



# Product Specification

Product Name: 24V50A Lithium Battery management system

Product Number: 2450-1003-10B

| Configuration           | Parameter   | Function |
|-------------------------|-------------|----------|
| Single voltage platform | 3.2V        |          |
| PCS                     | 8S          | Options  |
| Capacity                | 50AH        | Settable |
| External switch         | ON          | Options  |
| Current limiting        | ON          | Options  |
| LCD                     | ON          | Options  |
| Storage                 | ON          | Own      |
| Heating                 | ON          | Options  |
| Precharge               | ON          | Own      |
| Communication           | RS232、RS485 | Options  |

| Signature and seal of supplier | Signature and seal of client |
|--------------------------------|------------------------------|
|                                |                              |

|             |            |            |        |             |           |
|-------------|------------|------------|--------|-------------|-----------|
| Executed By | Lin Jialei | Checked By | Wei Qi | Approved By | Huang Bin |
|-------------|------------|------------|--------|-------------|-----------|



| Date                |  | Date |  | Date |  |
|---------------------|--|------|--|------|--|
| <p>上海恩阶电子科技有限公司</p> |  |      |  |      |  |



| version | Date       | Draw up/amend | Version Revision Note |
|---------|------------|---------------|-----------------------|
| V1.0    | 2019.12.26 | Lin Jialei    | Create first draft    |
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|         |            |               |                       |
|         |            |               |                       |
|         |            |               |                       |
|         |            |               |                       |
|         |            |               |                       |



## 目录

|                                                             |            |
|-------------------------------------------------------------|------------|
| 1. Application scope.....                                   | 错误! 未定义书签。 |
| 2. Normative citation documents.....                        | 错误! 未定义书签。 |
| 3. Functional characteristics.....                          | 错误! 未定义书签。 |
| 3.1. Battery voltage detection.....                         | 错误! 未定义书签。 |
| 3.2. Cell, environment and power temperature detection..... | 错误! 未定义书签。 |
| 3.3. Battery charge/discharge current detection.....        | 错误! 未定义书签。 |
| 3.4. Short circuit protection function.....                 | 错误! 未定义书签。 |
| 3.5. Battery capacity and cycle times.....                  | 错误! 未定义书签。 |
| 3.6. Charge, Discharge MOSFET switch.....                   | 错误! 未定义书签。 |
| 3.7. Balance of intelligent single cell.....                | 错误! 未定义书签。 |
| 3.8. LED indication function.....                           | 错误! 未定义书签。 |
| 3.9. Dormant function.....                                  | 错误! 未定义书签。 |
| 3.10. One-key switch machine.....                           | 错误! 未定义书签。 |
| 3.11. CAN and RS485 communication interfaces.....           | 错误! 未定义书签。 |
| 3.12. Communications.....                                   | 错误! 未定义书签。 |
| 3.13. Historical data records are stored and read.....      | 错误! 未定义书签。 |
| 3.14. Battery Management Parameters.....                    | 错误! 未定义书签。 |
| 3.15. Battery management functions.....                     | 错误! 未定义书签。 |
| 3.16. Precharge function.....                               | 错误! 未定义书签。 |
| 3.17. Connect the compensation.....                         | 错误! 未定义书签。 |
| 3.18. Charging current limit.....                           | 错误! 未定义书签。 |
| 3.19. PC.....                                               | 错误! 未定义书签。 |
| 3.20. Program upgrades.....                                 | 错误! 未定义书签。 |
| 4. Functional framework.....                                | 错误! 未定义书签。 |
| 5. Electrical characteristics.....                          | 错误! 未定义书签。 |
| 6. Basic parameters.....                                    | 错误! 未定义书签。 |
| 6.1. Basic parameters.....                                  | 错误! 未定义书签。 |
| 6.2. Basic mode of work.....                                | 错误! 未定义书签。 |
| 6.3. LED light indication instructions.....                 | 错误! 未定义书签。 |
| 7. Functional description.....                              | 错误! 未定义书签。 |
| 7.1. Standby state.....                                     | 错误! 未定义书签。 |
| 7.2. Over-protection and rehabilitation.....                | 错误! 未定义书签。 |
| 7.3. Protection and rehabilitation.....                     | 错误! 未定义书签。 |
| 7.4. Charging overcurrent protection and recovery.....      | 错误! 未定义书签。 |
| 7.5. Discharge overcurrent protection and recovery.....     | 错误! 未定义书签。 |
| 7.6. Temperature protection and recovery.....               | 错误! 未定义书签。 |
| 7.7. Balanced function.....                                 | 错误! 未定义书签。 |
| 7.8. Turn on and off.....                                   | 错误! 未定义书签。 |
| 7.9. Storage functions.....                                 | 错误! 未定义书签。 |
| 8. Dimensional mapping.....                                 | 错误! 未定义书签。 |



|                                                        |           |
|--------------------------------------------------------|-----------|
| 9. Reference diagram and connection instructions ..... | 错误！未定义书签。 |
| 9.1. Wiring definition .....                           | 错误！未定义书签。 |
| 9.2. Order of up and down .....                        | 错误！未定义书签。 |
| 10. Communications .....                               | 错误！未定义书签。 |
| 10.1. CAN communications .....                         | 错误！未定义书签。 |
| 10.2. RS485 communications .....                       | 错误！未定义书签。 |
| 10.3. parallel communication .....                     | 错误！未定义书签。 |
| 10.4. Dial code address selection .....                | 错误！未定义书签。 |
| 11. LCD Screen .....                                   | 错误！未定义书签。 |
| 12. Points for attention .....                         | 错误！未定义书签。 |

上海恩阶电子科技有限公司



## 1、 Application scope

This product is a fully functional 8 series lithium ion battery pack management system, with monomer overvoltage / undervoltage, total voltage undervoltage / overvoltage, charge / discharge overcurrent, high temperature, low temperature and short circuit protection and recovery functions. to achieve accurate measurement of SOC during charge and discharge, SOH health status statistics. realize voltage equalization during charging. Data communication is carried out with the host computer through RS485 communication, and the parameter configuration and data monitoring are carried out through the human-computer interaction of the upper computer software.

**Note: The baud rate of the host computer is 9600**

## 2、 Normative citation documents

The following documents are essential for the application of this document. The date-only version of the reference file is applicable to this file. The latest version of any undated reference file (including all modifications) applies to this file.

|                   |                                                                                                                                                                    |
|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| GB/T 191          | Marking of Packaging Storage and Transportation                                                                                                                    |
| GB/T 2408-2008    | plastic Determination of combustion properties Horizontal and vertical test                                                                                        |
| YD/T 983-2013     | Electromagnetic Compatibility Limit and Measurement Method for Communication Power Equipment                                                                       |
| GB/T 17626.5-2008 | Electromagnetic compatibility test and surge (shock) immunity test for measuring technology                                                                        |
| GB/T 17626.2-2006 | Electromagnetic Compatibility Test and Measurement Technology                                                                                                      |
| YD/T 2344.1—2011  | Lithium iron phosphate battery pack for communications - Part 1: integrated battery pack                                                                           |
| YD/T 2344.2—2015  | Lithium iron phosphate battery pack for communications - Part 2: discrete batteries                                                                                |
| YD/T 1363.3       | Communications Bureau (Station) Power, Air Conditioning and Environmental Centralized Monitoring Management System Part 3:Front-end Intelligent Equipment Protocol |
| YD/T 1058-2015    | High Frequency Switching Power Supply System for Communication                                                                                                     |



### 3、Functional characteristics

#### 3.1、Battery voltage detection

Real-time acquisition and monitoring of the voltage of the series cell to realize the alarm and protection of overvoltage and undervoltage. The voltage detection accuracy of the cell is  $\pm 10\text{mV}$  at  $0 \sim 45^\circ\text{C}$  and  $\pm 30\text{mV}$  at  $-20 \sim 70^\circ\text{C}$ .

Alarm, protection parameter setting can be changed by the upper computer.

#### 3.2. Cell, environment and power temperature detection

The BMS measure the cell temperature, ambient temperature and power temperature in real-time via NTC to provide high temperature or low temperature warnings and protections. The measured temperature difference is within  $\pm 2^\circ\text{C}$

Cell temperature sensor USES 10K, B value 3435.

Alarm, protection parameter setting can be changed by the upper computer.

#### 3.3. Battery charge/discharge current detection

The charge and discharge current of the battery pack is collected and monitored in real time by detecting the resistance of the current connected in the charge and discharge main circuit, The current accuracy is better than  $\pm 1\%$ .

Alarm, protection parameter setting can be changed by the upper computer.

#### 3.4. Short circuit protection function

Has the function of detecting and protecting the output short circuit.

#### 3.5. Battery capacity and cycle times

Real-time calculation of battery residual capacity, complete the learning of total charging and discharging capacity at one time, SOC estimation accuracy is better than  $\pm 5\%$ . It has the function of counting the number of charge and discharge cycles. When the accumulative discharge capacity of the battery pack reaches 80% of the set full capacity, the number of cycles will increase once.

Alarm, protection parameter setting can be changed by the upper computer.

#### 3.6. Charge, Discharge MOSFET switch

Low internal resistance, high current, high capacitance for backup power applications load startup, zero switching, double charging voltage optimization design.

#### 3.7. Balance of intelligent single cell

Unbalanced cells can be balanced when charging or standby, which can effectively improve the service time and cycle life of the battery.

Equalizing open voltage and equalizing differential pressure can be set by upper computer.



### 3.8. LED indication function

There are 6 LED indicators, 4 white LED indicators for the current battery SOC, 1 red LED indicator for alarm and protection failure, and 1 white LED indicator for battery standby, charging and discharging state.

### 3.9. Dormant function

BMS has manual and automatic sleep functions;

Automatic sleep function: The battery will automatically sleep for 48 hours when there is no external charging or discharging. When the battery pack is over-discharged, the communication is maintained for 1 minute, and the BMS enters the dormant state.

Manual sleep function: 1. By manually pressing the 6S reset button, the BMS enters sleep after the 6 LED lights light up in sequence.

2. The switch is controlled by an external switch, the switch is turned on when the switch is closed, and the switch is turned off when the switch is off.

The standby and hibernation can be set through the host computer.

### 3.10. One-key switch machine

BMS in parallel, the host can control the slave machine and boot. The host must dial the code according to the parallel mode, the host dial code address can not achieve one-click switch machine. (The batteries return to each other during the machine and can not be shut down by one button)

### 3.11. Communications

1. Connect the upper computer through RS485 set
2. After the RS485 set is connected, the host CAN/RM485 interface is connected to the inverter

### 3.12. Historical data records are stored and read

Historical data is to store a piece of data according to the BMS state transition; to store all kinds of alarm, protection trigger and elimination measurement data in real time; to store the measurement data in a certain time period by setting the record start time, record end time and record interval time. Currently can store not less than 300 historical data records, through the PC to read historical data and save as excel files into the computer.

### 3.13. Historical data records are stored and read

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### 3.14、Battery management functions

Voltage related functions, temperature related functions, current related functions (**Note: The output short-circuit function does not support the shutdown setting**), capacity related functions can be turned on or off through the upper computer setting.

### 3.15、Precharge function

The precharge function can be started immediately after starting up or discharging tube is turned on. The precharge time can be set (1mS to 5000mS) to cope with various capacity load scenarios and avoid short circuit protection of BMS output.

### 3.16、Connect the compensation

To prevent excessive pressure difference between cells or modules, 2 compensation points can be provided. When a wire or a long copper bar is used between the cells, a voltage difference will be generated, and impedance compensation is required. You can check whether the voltage difference between the cells is too large through the host computer.

When discharging, measure the pressure difference between the wire and the long copper bar; if the pressure difference is too large, according to the pressure difference/current=impedance, manually fill in the calculated impedance into the upper computer parameters. In the upper computer parameters, the default is the compensation impedance of the 9th and 13th wire connection, and the 2-way compensation impedance can be set according to the actual battery cell module.

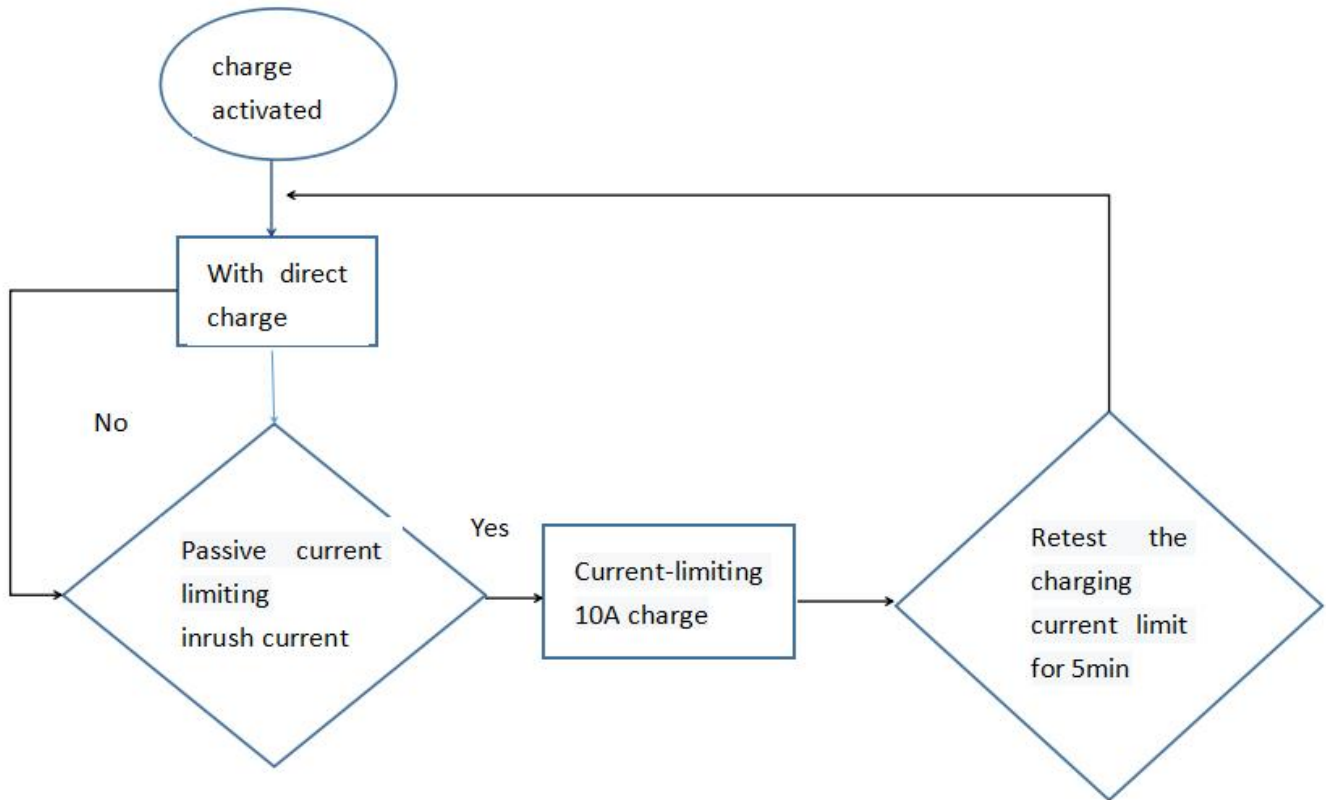
**Note: If the battery cell module is assembled with long wires and long copper bars, it must be communicated with the BMS manufacturer for impedance compensation. Otherwise it will affect the battery consistency.**

### 3.17、Charging current limit

Charging current limiter can be divided into two modes: active current limiter and passive current limiter. (**Note: Customers choose passive current limiting**)

1. Active current limiting: In the charging state of BMS, BMS keeps the current limiting module MOS tube open and actively restricts the charging current to 10A.

2. Passive current limiting: In the charging state of BMS, BMS opens the charging module MOS tube. If the charging current reaches the overcurrent warning value of charging (**Note: current setting 100A**), open the current limiting module MOS tube 10A, and re-test whether the charger current reaches the passive current limiting condition after 5 minutes of current limiting. (The passive current limit value can be set on)



### 3.18、PC

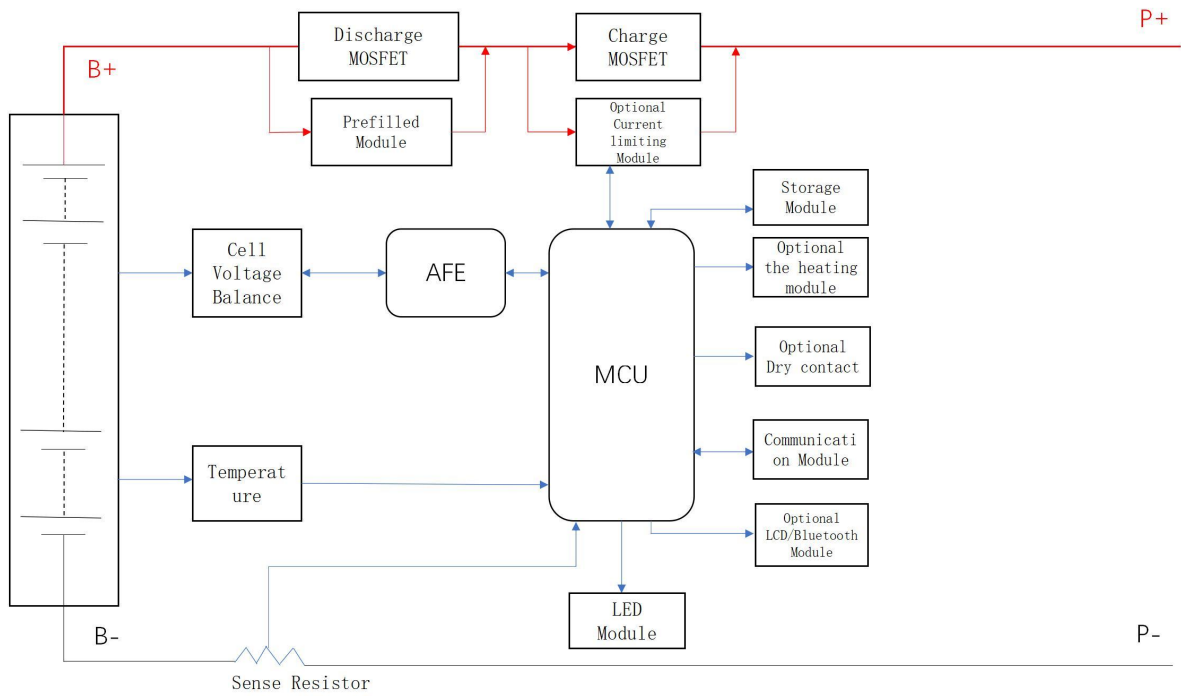
The host computer uses BatteryMonitorV2.1.9. It can switch between English and Chinese (English protocol is loaded when switching to English) and the loading protocol (Chinese file name: 16S\_V20\_ADDR, English protocol name: 16S\_V20\_ADDR\_EN). Please check the operation method in the file of host computer for the operation instructions.

### 3.19、Program upgrades

The main program version can be upgraded through the firmware update in the upper computer software.

The upper computer and the BMS are connected via RS485.

#### 4、功能框架图



#### 5、电气特性

| Project                      | Min  | Max  | Type | Unit |
|------------------------------|------|------|------|------|
| Normal operating voltage     | 21.6 | 29.2 | 24   | V    |
| Normal charging voltage      | /    | 30   | 28   | V    |
| Operating temperature range  | -20  | 70   | 25   | °C   |
| Storage temperature          | -40  | 85   | 25   | °C   |
| Use environment humidity     | 10   | 85   | /    | %    |
| Continuous charging current  | /    | 60   | 50   | A    |
| Continuous discharge current | /    | 60   | 50   | A    |
| Discharge output resistance  |      | <2   |      | mΩ   |
| Normal operating power       |      | <40  |      | mA   |
| Dormancy power consumption   |      | 50   | 0    | uA   |

## 6、基本参数

### 6.1、基本参数设置

| Function name                    | Function settings | Item list                          | Set value                                                                                                                                                                                                                                    | Setting range |
|----------------------------------|-------------------|------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| Single voltage alarm             | Open              | Single high pressure alarm         | 3500mV                                                                                                                                                                                                                                       | Can be set    |
|                                  |                   | High pressure recovery of monomer  | 3400mV                                                                                                                                                                                                                                       | Can be set    |
|                                  | Open              | Single low voltage alarm           | 2900mV                                                                                                                                                                                                                                       | Can be set    |
|                                  |                   | Low pressure recovery of monomer   | 3100mV                                                                                                                                                                                                                                       | Can be set    |
| Monomer overweight protection    | Open              | Monomer overweight protection      | 3650mV                                                                                                                                                                                                                                       | Can be set    |
|                                  |                   | Recovery of monomeric overpressure | 3400mV                                                                                                                                                                                                                                       | Can be set    |
|                                  |                   | Overpressure recovery conditions   | 1.monomer voltage drop overvoltage recovery point<br>2.residual capacity below intermittent recharge capacity 96%<br><b>Note: Two conditions must be met to recover</b><br>It is detected that the battery has a discharge current $\geq 3A$ |               |
|                                  |                   |                                    |                                                                                                                                                                                                                                              |               |
| Monomer underpressure protection | Open              | Under voltage protection voltage   | 2600mV                                                                                                                                                                                                                                       | Can be set    |
|                                  |                   | Under voltage recovery voltage     | 2900mV                                                                                                                                                                                                                                       | Can be set    |
|                                  |                   | Single under pressure shutdown     | Shut down after undervoltage protection and maintain 1 minute communication                                                                                                                                                                  |               |
|                                  |                   | Under pressure recovery conditions | Charging current detected $>1 A$                                                                                                                                                                                                             |               |



|                                                              |              |                                         |                                                                                                                                                                                                                                         |            |
|--------------------------------------------------------------|--------------|-----------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| Battery Total Pressure Alarm<br>Battery Total Pressure Alarm | Open         | Total pressure high pressure alarm      | 56.0V                                                                                                                                                                                                                                   | Can be set |
|                                                              |              | Total pressure recovery                 | 54.0V                                                                                                                                                                                                                                   | Can be set |
|                                                              | Open<br>Open | Total Pressure Low Pressure Alarm       | 46.4V                                                                                                                                                                                                                                   | Can be set |
|                                                              |              | Total pressure high pressure alarm      | 56.0V                                                                                                                                                                                                                                   | Can be set |
| Total pressure overvoltage protection                        | Open         | Total pressure overvoltage protection   | 28.8V                                                                                                                                                                                                                                   | Can be set |
|                                                              |              | Total pressure relief                   | 27.0V                                                                                                                                                                                                                                   | Can be set |
|                                                              |              | Overpressure recovery conditions        | 1.monomer voltage drop overvoltage recovery point<br>2.residual capacity below intermittent recharge capacity 96%<br><b>Note: Two conditions must be met to recover</b><br>It is detected that the battery has a discharge current > 3A |            |
|                                                              |              |                                         |                                                                                                                                                                                                                                         |            |
| Total pressure underpressure protection                      | Open         | Total pressure underpressure protection | 21.6V                                                                                                                                                                                                                                   | Can be set |
|                                                              |              | Total underpressure recovery            | 24.0V                                                                                                                                                                                                                                   | Can be set |
|                                                              |              | Total undervoltage shutdown             | Shut down after undervoltage protection and maintain 1 minute communication                                                                                                                                                             |            |
|                                                              |              | Underpressure recovery conditions       | Charging current detected >1A                                                                                                                                                                                                           |            |
| Cell                                                         | Open         | Charge High Temperature Alarm           | 50°C                                                                                                                                                                                                                                    | Can be set |



|                                         |      |                                       |       |            |
|-----------------------------------------|------|---------------------------------------|-------|------------|
| temperature forbidden to charge         |      | Charging High Temperature Recovery    | 47°C  | Can be set |
|                                         |      | Overcharge protection                 | 55°C  | Can be set |
|                                         |      | Overcharge recovery                   | 50°C  | Can be set |
|                                         |      | Charge Low Temperature Alarm          | 2°C   | Can be set |
|                                         |      | Low temperature charging recovery     | 5°C   | Can be set |
|                                         |      | Undercharge protection                | -10°C | Can be set |
|                                         |      | Recovery of undercharging             | 0°C   | Can be set |
| Cell temperature forbidden to discharge | Open | High Temperature Discharge Alarm      | 52°C  | Can be set |
|                                         |      | High temperature discharge recovery   | 47°C  | Can be set |
|                                         |      | Discharge overtemperature protection  | 55°C  | Can be set |
|                                         |      | Discharge overtemperature recovery    | 50°C  | Can be set |
|                                         |      | Low temperature discharge alarm       | -10°C | Can be set |
|                                         |      | Low temperature discharge recovery    | 3°C   | Can be set |
|                                         |      | Discharge undertemperature protection | -15°C | Can be set |



|                                      |       |                                            |       |                              |
|--------------------------------------|-------|--------------------------------------------|-------|------------------------------|
|                                      |       | Discharge undertemperature recovery        | 0°C   | Can be set                   |
| Environmental temperature protection | Open  | Environmental High Temperature Alarm       | 50°C  | Can be set                   |
|                                      |       | Environmental High Temperature Recovery    | 47°C  | Can be set                   |
|                                      |       | Environmental Over-temperature Protection  | 60°C  | Can be set                   |
|                                      |       | Environmental Overheating Recovery         | 55°C  | Can be set                   |
|                                      |       | Environmental Low Temperature Warning      | 0°C   | Can be set                   |
|                                      |       | Environmental Low Temperature Recovery     | 3°C   | Can be set                   |
|                                      |       | Environmental under-temperature protection | -10°C | Can be set                   |
|                                      |       | Environmental undertemperature recovery    | 0°C   | Can be set                   |
|                                      |       | Power temperature protection               | Open  | Power High Temperature Alarm |
| Power High Temperature Recovery      | 85°C  |                                            |       | Can be set                   |
| Overpower protection                 | 100°C |                                            |       | Can be set                   |



|                                 |                     |                                 |                                                             |                                                                                                                     |
|---------------------------------|---------------------|---------------------------------|-------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|
|                                 |                     | Power overtemperature recovery  | 85°C                                                        | Can be set                                                                                                          |
| Charging Current Limit          | Closed              | Active Current                  | 10A                                                         | Charger current greater than 10A, opening limit                                                                     |
|                                 | Open                | Passive limit flow              |                                                             | Charger current is greater than charging overcurrent alarm (value can be set), start current limit                  |
|                                 |                     | Charge Limit Delay              | 5 minutes                                                   | After the current limit is switched on, check again 5 minutes later whether the current limit is switched on or not |
| Charge Overcurrent Alarm        | Open                | Charge Overcurrent Alarm        | 50A                                                         | Can be set                                                                                                          |
|                                 |                     | Charging Overcurrent Recovery   | 45A                                                         | Can be set                                                                                                          |
| Charging Overcurrent Protection | Open                | Charging Overcurrent Protection | 60A                                                         | Can be set                                                                                                          |
|                                 |                     | Charge Overcurrent Delay        | 10S                                                         | Can be set                                                                                                          |
|                                 |                     | Overcurrent recovery conditions | Discharge recovered immediately or automatically after 60 S |                                                                                                                     |
| Effective charging current      | Charge into current |                                 | 600mA                                                       |                                                                                                                     |
|                                 | Charge Exit Current |                                 | 500mA                                                       |                                                                                                                     |
| Discharge Overflow Warning      | Open                | Discharge Overflow Warning      | -55A                                                        | Can be set                                                                                                          |
|                                 |                     | Discharge overcurrent recovery  | -53A                                                        | Can be set                                                                                                          |





|                                   |                        |                                            |                                                                             |            |
|-----------------------------------|------------------------|--------------------------------------------|-----------------------------------------------------------------------------|------------|
| Discharge over-current protection | Open                   | Discharge over-current protection          | -60A                                                                        | Can be set |
|                                   |                        | Discharge Overcurrent Delay                | 10S                                                                         | Can be set |
|                                   |                        | Overcurrent recovery conditions            | Charge immediately, or after 60 S automatically                             |            |
| Transient Overcurrent Protection  | Open                   | Transient Overcurrent Protection           | -150A                                                                       | Can be set |
|                                   |                        | Transient Overcurrent Delay                | 30mS                                                                        | Can be set |
|                                   |                        | Transient Overcurrent Recovery             | Charge immediately, or after 60 S automatically                             |            |
|                                   | Closed                 | Transient Overcurrent Lock                 | Continuous secondary overcurrent, exceeding the number of overcurrent locks |            |
|                                   |                        | Overcurrent locking times                  | 5 times                                                                     |            |
|                                   |                        | Transient lockout                          | Connect charger                                                             |            |
| Output short circuit              | Open                   | Short circuit protection current and delay | Write program ( <b>Note: Cannot be set</b> )                                |            |
|                                   |                        | Recovery of short circuit protection       | Charge immediately, or after 60 S automatically                             |            |
|                                   | Open                   | Short circuit protection lock              | Continuous output short circuit, over-current lock times                    |            |
|                                   |                        | Short circuit locking times                | 5 times                                                                     |            |
|                                   |                        | Short circuit lock release                 | Connect charger                                                             |            |
| Effective                         | Discharge into current |                                            | -500mA                                                                      |            |



|                                     |                              |                                       |                                                                                        |                        |            |
|-------------------------------------|------------------------------|---------------------------------------|----------------------------------------------------------------------------------------|------------------------|------------|
| discharge current                   | Discharge withdrawal current | -400mA                                |                                                                                        |                        |            |
| Core equalization function          | Open                         | Standby balance                       | Uncharged/discharge state open equilibrium                                             |                        |            |
|                                     |                              | Standby equalization time             | 10 hours                                                                               |                        |            |
|                                     | Open                         | Charge Balance                        | Open equalization in charging state and floating state                                 |                        |            |
|                                     | On voltage condition         | Balanced on voltage                   | 3400mV                                                                                 |                        |            |
|                                     |                              | Equilibrium Open Pressure             | 30mV                                                                                   |                        |            |
|                                     |                              | Equilibrium end differential pressure | 20mV                                                                                   |                        |            |
|                                     | Open                         | Equilibrium temperature limits        | Close the temperature range evenly according to the <b>(ambient alarm temperature)</b> |                        |            |
|                                     |                              | Equilibrium High Temperature Ban      | 50°C                                                                                   |                        |            |
|                                     |                              | Equilibrium cryogenic prohibition     | 0°C                                                                                    |                        |            |
|                                     | Core Failure Alarm           | Open                                  | Failure Pressure Differential                                                          | 500mV                  | Can be set |
| Core recovery pressure differential |                              |                                       | 300mV                                                                                  |                        |            |
| Battery capacity setting            | Battery rated capacity       |                                       | 50Ah                                                                                   | 5Ah~300Ah              |            |
|                                     | Battery residual capacity    |                                       | Estimation of core voltage                                                             | Can be set             |            |
|                                     | Accumulated cycle capacity   |                                       | 80%                                                                                    | Number of cycles (Set) |            |
|                                     | Open                         | Residual capacity alarm               | 15%                                                                                    |                        |            |
|                                     | Open                         | Residual capacity protection          | 5%                                                                                     | Turn off output        |            |



|                                 |                      |                                                                                    |                                                                                                                                                           |            |
|---------------------------------|----------------------|------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| Precharge function              | 2000ms               | 0~5000ms                                                                           | BMS boot up precharge function                                                                                                                            |            |
| BMS Power Management            | Open                 | Maximum standby time                                                               | 24h (Charger is not present and no effective discharge current)                                                                                           |            |
| Low temperature heating of core | Open                 | Low temperature heating of core                                                    | 0°C                                                                                                                                                       | Can be set |
|                                 |                      | Core heating recovery                                                              | 10°C                                                                                                                                                      |            |
|                                 |                      | Heating on logic                                                                   | The charger is on line and the temperature of the cell reaches the opening condition. Turn on and heat up.No heating in standby state and discharge state |            |
| External switches               | Open                 | BMS in standby state can operate external switch off and turn on BMS.              |                                                                                                                                                           |            |
| LCD screen                      | Open                 | Simple monitoring software, can view the core,temperature, current and other data. |                                                                                                                                                           |            |
| Compensation impedance          | Compensation point 1 | 0m Ω                                                                               | 9                                                                                                                                                         | Can be set |
|                                 | Compensation point 2 | 0m Ω                                                                               | 13                                                                                                                                                        |            |

## 6.2、Basic mode of work

### 6.2.1.charging mode

When the BMS detects that the charger is connected and the external charging voltage is greater than the internal battery voltage by more than 0.5V, when the charging current reaches the effective charging current, it enters the charging mode.

### 6.2.2.discharge mode

BMS into discharge mode when the load connection is detected and the discharge current reaches the effective discharge current.

### 6.2.3.standby mode

When the above two modes are not satisfied, enter standby mode.

### 6.2.4、 shutdown mode

Normal standby for 48 hours, battery triggers under-voltage protection, key-press shutdown or



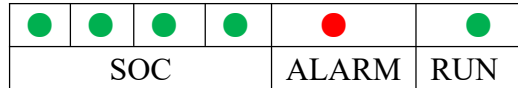
external switch shutdown, BMS enters shutdown mode.

Wake-up conditions for shutdown mode: 1. Charge activation; 2. 48V voltage activation; 3. Press the key to turn on; 4. External switch.

### 6.3.LED light indication instructions

#### 6.3.1、LED lamp sequence

1 operational light ,1 alarm light ,4 capacity indicator lights



#### 6.3.2.Capacity indication

| Status                    |        | Status      |             |             |             | Discharge   |             |             |             |
|---------------------------|--------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| Capacity indicator        |        | L4 ●        | L3 ●        | L2 ●        | L1 ●        | L4 ●        | L3 ●        | L2 ●        | L1 ●        |
| The remaining capacity    | 0~25%  | OFF         | OFF         | OFF         | Flash       | OFF         | OFF         | OFF         | Solid Green |
|                           | 25~50% | OFF         | OFF         | Flash       | Solid Green | OFF         | OFF         | Solid Green | Solid Green |
|                           | 50~75% | OFF         | Flash       | Solid Green | Solid Green | OFF         | Solid Green | Solid Green | Solid Green |
|                           | ≥75%   | Flash       | Solid Green | Solid Green | Solid Green | Solid Green | Solid Green | Solid Green | Solid Green |
| Running indicator light ● |        | Solid Green |             |             |             | Flash       |             |             |             |

#### 6.3.3.Light Blink explanation

| Flash Mode | ON    | OFF   |
|------------|-------|-------|
| Flash 1    | 0.25s | 3.75s |
| Flash 2    | 0.5s  | 0.5s  |
| Flash 3    | 0.5s  | 1.5s  |

#### 6.3.4.State indication

| System state | Running state | RUN         | ALM    | SOC                            |     |     |     | Note                |
|--------------|---------------|-------------|--------|--------------------------------|-----|-----|-----|---------------------|
|              |               | ●           | ●      | ●                              | ●   | ●   | ●   |                     |
| Shutdown     | Sleep         | OFF         | OFF    | OFF                            | OFF | OFF | OFF | OFF                 |
| Standby      | Normal        | Flash1      | OFF    | OFF                            | OFF | OFF | OFF | Standby status      |
| Charge       | Normal        | Solid Green | OFF    | According to battery indicator |     |     |     | Highest LED flash 2 |
|              | Alarm         | Solid       | Flash2 | According to battery indicator |     |     |     | Highest LED flash 2 |

|           |                                                     |        |             |                                |     |     |     |                                                                                      |
|-----------|-----------------------------------------------------|--------|-------------|--------------------------------|-----|-----|-----|--------------------------------------------------------------------------------------|
|           |                                                     | Green  |             |                                |     |     |     |                                                                                      |
|           | overvoltage protection                              | Flash1 | OFF         | OFF                            | OFF | OFF | OFF |                                                                                      |
|           | Temperature ,overcurrent protection                 | Flash1 | Flash1      | OFF                            | OFF | OFF | OFF |                                                                                      |
| Discharge | Normal                                              | Flash3 | OFF         | According to battery indicator |     |     |     | According to battery indicator                                                       |
|           | Alarm                                               | Flash3 | Flash3      |                                |     |     |     |                                                                                      |
|           | Temperature ,overcurrent , short circuit protection | OFF    | Solid Green | OFF                            | OFF | OFF | OFF | Stop discharging, forced dormancy without action after 48h when the mains is offline |
|           | Under-voltage protection                            | OFF    | OFF         | OFF                            | OFF | OFF | OFF | Stopping Discharge                                                                   |

# 1. Functional description

## 7.1. Standby state

BMS the correct connection on the power, in no overvoltage, undervoltage, overcurrent, short circuit, over temperature, under temperature and other protection state, press the reset button to boot, BMS in standby state.

BMS standby state, the running lamp flashes, and the battery can be charged and discharged.

## 7.2. Over-protection and rehabilitation

### 7.2.1. Monomer overcharge protection and recovery

If any section of the battery core is higher than the set value of the monomer overcharge protection, the BMS enters the overcharge protection state, and the charging equipment can not charge the battery.

After the monomer overvoltage protection, when the maximum monomer voltage drops below the monomer overcharge recovery value and the SOC is below 96%, the overcharge protection state is relieved. can also discharge release.

### 7.2.2. Total pressure overcharge protection and recovery

If the battery voltage is higher than the set value of the total voltage overcharge protection, the BMS enters the overcharge protection state, and the charging equipment can not charge the battery. If the total voltage drops below the recovery value and SOC below 96%, the overcharge protection is relieved. It can also be released Except.

## 7.3. Protection and rehabilitation

### 7.3.1. Protection and restoration of monomers

If any section of the battery core is lower than the set value of the monomer



over-discharge protection, the BMS enters the over-discharge protection state, and the load can not discharge the battery. Hold 1 minute communication after BMS shutdown.

After over-discharge protection occurs, charging the battery pack can release the over-discharge protection state. or press the reset button, BMS will boot to re- detect whether the battery pack voltage reaches the recovery value.

**Note: After the BMS discharges under-voltage protection, it is shut down, and the button is activated or the charging is activated. The BMS keeps the output voltage for 1 minute for the inverter to detect the battery voltage, so it is not allowed to discharge within 1 minute.**

### 7.3.2. Total pressure protection and recovery

When the battery voltage is lower than the total voltage over-discharge protection set value, the BMS enters the over-discharge protection state, and the load can not discharge the battery. Hold 1 minute communication after BMS shutdown.

After over-discharge protection occurs, charging the battery pack can release the over-discharge protection state. or press the reset button, BMS will boot to re- detect whether the battery pack voltage reaches the recovery value.

**Note: After the BMS discharges under-voltage protection, it is shut down, and the button is activated or the charging is activated. The BMS keeps the output voltage for 1 minute for the inverter to detect the battery voltage, so it is not allowed to discharge within 1 minute.**

### 7.4. Charging overcurrent protection and recovery

Charging overcurrent protection can be triggered when there is no charging current limiting function. when the charging current exceeds the charging overcurrent protection setting value and reaches the delay time. BMS access charging overcurrent protection, charging equipment can not charge the battery.

After charging overcurrent protection occurs, the BMS automatically delays recovery and re-detects the external charger current. discharge can also remove the charging overcurrent protection.

### 7.5. Discharge overcurrent protection and recovery

When the discharge current exceeds the discharge overcurrent protection setting value and reaches the delay time. BMS into the discharge overcurrent protection, the load can not charge the battery.

After the discharge overcurrent protection occurs, the BMS automatically delays recovery and re-detects the external load current. charging can also release the discharge overcurrent protection.

Discharge over-current protection has two-stage protection to achieve transient over-current protection and discharge over-current protection recovery. Transient protection occurs when the number of times the condition will be locked, recovery must be turned off in the boot or charge release.

### 7.6. Temperature protection and recovery



BMS there are 6 temperature detection ports, the implementation of monitoring temperature changes to achieve protection measures.

**7.6.1. Charge/discharge high temperature protection and recovery**

When charging and discharging state ,4 cores NTC arbitrarily one higher than the high temperature protection set value, BMS into the high temperature protection. BMS stop charging or discharging.

If the temperature of the core is lower than the high temperature recovery value, the charge or discharge BMS resume.

**7.6.2. Charge/discharge low temperature protection and recovery**

When charging and discharging state ,4 cores NTC randomly one lower than the low temperature protection set value, BMS into the low temperature protection. BMS stop charging or discharging.

If the core temperature is higher than the low temperature recovery value, the charge or discharge BMS resume.

**7.6.3. Ambient temperature protection, power temperature protection**

When the NTC detects that the ambient temperature is higher than the ambient high temperature setting value, the BMS enters the ambient high temperature protection. The BMS stops charging and discharging.

When NTC detects that the power temperature is higher than the power protection setting value, the BMS enters the power high temperature protection. The BMS stops charging and discharging.

**7.7. Balanced function**

BMS should have standby and charge equalization function, the system adopts energy consumption type equalization circuit, the equalization open voltage software is adjustable, the equalization open condition any section is higher than the equalization open voltage and the pressure difference reaches the condition together.

When stop charging or the core pressure difference is less than the set value.

**7.8. Turn on and off**

| Serial number | Function         | Definition                                                                                                                                                                                   |
|---------------|------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1             | Boot/boot        | BMS in hibernation, press the reset button, the BMS is activated, After the LED indicator lights shine in turn, turn to normal working state.                                                |
| 2             | Shutdown / Sleep | BMS in standby or discharge state, press this key, after 6 s, the BMS is dormant, and the LED indicator lights shine in turn, and turn to sleep state. Sleep after BMS no power consumption. |
| 3             | External         | External switch can control BMS switch machine,                                                                                                                                              |

|  |          |                          |
|--|----------|--------------------------|
|  | switches | external switch priority |
|--|----------|--------------------------|

### 7.9. Storage functions

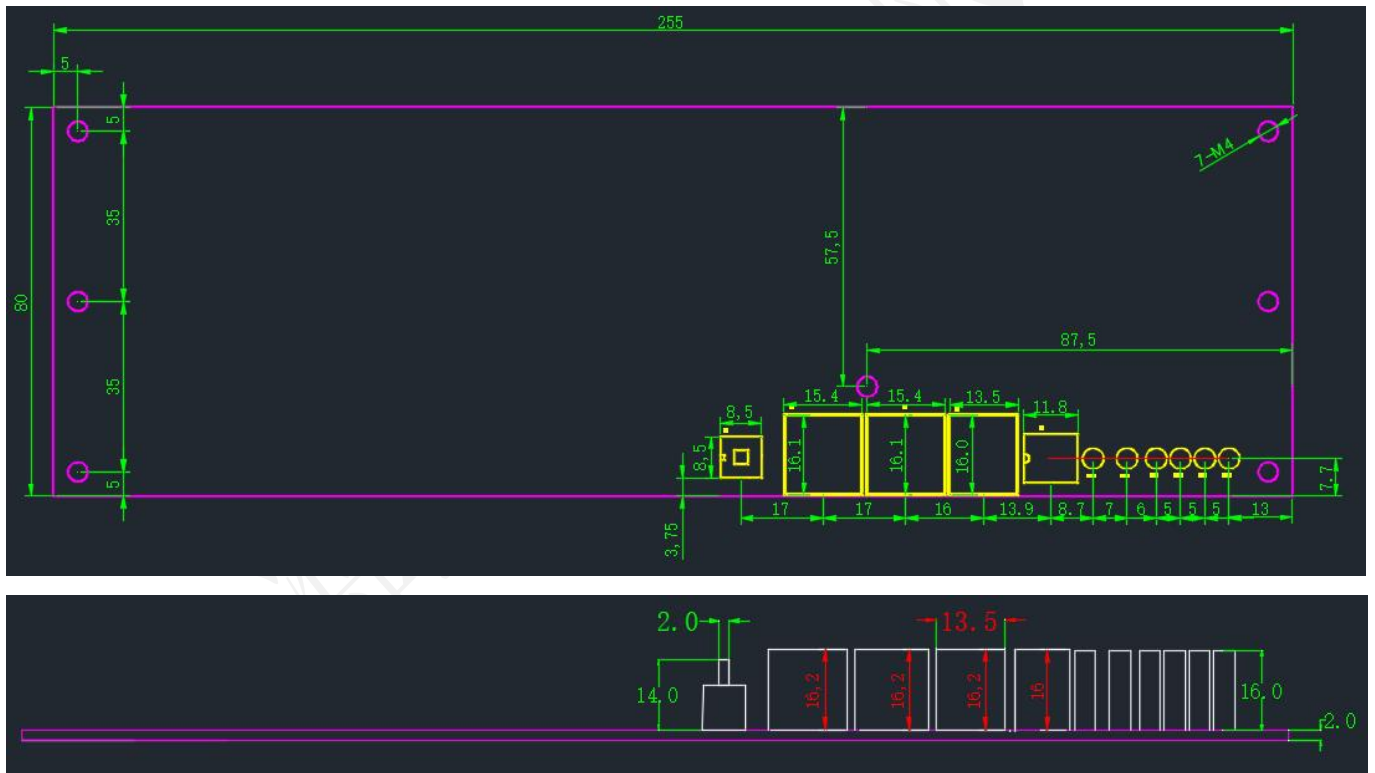
Storage content includes: protection and alarm and its category, protection and alarm recovery time, single battery voltage, total battery voltage, charge/discharge capacity, charge/discharge current, temperature, etc.

It records in year/month/day/hour/minute/second, and can also be set to record the information content within a certain period of time.

The amount of information storage is not less than 300.

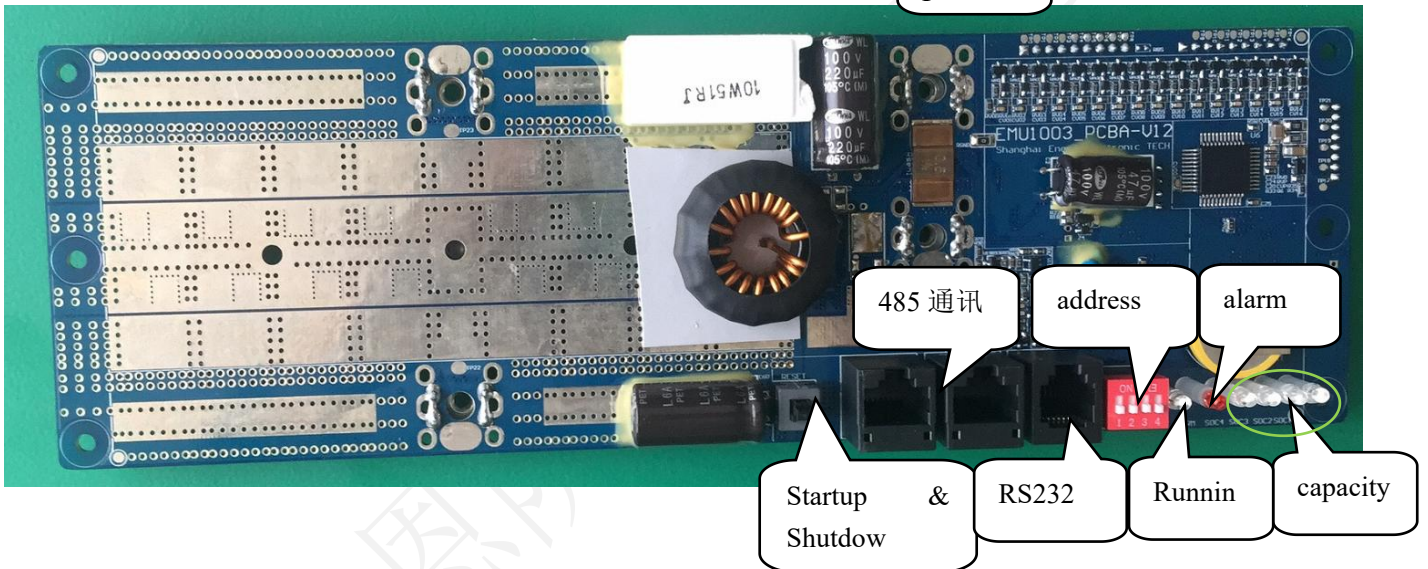
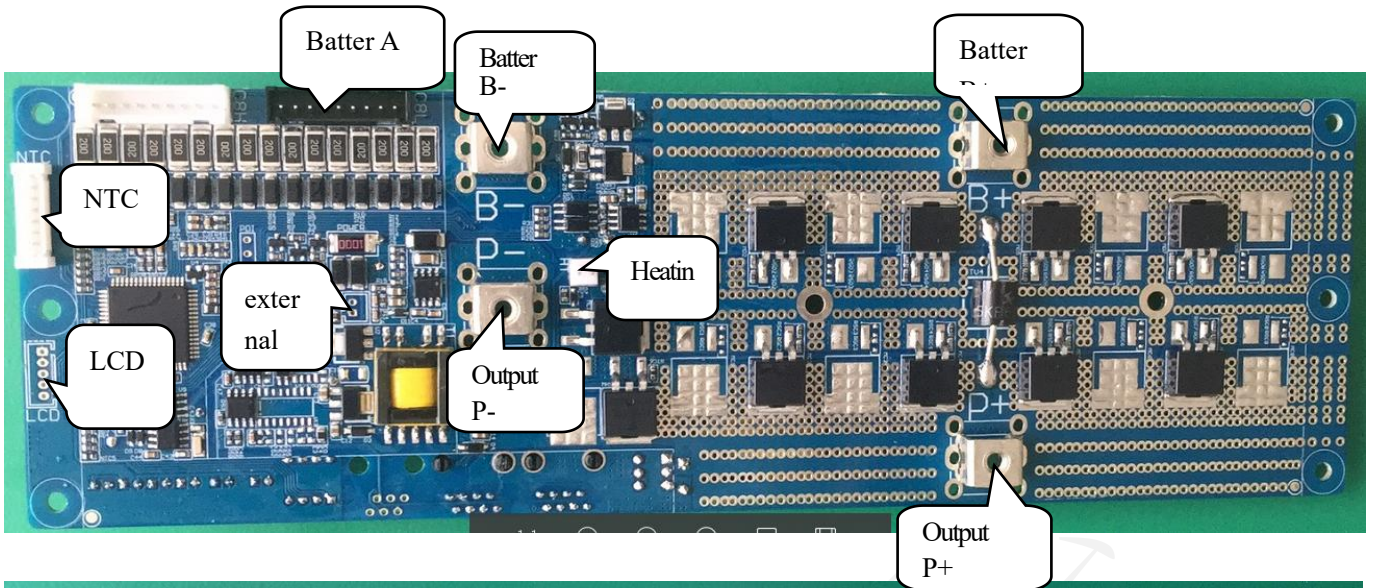
The historical data can be read through the host computer and saved as an excel file to the computer.

### 8、 Dimensional mapping



## 1. 9、 Reference diagram and connection instructions





Note: There may be some differences between the actual product and the physical drawing of the above products.

9.1、接线定义

| 线束 A (黑色排插) |        |                                                     |
|-------------|--------|-----------------------------------------------------|
|             | CELL1- | Connect to the negative of the first battery        |
|             | CELL1+ | Connect to the positive pole of the first battery   |
|             | CELL2+ | Connect to the positive pole of the second battery  |
|             | CELL3+ | Connect to the positive pole of the third battery   |
|             | CELL4+ | Connect to the positive pole of the fourth battery  |
|             | CELL5+ | Connect to the positive pole of the fifth battery   |
|             | CELL6+ | Connect to the positive pole of the sixth battery   |
|             | CELL7+ | Connect to the positive pole of the seventh battery |
|             | CELL8+ | Connect to the positive pole of the eighth battery  |

| NTC 线 |       |                                 |
|-------|-------|---------------------------------|
|       | NTC1+ | Connect temperature sensor NTC1 |
|       | NTC1- | Connect temperature sensor NTC1 |
|       | NTC2+ | Connect temperature sensor NTC2 |
|       | NTC2- | Connect temperature sensor NTC2 |
|       | NTC3+ | Connect temperature sensor NTC3 |
|       | NTC3- | Connect temperature sensor NTC3 |
|       | NTC4+ | Connect temperature sensor NTC4 |
|       | NTC4- | Connect temperature sensor NTC4 |

注：CELL8+为电芯 B+端。

## 9.2、上下电顺序

1) 上电按照以下顺序：先接主板 B-，依次接排线线束 A、NTC 线，在接主板 B+，最后再连接接 P+和 P-到充电器或者负载（注：主板接好线后是关机状态，按一下复位按键开机或者闭合外部开关，充电也可激活 BMS）。

2) 下电顺序完全相反：先断开充电器或者负载（注：按 6S 复位按键或者断开外部开关，流转灯一次熄灭关机），在断开 B+，依次断开线束 A、NTC 线，最后断开 B-。

### 3) 输入输出

充电时：充电器的正极连接保护板的“P+”，充电器的负极连接保护板的“P-”。

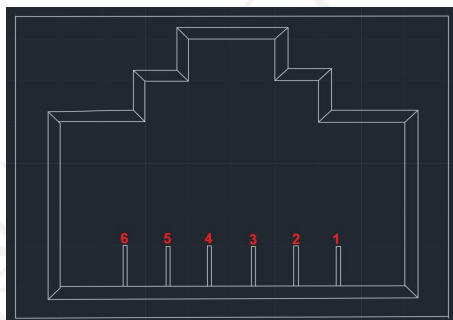
放电时：负载的正极连接保护板的“P+”，负载的负极连接保护板的“P-”。

## 10、通信说明

### 10.1、RS232 communications

The BMS should have RS232 communication function for battery pack data upload, with a baud rate of 9600bps. RS232 upload communication interface. Through the RS232 communication interface, it can communicate with the host computer.

RS232 communication interface definition.

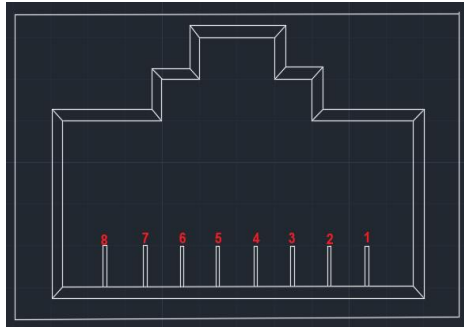


| PIN | Definitions |
|-----|-------------|
| 2   | GND         |
| 3   | RX          |
| 4   | TX          |
| 5   | GND         |

### 10.2、RS485 communications

BMS has RS485 communication with battery pack integration and baud rate of 9600bps. RS485 communication interface adopts 8P8C network cable interface.

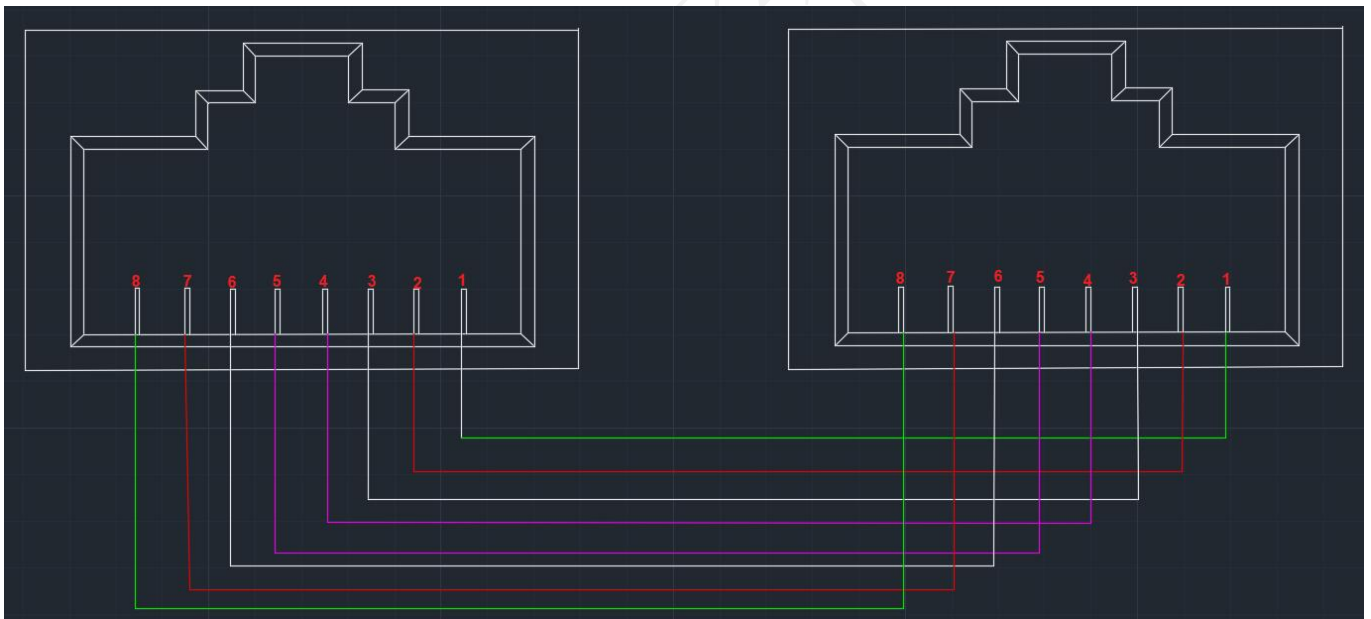
RS485 communication interface definition:



| PNG | Definitions |
|-----|-------------|
| 1、8 | RS485-B     |
| 2、7 | RS485-A     |
| 3、6 | GND         |
| 4、5 | NC          |

### 10.3、Parallel communication

When multiple machines are connected in parallel, the RS485 interface is used as the parallel communication interface. The terminal device can read the sum of the battery data of all parallel packs through the 485 interface. When multiple machines are connected in parallel, the RS485 interface connection is shown in the figure below:



### 10.4、Dial address selection

**Parallel DIP switch definition:** In the multi-machine communication when the battery pack is connected in parallel, the DIP switch is used to distinguish different Pack addresses, and the hardware address can be set through the DIP switch on the board.

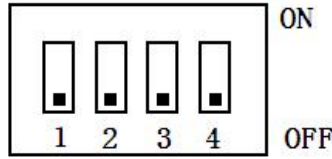
**Stand-alone address setting:** 0000 Connect to the host computer through RS232 or RS485

**Parallel use address setting:** For the definition of DIP switches, refer to the following table

For example, 2 parallel machines: the first one dials 1000 and the second dials 0100 to

connect the host computer through RS485

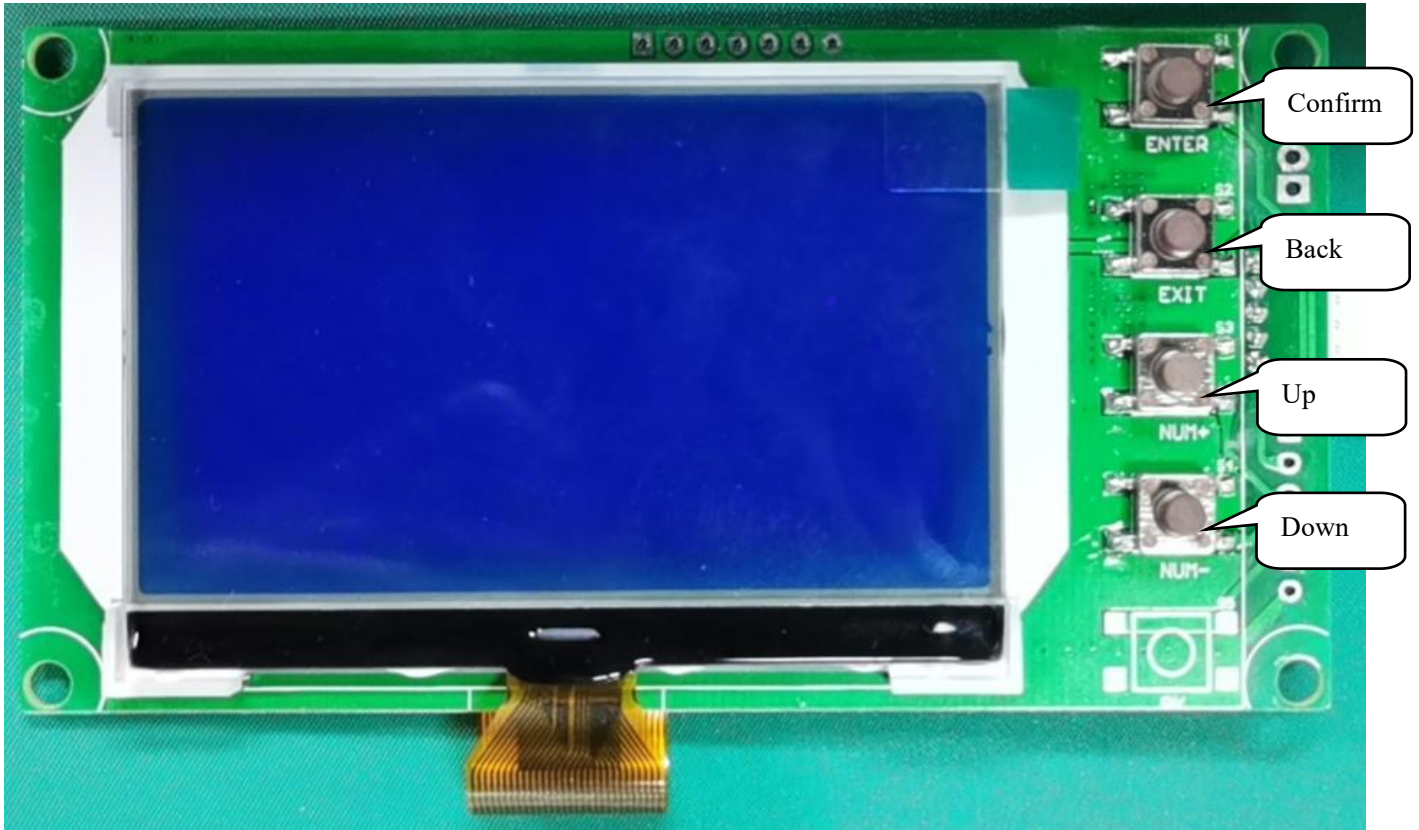
3 parallel machines: the first one dials 1000, the second dials 0100, and the third dials 1100 Connect to the host computer through RS485

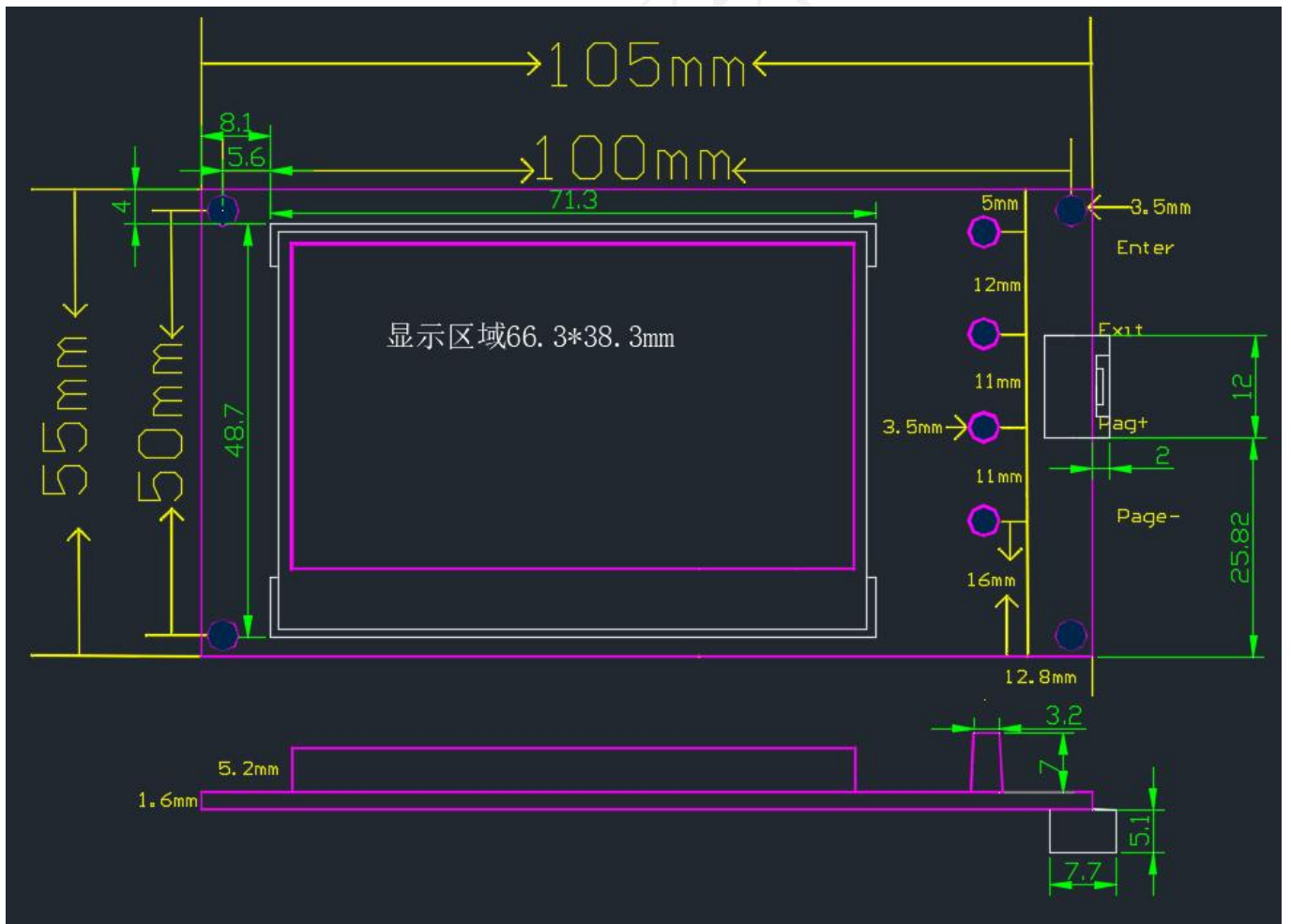
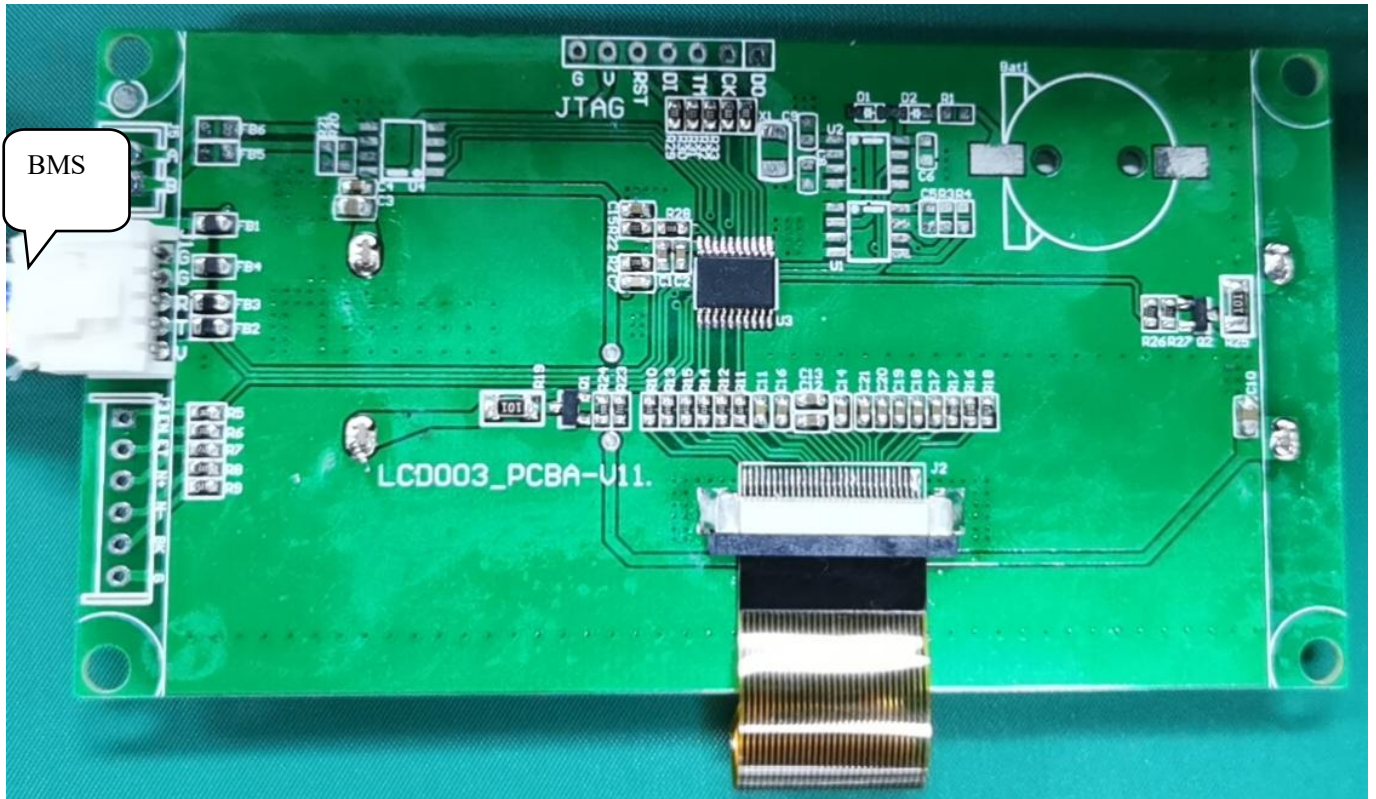


| Add<br>ress | DIP switch position |     |     |     | Note   |
|-------------|---------------------|-----|-----|-----|--------|
|             | #1                  | #2  | #3  | #4  |        |
| 0           | OFF                 | OFF | OFF | OFF | Pack0  |
| 1           | ON                  | OFF | OFF | OFF | Pack1  |
| 2           | OFF                 | ON  | OFF | OFF | Pack2  |
| 3           | ON                  | ON  | OFF | OFF | Pack3  |
| 4           | OFF                 | OFF | ON  | OFF | Pack4  |
| 5           | ON                  | OFF | ON  | OFF | Pack5  |
| 6           | OFF                 | ON  | ON  | OFF | Pack6  |
| 7           | ON                  | ON  | ON  | OFF | Pack7  |
| 8           | OFF                 | OFF | OFF | ON  | Pack8  |
| 9           | ON                  | OFF | OFF | ON  | Pack9  |
| 10          | OFF                 | ON  | OFF | ON  | Pack10 |
| 11          | ON                  | ON  | OFF | ON  | Pack11 |
| 12          | OFF                 | OFF | ON  | ON  | Pack12 |
| 13          | ON                  | OFF | ON  | ON  | Pack13 |
| 14          | OFF                 | ON  | ON  | ON  | Pack14 |
| 15          | ON                  | ON  | ON  | ON  | Pack15 |

## 11、LCD Screen

Please refer to the LCD screen specification for detailed instructions







Note: The display screen is shipped according to the actual situation. Our company has three kinds of display screens LCD003 and LCD005.

上海恩阶电子科技有限公司





## 12、 Points for attention

- ❖ Battery management systems can not be used in series.
- ❖ BMS power components withstand voltage 100V.
- ❖ If the battery module is assembled in the form of long wire and long copper bar, it must communicate with the BMS manufacturer for impedance compensation. Otherwise, it will affect the consistency of the cell.
- ❖ The external switch on BMS is prohibited to connect with other equipment. If necessary, please confirm with the technology for docking. Otherwise, BMS will not bear any responsibility for damage.
- ❖ Do not touch the surface of the core directly when assembling, so as not to damage the core. The assembly should be firm and reliable.
- ❖ In use pay attention to lead wire head, soldering iron, solder and so on do not touch the components on the circuit board, otherwise it may damage the circuit board.
- ❖ Use process should pay attention to anti-static, moisture-proof, waterproof and so on.
- ❖ Please follow the design parameters and use conditions during use, must not exceed the value in this specification, otherwise it may damage the protection board.
- ❖ After combining the battery pack and the protection plate, if you find no voltage output or charge, please check the wiring is correct.
- ❖ The final interpretation right is owned by our company.