection | Over Charge Protection Voltage | 3.8 ± 0.1V & 1S |
| | | Over Charge Release Voltage | 3.38 ± 0.1V |
| 4 | Over Discharge Protection | Over Discharge Protection Voltage1 | 2.70 ± 0.1V |
| | | Over Discharge Protection Delay Time | <1500mS |

| NO. | Item | | Standard |
|---|---|---|---|
| | | Over Discharge Release Voltage | 2.9V±0.1V/Cell and Charge<br>or<br>the battery recover automatically when the min Cell voltage recover to 3.35V±0.1V/Cell |
| 5 | Discharge Over Current Protection | Discharge Over Current Protection Current | 185±5A |
| | | Discharge Over Current Protection Delay | 360S |
| | | Discharge Over Current Protection Current | 210±5A |
| | | Discharge Over Current Protection Delay | 90S |
| | | Discharge Over Current Protection Current | 250±5A |
| | | Discharge Over Current Protection Delay | 2S |
| | | Over Current Release | After 55S Release |
| 6 | Charge Over Current Protection | Charge Over Current Protection | 170±5A |
| | | Charge Over Current Protection Delay | 360S |
| | | Charge Over Current Protection | 180±5A |
| | | Charge Over Current Protection Delay | 90S |
| | | Charge Over Current Protection | 200±5A |
| | | Charge Over Current Protection Delay | 2S |
| | | Over Current Release | After 55S Release |
| 7 | Short Current Protection | Short Current Protection Current | 411A (typical) |
| | | Short Current Protection Delay | 100us(typical) |
| | | Short Current Protection Release | After 60S recovery |

| NO. | Item | | Standard |
|---|---|---|---|
| 8 | Charge Over Temperature Protection | Charge Over Temperature Protection Value | 65±5℃((FW version≥A08) |
| | | Over Temperature Protection Release Value | 50±5℃ |
| 9 | Charge Low Temperature Protection | Charge Low Temperature Protection Value | 0±5℃ |
| | | Low temperature protection release value | 5±5℃ |
| 10 | Discharge Over Temperature Protection | Discharge Over Temperature Protection Value | 80±5℃ |
| | | Over Temperature Protection Release Value | 60±5℃ |
| 11 | Discharge Low Temperature Protection | Discharge Low Temperature Protection Value | -20±5℃ |
| | | Low Temperature Protection Release Value | -10±5℃ |
| 12 | FET Over Temperature Protection | FET High Temperature Protection | >105±5℃ |
| | | FET High Temperature Release | <90±5℃ |
| 13 | Communication | The connection between the battery and the battery is CANBUS, between the battery and the device is RS-485 | CANBUS, RS-485 |
| 14 | LED Display | LEDs for SOC<br>Indicate the current remaining power.<br><br>Alarm Red and Run Green<br>Indicate the battery running status. | |
| 15 | Present Function | When the battery pack inserts to device. PRES1 and PRES2 will be short together, and there is output for battery pack. | |

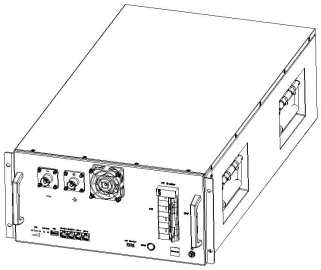
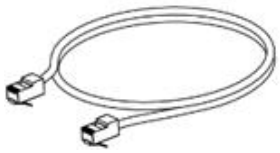
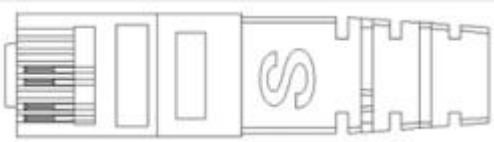
| NO. | Item | | Standard |
|---|---|---|---|
| 16 | FAN Function | When the temperature reaches 36℃, the fan start with 15% of speed;<br>When the temperature increase to 37℃, the speed of fan will be increased to 20%.<br>When the temperature increase 1℃ from 37℃, the speed of fan will be increased by 10%.<br>When the temperature > 45℃, the fan will turn to full speed. | |
| 17 | Operation to Wake Up Battery | When the battery pack in shutdown mode, press the button for 1s to wake up the battery, LEDs is on.<br>Or<br>Charge to wake up the battery with charger. | |
| 18 | Operation to Shutdown Battery | When the battery pack in active mode, press the button for 3s to shutdown the battery, LEDs is off.<br>Or<br>Rest the battery pack for 10 hours without charge or discharge when the cell voltage is less than 3V/Cell， the battery will enter shutdown mode.<br>Or<br>The battery removes from system, the battery will enter shutdown mode after 24hours<br>Or<br>When the cell voltage is lower than 2.1V/Cell for 10minutes, battery will enter shutdown mode.<br>Or | |
| 19 | External Control Function of the Breaker | When the external control signal active and last for 1s through Connector for the breaker control signal, the state of the Breaker will change from ON to OFF. | |

Note:The Charge MOSFET will also be turned off, when the battery is full charged， and cell voltage exceeds 3.55V.

# 4. Installation Instructions

## 4.1. Package Contents

Note: The packaging is recyclable and can be saved for future reuse or disposed of properly according to local regulations.

| **Name** | **Quantity** | **Picture** |
|---|---|---|
| Battery Module | 1 Unit |  |
| RJ45 External Communication Cable | 2 PCS |  |
| “PRES” Short Cable | 1 PCS |  |

Note: Power cable is premounted in the cabinet, not supplied from battery manufacturer.

## 4.2. Follow the Environment

Check whether the installation environment meets the following conditions:

1) It is recommended to be installed in a cabinet / indoor.
2) There is no water in the installation area.
3) According to the area near no flammable and explosive materials.
4) The installation position is flat on the ground.
5) The optimal ambient temperature should be in the range of 0~60°C.
6) Temperature and humidity are kept at a constant level.
7) There is very little dust and dirt in the installation area.
8) The area or enclosure is vermin proof to suit your environmental locations.
9) The batteries and battery cabinets/housings are not exposed to direct sunlight

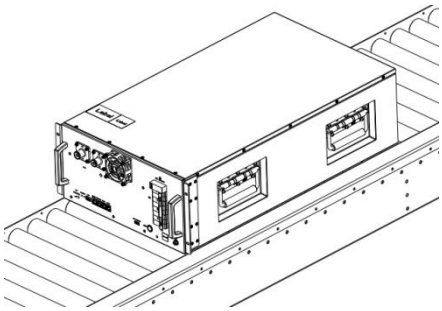
## 4.3. Extreme Humidity Climates

1) When batteries are being installed in climates of extreme humidity, extra precaution should be taken.
2) A humidity control agent (i.e. chemical which absorbs humidity) may be required inside the enclosure, with controlled airflow to expel moist air.
3) And or, the battery system to be installed in a moisture and climate controlled room (example, reverse cycle air-conditioner cooled).
4) The temperature of the cabinet should be held at a temperature above dew point at all times.

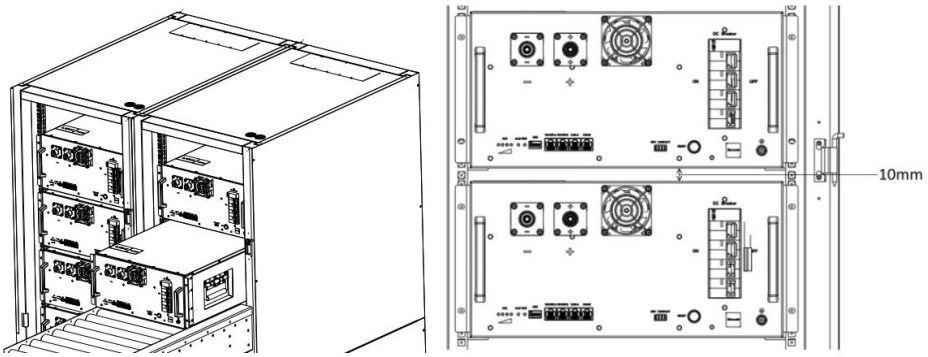
 **Warning**

When the ambient temperature is out of the operating range, the battery module will automatically stop working to protect itself. The optimal operating temperature range of the battery module is 0°C ~ 60°C. Frequent exposure to harsh environments can lead to reduced battery module performance and shortened life.

## 4.4. Module Installation

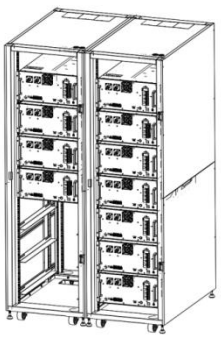


Step 1： Transfer the battery module to the lift using the carrying handle in the battery module




Step 2： Battery modules should be installed from top to bottom, Please ensure there is adequate air flow around the battery stack within the cabinet. A clearance of at least 10mm airflow around 4 sides of the stack is required as minimum, the installation platform rises to parallel with the cabinet mounting port and then push the battery module into the cabinet. Then secure the battery to the cabinet with screws through the mounting holes of the battery module and the mounting holes in the cabinet. (Recommended with M6 screws, 5N▪m torque. Please note that the actual torque also depends on the cabinet structure design)

Remark: Cabinet is not supplied by Ace.



## 4.5. Battery Packs in Parallel Use Connection Method

**Step 1:** Insert the RJ45 "PRES" short cable in the accessory into one of the expansion ports on the top of the battery module.

**Step 2** (single battery module):

1) Insert one end of the RJ45 external communication cable in the accessory into the RS485 communication port of the battery module, the other RJ45 insert inverter communication port.

2) Connect the power output lines of the battery module and the positive and negative electrodes of the inverter and confirm that the polarity of the battery module and inverter is connected correctly.

The positive terminal of the battery module and the positive terminal of the busbar installed in the cabinet are connected via the red power output cable (the cable wires are kept at the same length).

The negative terminal of the battery module and the negative terminal of the busbar installed in the cabinet are connected via the black power output cable (the cable wires are kept at the same length).

3) The Address Switch of the battery module needs to be adjusted to: 00

**Step 3** (if multiple battery modules are connected in parallel):

1) Insert one end of the RJ45 internal communication cable in the accessory into the CAN communication port of the No. 1 battery module, and the other end into the CAN communication port of the No. 2 battery module, if there are more battery modules connected to the system, repeat this step to connect more battery modules.

2) The No. 1 battery module is the main battery, the Address Switch is set to 00, and the other battery modules are set in order.

3) Insert one end of the RJ45 internal communication cable in the accessory into the RS485 communication port of the No. 1 battery module, and the other end into the RS485 communication port of the No. 2 battery module, if there are more battery modules connected

to the system, repeat this step to connect more battery modules and insert the last end into the inverter communication port.

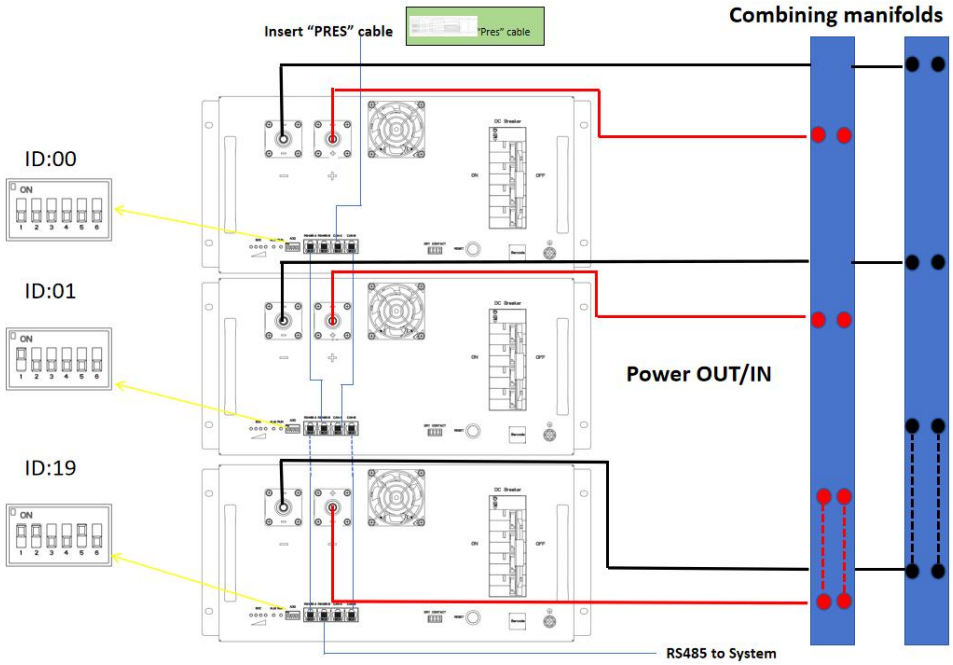
4) Connect the power output wires and Combining manifolds of the positive and negative poles of the No. 1 battery module（the main battery）and the No. 2 battery module and confirm that the polarity of the battery module and Combining manifolds is connected correctly, Connecting the Combining manifolds to the inverter and confirm the polarity.

5) The battery module，combining manifolds and the inverter positive pole are connected with a red power output line.

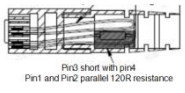
6) The battery module，combining manifolds and the inverter negative pole are connected with a black power output line.

**Reminder:** Battery packs are connected in parallel; the maximum number of parallel connections is 20, CANBUS communication is used between battery packs, and then one of the battery packs and the system is connected with RS485. In addition, the Address Switch of each parallel battery pack should be different.

If batteries work with inverter/ EMS, connecting diagram as below:




A "PRES" short cable is necessary, "PRES" short cable is used to active the batteries, the cable drawing as below:



# 5. Battery Function Overview

## 5.1. Start the Battery Module

Step 1: connect the power connector between battery and system.

Step 2: Push breaker to ON.

Step 3: Wake up from shutdown mode (shipment mode).

The battery is shipped in shutdown mode, all the LEDs is off. There are two ways to wake up the battery pack from shipment mode. 1ST, to charge the battery pack by inverter (if inverter can support 0V charge). 2nd, press the Button for manual ON/OFF for 1 second.

The LEDs will turn on after waking up.

Step 4: insert the "PRES" short cable into the CANBUS connector of the battery to activate the battery. If the battery is not insert “PRES” short cable; the battery can not discharge or charge.

## 5.2. Turn Off the Battery Module

1) When the battery pack in active mode, press the Button for manual ON/OFF for 3s to shut down the battery, LEDs is off.

2) Rest the battery pack for 10 hours without charge or discharge when the cell voltage is less than 3V/Cell, the battery will enter shutdown mode.

3) The battery removes from system, the battery will enter shutdown mode after 24hours.

4) When the cell voltage is lower than 2.1V/Cell for 10minutes, battery will enter shutdown mode.

5) When the battery is ready to enter transport mode, you can first turn off the Breaker and then press the Manual ON/OFF button for 3s, the battery will be completely turned off.

Note: Turn off the breaker but not press the manual ON/OFF button, the BMS will communicate for another 30 minutes and then turn off.

## 5.3. Calibration Details

### 5.3.1. Calibration of SOC

To calibrate the SOC, full charge is needed. Suggest full charge at least once a month in the temperature range of 15degC to 35degC, steps as below:

Step 1: Charge with 56V and typical current, until SOC reach 100%.

Step 2: Keep floating charge with 56V for 30 minutes or 1hr after full charge, for cell balancing.

Note1: Floating charge is applied for cell balancing. If the float charge time is longer, it can have a better balancing effect.

### 5.3.2. Calibration of FCC

To calibrate the FCC, full discharge is needed. Suggest full charge and full discharge in the temperature range of 15degC to 35degC, steps as below:

Step 1: Discharge with 0.5C current, until any cell voltage reaches 2.7V.

Step 2: Stay for more than 3hrs after full discharge.

Step 3: Charge with 56V and typical current, until SOC reach 100%.

Step 4: Keep floating charge with 56V for 30 minutes or 1hr after full charge, for cell balancing.

Note2: As step3 and step4 are total same with the process for SOC calibration, this process can also calibrate the SOC at the same time.

## 5.4. Communication

1) Battery to battery

CANBUS communication is used among paralleling battery packs, every battery transmits its data to the CANBUS and receives other batteries' data from CANBUS.

2) Battery to upper system

RS485 communication is used between the battery and the upper system. Based on MODBUS RTU protocol, self-defined data are added to complete the data interaction between BMS and upper device. The upper equipment requests or sets BMS data, and the BMS reports or receives relevant data. This is how the gateway monitor the real time battery operation. Generally, battery monitoring is achieved via the gateway, which is set up through its system configuration.

Note: The Address Switch of each parallel battery pack should be different to ensure the normally communication in both applications above .

## 5.5. SOH Calculation

The battery SOH(State of Health) is equal to full capacity divided by design capacity. For example, if full capacity is 95Ah and design capacity is 100Ah, then SOH is 95%. The full capacity and the battery SOH update based on the discharged cycles and rest time in various environmental temperature.

## 5.6. Cycle Count

The battery discharged cycle count calculate based on the discharged capacity. When the discharge capacity reaches 95% of the full capacity each time, the battery cycle count increase once.

# 6. Battery Module Recharge

If the battery is shipped with 30% SOC, when the battery storage time reach 6 months, cycle test maintenance shall be done before use under room temperature. Charge the battery to 100% SOC and then discharge to 50% SOC.

If the battery is shipped with 40%~ 50% SOC, when the battery storage time reach 12 months, cycle test maintenance shall be done before use under room temperature. Charge the battery to 100% SOC and then discharge to 50% SOC.

Customer can charge the battery by UPS or DC source any one of them. The charge procedure as below.

## 6.1. Charge with UPS

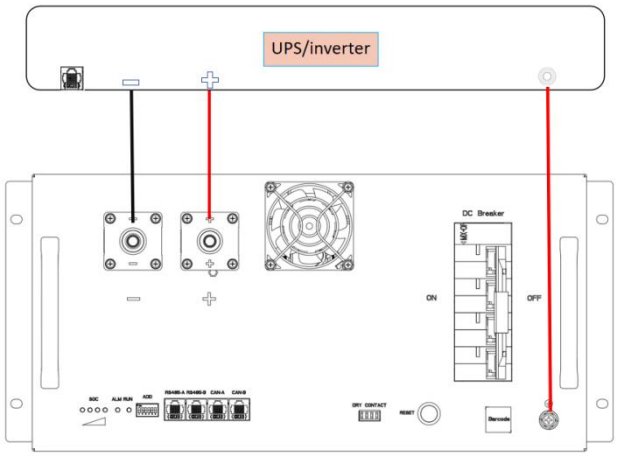
Equipment List:

| Equipment | Type / Rating Requirement | Comments |
|---|---|---|
| Customer UPS | / | / |

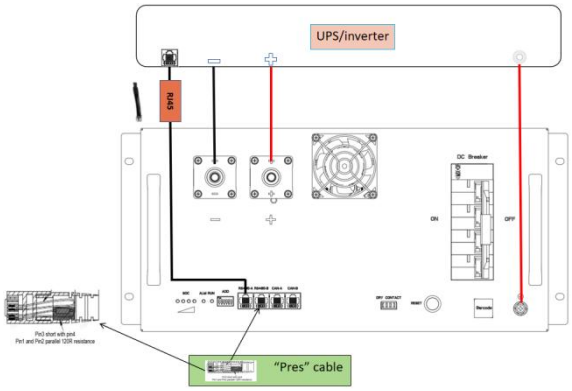
### 6.1.1. Battery and UPS Connection Steps

Note: To prevent surge current, before cycle test, must connect battery and equipment as followings:

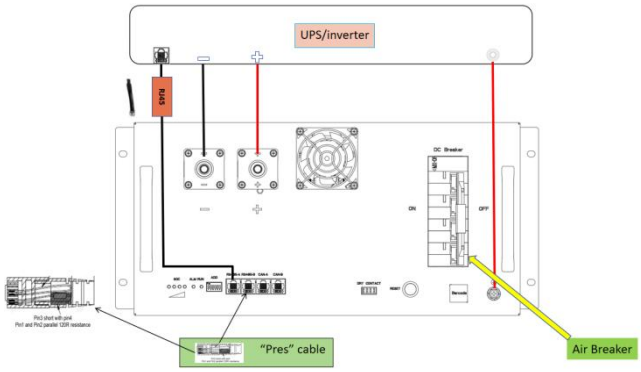
1) Connect UPS to the external battery pack with supplied battery cable.



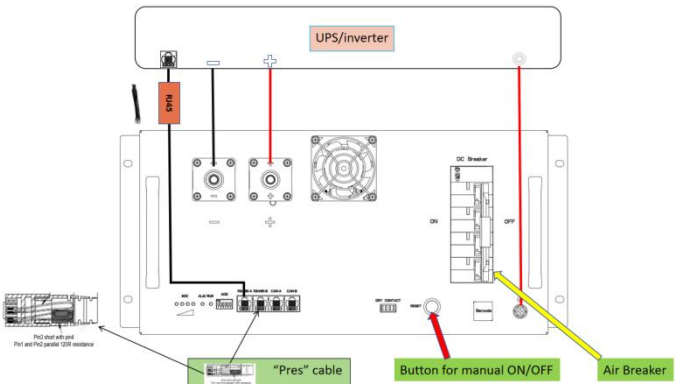

2) As the picture shows below, insert the COM cable (RJ45 cable supplied in the UPS package) into the BMS COM port on the battery pack. The other end connects to BMS communication port of the UPS. And insert “Pres” short cable on the battery RS485 connector to enable the battery.




3) Turn on the Air Breaker.




4) Press the Button for manual ON/OFF for 1s to wake up the battery, Run LED (Green) is on.




5) Connect AC power to UPS

### 6.1.2. Charge and Discharge Procedure with UPS

Steps as follows：

Step 1: Start charging

After battery is connected well to UPS. Connect AC power to UPS to start charging.

Step 2: Check if battery is able to be charge, or not.

Charge the battery with UPS. Check the Battery Level LED of the battery when start charging.

If anyone of the four Battery Level LED is flashing, it means the battery is charged successfully. Charging to SOC 100%. Customer can read the SOC of the battery pack through the system.

If no Battery Level LED is flashing during the charging process, it means that the battery is not charged successfully. Please filter out and contact the supplier for maintenance service.

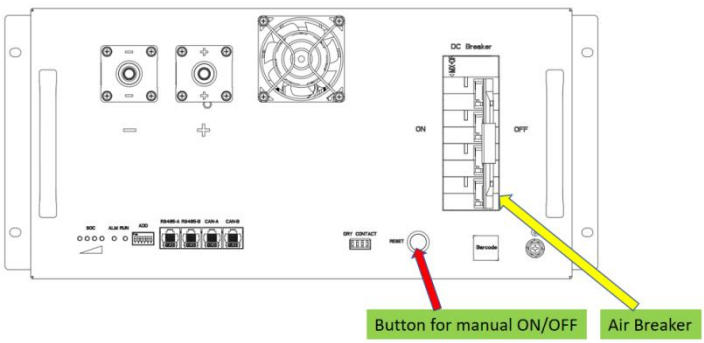
LED description as below:


Step 3: Start discharging

Discharge to SOC 50% for storage. Customer can read the SOC of the battery pack through the system.

Step 4: After discharge, pack it

Press the Button for manual ON/OFF for 3s to shut down the battery. Turn off the Breaker. Check if the battery is already turned off, and all LED are off. If yes, pack it.

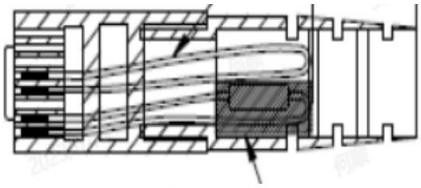


## 6.2. Charge with DC Source and Discharge with DC Electronic Load

Equipment List:

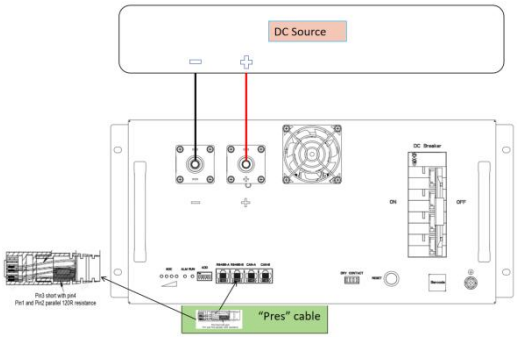
| **Equipment** | **Type / Rating Requirement** | **Comments** |
|---|---|---|
| DC Source | 56V/50A | For example, KIKUSUI PWR800L 80V/50A.<br>As long as charging voltage range is over 56V and charging current range is over 50A, these can be ap plied to charge the battery. |
| DC Electronic Load | CC160A | For example, Faith FT6814A 12000W/120V/600A.<br>As long as discharging current range is over 160A, it can be applied to discharge the battery. |
| "Pres" Short Cable | RJ45 Terminal | |

The drawing of RJ45 terminal

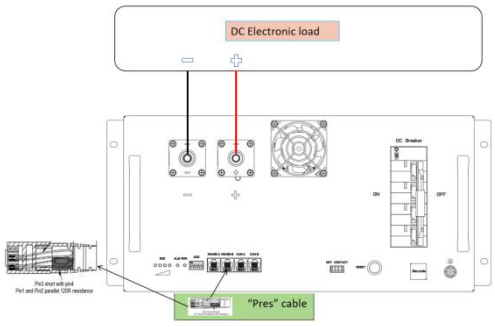


Pin3 short with pin4
Pin1 and Pin2 parallel 120R resistance

The connection between battery and DC source as below:




The connection between battery and DC Electronic load as below:



Notes: 1. Do not reverse connect the battery power cable. It may damage the battery pack, if reverse connected.

2. If use DC source or integrated equipment, need to insert an RJ45 terminal on the battery RJ45 connector to enable the battery.

The step as below:

Step 1: Set DC source with constant current (CC): 50A; Constant voltage (CV): 56V; then turn off the DC source output.

Step 2: Connect the battery and DC source as picture above.

Step 3: Turn on the Air Breaker and press the Button for manual ON/OFF for 1s to active the battery.

Step 4: Turn on the DC source and insert the “Pres” short cable into the RS485 connector of the battery. Then Charge the battery with 50A to SOC 100%. When charged to 100% SOC, the SOC LED will stop flashing and all the SOC LED will be solid on.

Step 5: Disconnect the battery and DC source, press the Button for manual ON/OFF for 3s to shut down the battery.

Step 6: Set DC Electronic load with constant current (CC): 100A; then turn off the DC Electronic load.

Step 7: Connect the battery and DC Electronic load as picture above.

Step 8: Press the Button for manual ON/OFF for 1s to active the battery.

Step 9: Turn on the DC Electronic load, then discharge with 160A for 1 hour, the battery SOC will be about 50%. And two SOC LED would be on. (Customer can read the SOC of the battery pack through the system.)

Step 10: Disconnect the battery and DC Electronic load, press the Button for manual ON/OFF for 3s to shut down the battery. Turn off the Breaker.

Step 11: After discharged, pack it.

## 6.3. Verification Methods for SOC of Battery

### 6.3.1. Read SOC by LED:

| Capacity Stat | Capacity display LED | | | |
|---|---|---|---|---|
| | ● | ● | ● | ● |
| | LED1 | LED2 | LED3 | LED4 |
| 0% | Off | Off | Off | Off |
| 0%~10% | Blink3 | Off | Off | Off |
| 10%~25% | On | Off | Off | Off |
| 25%~50% | On | On | Off | Off |
| 50%~75% | On | On | On | Off |
| 75%~100% | On | On | On | On |

Note:

Blink3: LED on 1s, and off 1s.

### 6.3.2. Read SOC by Communication:

You can read the SOC from ACE Communication Software by PCAN Tools or RS485 Tools.

# 7. Troubleshooting

Use the following table to resolve minor installation and operational issues.

| Problem | LED status | Possible cause | Solution |
|---|---|---|---|
| Power Off | All LED is off | Breaker is off | Turn on the breaker |
| | | Battery pack is shutdown | Charge the battery or press the button to wake up the battery |
| | | System failure | Shutdown system and call maintenance service |
| Battery Cannot Discharge | Alarm LED is slowly flashing (LED on 0.25s, and off 3.75s) | Missing "Present" signal<br>Or Address Switch setting conflict between parallel batteries | Check and insert the “PRES” short cable or the parallel batteries address setting and correct them |
| | Alarm LED is quickly flashing (LED on 0.5s, and off 0.5s). All SOC LED are off. | Protection against under-voltage | Charge the battery |
| | Alarm LED is quickly flashing (LED on 0.5s, and off 0.5s) | Protection against over-temperature or under-temperature (cell temperature is lower than -20'C or higher than 80'C) | Regulate cell temperature in the range of -20°C to 60°C for discharge |
| | | Protection against over current | Remove some unimportant load and charge battery |
| | | Battery output is short circuit | Remove short circuit and charge battery |
| | Alarm LED is solid on | System failure | Shutdown system and call maintenance service |
| Battery Cannot Charge | Alarm LED is slowly flashing (LED on 0.25s, and off 3.75s) | Missing "Present" signal<br>Or Address Switch setting conflict between parallel batteries | Check and insert the “PRES” shorting plug<br>or the parallel batteries address setting and correct them |

| | | | |
|---|---|---|---|
| | Alarm LED is quickly flashing (LED on 0.5s, and off 0.5s) | Protection against over current | Ensure power shelf setting is not over 100A for battery. |
| | | Protection against over-temperature or under- temperature (cell temperature is lower than 0°C or higher than 60°C) | Regulate cell temperature in the range of 0°C to 60°C for charge |
| | Alarm LED is solid on | System failure | Shutdown system and call maintenance service |
| Communication Failure | Alarm LED is quickly flashing (LED on 0.5s, and off 0.5s) | Fault of communication cable | Inspect communication cable |
| | | Communication address conflict | Check the parallel batteries address setting and correct them |
| | Alarm LED is solid on | System failure | Shutdown system and call maintenance service |

# 8. System Maintenance

**DANGER**

● Wear personal protective equipment and use dedicated insulated tools to avoid electric shocks or short circuits. Refer to section 2.3.

● Do not smoke or use open flame around the battery.

● Do not use wet cloth to clean exposed copper bars or other conductive parts.

● Do not use water or any solvent to clean batteries.

**WARNING**

● Do not perform maintenance on the battery while it is energized. Turn off the battery power before performing operations such as inspection and tightening screw torque. Before performing operations such as inspection and tightening screw torque, explain the risks to the customer, obtain the customer's written consent, and take the following measures Explain the risks to the customer, obtain the customer's written consent, and take preventive measures.

● After the battery is discharged, it should be charged in time to avoid damage caused by over-discharge. Damage caused by over-discharge.

● Before moving or reconnecting the unit, disconnect the power supply and battery and wait five minutes until the unit is powered off. Before servicing equipment, check for the presence of hazardous voltages in the DC voltage. Before servicing the equipment, use a multimeter to check for the presence of hazardous voltages in the DC bus or components requiring maintenance.

**CAUTION**

● Do not connect two or more cables to the positive or negative power port of a battery in parallel.

● Stay away from the equipment when preparing cables to prevent cable scraps from entering the equipment. Cable scraps may cause sparks and result in personal injury and equipment damage.

## 8.1. Routine Maintenance

To ensure that the battery will work properly for a long time, it is recommended that you perform routine maintenance on it as described in this chapter.

Maintenance checklist

| **Check Item** | **Check Method** | **Maintenance Interval** |
|---|---|---|
| Cleanliness | ● Check periodically that the heat sinks are free from obstacles and dust.<br>● Check periodically that ESD protective equipment is free of foreign objects and dust. | Once every 12 months |
| Running Status | ● Check that the battery is not damaged or deformed.<br>● Check that the battery does not generate abnormal sound when it is in operation.<br>● Check that the battery parameters are correctly set when the battery is running. | Once every 12 months |
| Electrical Connection | ● Check that cables are secured.<br>● Check that cables are intact, and that in particular, the parts touching the metallic surface are not scratched.<br>● Check that unused DC input terminals, battery terminals, and COM ports are locked by watertight caps. | Checked 12 months after first commissioning. Thereafter, once every 12 months. |
| Grounding Reliability | Check that ground cables are securely connected. | The first inspection takes place 12 months after the initial commissioning. From then on, the intervals are once every 12 months. |

# 9. Download Log and SW Details

For details about downloading battery logs and software details, refer document [Download Log and SW Details-CAN] or [Download Log and SW Details-RS485].

# 10. SOH Calculation

SOH is equal to full capacity divided by design capacity. For example, if full capacity is 95Ah and design capacity is 100Ah, then SOH is 95%. You can calibrate the full capacity of battery if you need, please refer section 5.3.

# 11. Battery EOL Handling Procedure

## 11.1. Introduction

This section aims to provide detailed guidance that complies with local regulations for the EOL treatment of industrial and commercial batteries.

Proper treatment of end-of-life batteries is crucial for environmental protection, resource recycling, and regulatory compliance.

## 11.2. Overview of Relevant Local Regulations

There is a series of strict regulations regarding battery recycling and treatment globally. The main purpose is to ensure that the hazardous substances in batteries are properly handled to prevent harm to the environment and human health.

These regulations require battery manufacturers, sellers, and users to take appropriate measures for the recycling and treatment of batteries at the end of their life.

## 11.3. Identification of Battery EOL

When a battery reaches the end of its service life, the following signs may appear:

1) Significant capacity decline: When the actual capacity of a battery is less than 60% of its rated capacity, it usually indicates that the battery is approaching or has reached EOL.

2) Poor charging performance: The charging time is significantly prolonged, or abnormal situations such as overheating occur during the charging process.

3) Unstable voltage: During the discharge process, the battery voltage fluctuates greatly and cannot maintain a stable output.

4) Physical damage: The battery casing is cracked, deformed, etc., which may cause

damage to the internal structure and affect the battery performance.

## 11.4. Safety Treatment Measures for EOL Batteries

1) Isolated storage

- Once a battery is identified as EOL, it should be immediately removed from the using device and placed in a dedicated isolation area. This area should be away from flammable and explosive materials, and avoid direct sunlight and humid environments.

- Batteries of different types and specifications should be stored separately to prevent mutual influence and accidents.

2) Prevent short - circuit

- During the storage and transportation of EOL batteries, it is necessary to ensure that the positive and negative electrodes of the battery do not come into contact with each other to avoid short - circuits that may cause fires or explosions. Insulating materials can be used to wrap the battery electrodes, or the batteries can be placed in specially designed insulating containers.

3) Clear identification

- Clearly identify EOL batteries, indicating information such as the battery type, specification, production date, usage status, and whether there are potential safety hazards. The identification should use languages and symbols commonly used locally so that relevant personnel can accurately identify and handle them.

## 11.5. Recycling and Treatment Process of EOL Batteries

1) Contact authorized recyclers

Only authorized recyclers are legally allowed to handle battery waste. You can obtain a list of authorized recyclers through the official website of the local environmental department or relevant industry associations.

- When contacting recyclers, provide detailed information about the batteries, including quantity, specification, weight, etc., so that the recyclers can formulate appropriate recycling plans.

2) Transportation arrangement

- Authorized recyclers will arrange professional transport vehicles and personnel to collect EOL batteries. During transportation, the safety of the batteries should be ensured to avoid collisions and leaks.

- Transport vehicles should be equipped with necessary protective equipment and emergency treatment tools to handle possible emergencies.

3) Recycling and treatment process

- Recyclers will classify and test the collected EOL batteries and select appropriate treatment methods according to the type and condition of the batteries.

- For reusable battery components, such as electrode materials and casings, they will be recycled and re - processed to achieve resource recycling.

- For non - reusable hazardous substances, such as heavy metals and electrolytes, they will be safely treated in accordance with local regulations to ensure that they do not pollute the environment.

## 11.6. Records and Reports

1) Treatment records

- Enterprises should establish detailed EOL battery treatment records, including the collection time, quantity, transportation information, and the name of the recycler. The records should be kept for at least 5 years for inspection by relevant departments.

2) Reporting obligations

Enterprises may need to regularly report the treatment situation of EOL batteries to the local environmental department. The report should include information such as the quantity of treated batteries, treatment methods, and recycling utilization rate.

# 12. Emergency Treatment Measures

1) In case of emergencies such as leaks, fires, or explosions during the treatment of EOL batteries, the following measures should be taken immediately:

Evacuate personnel: Ensure that all personnel are quickly evacuated to a safe area to avoid

injury.

Evacuate the area and call emergency services. Toxic gases may be produced if the battery catches fire. The battery needs to be rapidly cooled to prevent any heat or fire spreading.

2) Extinguish the fire: If a fire occurs, appropriate fire - fighting equipment should be used to extinguish it. For battery fires, dry powder fire extinguishers or carbon dioxide fire extinguishers should be used, and liquid fire extinguisher are prohibited.

3) Handle leaks: If a battery leaks, absorbent materials should be used immediately to absorb the leaked substances, and the absorbed materials should be properly disposed of.

| | |
|---|---|
| Eye Contact | Rinse gently with running water and<br>seek medical attention if irritation develops |
| Skin Contact | Rinse gently with running water and seek<br>medical attention if irritation develops |
| Ingestion | If ingested, do not induce vomiting and<br>contact your local poisons information centre or doctor. |
| Inhalation | Evacuate area and seek professional medical attention immediately |

4) Call the local emergency number immediately: While taking emergency measures, the local emergency rescue hotline, such as the fire alarm number, should be called immediately to report the accident situation.