apexium 东莞安智电子科技有限公司
Dongguan Anzhi Electronic Technology Co., Ltd

# Specification for Lithium-ion Battery BOX


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Dongguan Anzhi Electronic Technology Co., Ltd

Battery pack model： **16S1P-51.2V_280Ah**

Material number： **240119280**

| Customer acknowledgment stamp | | Company acknowledgment stamp | | R&D department | |
|---|---|---|---|---|---|
| Department | | Department | | Version | V1.0 |
| | | | | Latest effective date | 2024-01-19 |
| | | | | page numbers | 34 |
| | | | | Editor | Xingrui Liu |
| | | | | Reviewer | |
| Effective date | | Effective date | 2024-01-19 | Approver | |

| **Version Change History Form** | | | |
|---|---|---|---|
| Version | Major Change History Description | Editor | Effective date |
| V1.0 | Initial release | Xingrui Liu | 2024-01-19 |
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## Table of Contents

# 1 Applicability

This specification is applied to the reference battery in this Specification that manufactured or assembled by Dongguan Anzhi Electronic Technology Co., Ltd.

# 2 Test conditions

## 2.1 Test environmental conditions

Unless otherwise specified, all tests in this specification shall be conducted under standard atmospheric conditions：

Temperature：15℃～35℃

Relative humidity：45%～75%

Atmospheric pressure：86kPa～106kPa

## 2.2 Requirements for Measuring Instruments and Equipment

2.2.1 The accuracy of voltmeters used for measurement shall be no less than 0.5 grade, and the internal resistance shall be no less than 10KΩ/V.

2.2.2 The accuracy of ammeters used for measurement shall be no less than 0.5 grade.

2.2.3 The accuracy of timers used for measurement shall be within ±0.1%.

2.2.4 The accuracy of thermometers used for measurement shall be within ±0.5°C.

# 3 Finished Product

## 3.1 Main Technical Parameters

| Project | Parameters | Note |
|---|---|---|
| Rated capacity | 280Ah | Discharging at 0.2C |
| Minimum capacity | 280Ah | |
| Rated voltage | 51.2V | |
| Internal resistance | ≤0.2mΩ | Measuring internal resistance with AC 1kHz |
| Combination method | 16S1 P | |
| Charging method | CC/CV | Constant current to constant voltage |
| Standard charging current | 0.2C | |
| Maximum charging current | ≤280A | |
| Standard discharging current | 0.2C | |
| Maximum discharging current | ≤280A | |
| Charging cut-off voltage | 58.4V | |
| Discharging cut-off voltage | 40V | |
| Factory voltage | 48V～51.2V | |
| Weight | 约125kg | |
| Size | L930*W450*H300（mm） | |
| Charging temperature | 0℃～ + 45℃ | |
| Discharging temperature | –20℃～ + 60℃ | |
| Storage temperature | 1 month：-20~60℃<br>3 month：-10~40℃<br>1 year：-20~25℃ | |
| Relative humidity | 45%~85% RH | |
| Maximum sustainable discharge current | ≤200A | |
| Maximum sustainable charge current | ≤200A | |
| Cycle life | 6000 times | |

## 3.2 Routine performance

| Project | Testing method | Judgment criteria |
|---|---|---|
| Standard charging | Charge the battery with 0.2C current at (25±2)℃ ambient temperature until the voltage reaches the charging cut-off voltage. Then switch to charging with constant voltage at the charging cut-off voltage until the charging current drops below 0.02C to stop charging | Charging time is ≤7h |
| Rated capacity | At (25±2)℃ ambient temperature, after fully charged by standard charging method, let it sit for 0.5h, then discharge with 0.2C current to the discharging cut-off voltage and record the discharging capacity | ≥Minimum capacity |
| Internal resistance | Using AC 1kHz detection method | Please refer to section 3.1 for the internal resistance item |
| Charge retention capacity | After the standard charging of the battery is completed, the battery is left open-circuit for 28 days at an ambient temperature of (25±2)°C. It is then discharged at a rate of 0.2C until reaching the cut-off voltage V, and the discharge capacity is recorded | ≥85% of the initial capacity |
| Cycle life | Under the condition that the environmental temperature is (25 ± 2) °C, after being fully charged by the standard charging method and placed for 0.5h, discharge the battery at constant current 0.2C to the discharge cut-off voltage , after discharging , place it for 0.5h and then perform the next charge and discharge cycle until the rated capacity for continuous two cycles ≤ 80% | ≥ 6000 times |

## 3.3 Environmental adaptability

| Project | Testing method | Judgment criteria |
|---|---|---|
| High-temperature usage | The fully charged sample is placed in a high-temperature chamber, with the temperature set to the upper limits specified for charging and discharging temperatures of the battery, as well as the maximum value at 80℃. After the surface temperature of the battery stabilizes, it is kept at that temperature for 7 hours | Cutting off the power supply, the battery should not explode, catch fire, or leak liquid |
| Vibration | After the battery is fully charged, it is fixed on the vibration table without deformation. Sinusoidal vibration is applied using a logarithmic sweep frequency method. Within 15 minutes, the frequency is swept from 7Hz to 200Hz and then back to 7Hz. The vibration is performed in three directions perpendicular to each other (one of which must be perpendicular to the plane where the positive and negative terminals of the sample are located). Each direction repeats the logarithmic sweep frequency method 12 times, with a total vibration duration of 3 hours.<br>The logarithmic sweep frequency method is as follows:<br>From 7Hz to 18Hz, maintain a peak acceleration of 9.8m/s² and keep the amplitude at 0.8mm (displacement of 1.6mm) until the peak acceleration reaches 78.4m/s² (at a frequency of approximately 50Hz).<br>Maintain a peak acceleration of 78.4m/s² until the frequency increases to 200Hz.<br>After the experiment, perform one charge-discharge cycle on the battery. | The battery should not explode, catch fire, rupture, emit smoke, leak liquid, or release gas |
| Free fall | After the charging is completed, the battery sample is left idle for 1-4 hours before testing. The battery sample is dropped freely from a height of 1000mm (1500mm for batteries below 1000mAh) onto a concrete surface. It is dropped once in each of the positive and negative directions along the X, Y, and Z axes (six directions in total). | The battery should not explode, catch fire, rupture, emit smoke, leak liquid, or release gas |
| Low pressure | After rapid charging or standard charging of the battery, the sample is placed in a vacuum chamber with a temperature of (25±2)℃. Once the vacuum chamber is sealed, the internal pressure is gradually reduced until it is not higher than 11.6kPa (simulating an altitude of 15240m) and maintained for 6 hours | The battery should not explode, catch fire, rupture, emit smoke, leak liquid, or release gas |

## 3.4 Safety performance

| Project | Testing method | Judgment criteria |
|---|---|---|
| External short circuit at room temperature | After the battery is fully charged, it is placed under the condition of temperature 25℃±2℃. The battery is allowed to reach a temperature of 25℃±2℃ and then left idle for 30 minutes. After that, the battery is connected using a wire to the positive and negative terminals, ensuring that the total external resistance is 80±20 mΩ (with wire resistance temperature coefficient less than 5*10-3/℃). The experiment will be terminated if either of the following two conditions occurs: a) the battery temperature drops by 20% compared to the peak value, or b) the short-circuit time reaches 24 hours. | The battery should not explode, catch fire, and the maximum temperature should not exceed 150℃. |
| External short circuit at high temperature | After the battery is fully charged, it is placed under the condition of temperature 55℃±5℃. The battery is allowed to reach a temperature of 55℃±5℃ and then left idle for 30 minutes. After that, the battery is connected using a wire to the positive and negative terminals, ensuring that the total external resistance is 80±20 mΩ (with wire resistance temperature coefficient less than 5*10-3/℃). The experiment will be terminated if either of the following two conditions occurs: a) the battery temperature drops by 20% compared to the peak value, or b) the short-circuit time reaches 24 hours. | The battery should not explode, catch fire, and the maximum temperature should not exceed 150℃. |
| Combustion jet | After the battery is fully charged, place the battery on a wire mesh in the experimental fixture, securing the sample battery to the wire mesh with a single metal wire. Apply flame heating to the battery. The heating should be stopped if any of the following three conditions occur: a) the battery explodes, b) the battery completely burns, or c) the battery is continuously heated for 30 minutes without catching fire or exploding. | The components of the battery (excluding powdery products) or battery products must not penetrate the aluminum mesh |
| Overcharging | The single cell (without protection circuit) is discharged at a constant current of 0.2C to the cut-off voltage at an ambient temperature of | The battery should not explode or catch fire |

| | | |
|---|---|---|
| | 25℃±2℃. Then, a constant current of 3C and a voltage of 3.65V are applied until the voltage reaches its maximum value. The battery is continuously charged for 7 hours, and the temperature of the battery drops by 20% compared to its peak value. | |
| Acceleration shock | After the battery is fully charged, it is fixed on the shock table for a half-sine pulse shock test. Within the initial 3ms, the minimum average acceleration is 75g, the peak acceleration is 150±25g, and the pulse duration is 6ms±1ms. The battery undergoes three consecutive acceleration shocks in three mutually perpendicular directions | The battery should not explode, catch fire, rupture, emit smoke, leak liquid, or release gas |
| Thermal abuse. | After the battery is fully charged, it is placed in a thermal chamber. The temperature is increased at a rate of (5℃±2℃) per minute until it reaches 130℃±2℃, and then it is kept at that temperature for 30 minutes. | The battery should not explode or catch fire |
| Temperature cycling | After the battery is fully charged using the standard charging method, it is placed in a temperature-controlled chamber with a temperature of (25±2)°C. The following steps are performed:(1)The sample is placed in an experimental chamber with a temperature of 75℃±2℃ and kept for 6 hours.(2)The temperature of the experimental chamber is then lowered to -40℃±2℃ and kept for 6 hours. (3)The transition time between these temperature changes should not exceed 30 minutes.(4)Steps 1 and 2 are repeated for a total of 10 cycles. | The battery should not explode, catch fire, rupture, emit smoke, leak liquid, or release gas |
| Forced discharge | Under ambient temperature conditions of (25±2)℃, the battery is discharged at a rate of 0.2C until it reaches the cut-off voltage. Then, the battery is reverse charged at a current of 1C, ensuring that the charging time is not less than 90 minutes | The battery should not explode or catch fire |

| | | |
|---|---|---|
| Overcharging | After the battery is fully charged, it continues to be charged at a constant current of the maximum charging current until it reaches either n*6.0V or the highest voltage it can withstand (whichever is higher), and then it is maintained at that voltage for constant voltage charging. For batteries without protection circuits or with removed protection circuits, it is charged for 1 hour. For batteries with protection circuits, it is charged until the protection circuit is activated | The battery should not explode, catch fire, rupture, emit smoke, leak liquid, or release gas |
| Over current charging | After the battery is fully discharged, it is then charged at a constant current of 1.5 times the over current protection current (1.5C). For batteries without protection circuits or with removed protection circuits, it is charged until reaching the upper voltage limit. For batteries with protection circuits, it is charged until the protection circuit is activated. | The battery should not explode, catch fire, rupture, emit smoke, leak liquid, or release gas |
| Under-voltage discharge | After the battery is fully charged, it is discharged at its maximum discharge current in a constant current manner. For batteries without protection circuits or with removed protection circuits, it is discharged until reaching (n*0.15)V. For batteries with protection circuits, it is discharged until the protection circuit is activated. After the discharge, the battery is left idle for 10 minutes and then charged back to full capacity following the standard charging procedure. | The battery should not explode, catch fire, rupture, emit smoke, leak liquid, or release gas |
| Overload | After the battery is fully charged, it is discharged at a constant current of 1.5 times the over current discharge protection current (1.5C). For batteries without protection circuits or with removed protection circuits, it is discharged until reaching the cut-off voltage. For batteries with protection circuits, it is discharged until the protection circuit is activated. | The battery should not explode, catch fire, rupture, emit smoke, leak liquid, or release gas |

# 4 BMS parameters

## 4.1 Electrical specifications

| Project | Min | Max | Type | Unit |
|---|---|---|---|---|
| Normal operating voltage | 40 | 59 | 48 | V |
| Normal charging voltage | / | 60 | 54 | V |
| Operating temperature range | -20 | 70 | 25 | ℃ |
| Storage environment temperature | -40 | 85 | 25 | ℃ |
| Operating humidity | 10 | 85 | / | % |
| Continuous charging current | / | 210 | 200 | A |
| Continuous discharging current | / | 210 | 200 | A |
| Discharge output impedance | <2 | | | mΩ |
| Normal operating power consumption | <40 | | | mA |
| Standby power consumption | | 50 | 0 | uA |

## 4.2 Basic parameters and function

| function name | Function settings | project list | Settings | Set range |
|---|---|---|---|---|
| Single voltage alarm | turn on | Single high voltage alarm | 3500mV | Cell high voltage recovery ~ Cell over voltage protection |
| | | single high pressure recovery | 3400mV | 3000mV~Single high voltage alarm |
| | turn on | Single low voltage alarm | 2900mV | Cell under-voltage protection ~ Cell low-voltage recovery |
| | | Single low pressure recovery | 3100mV | Single unit low voltage alarm ~3300mV |

| | | | | |
|---|---|---|---|---|
| | | | | |
| Single over voltage protection | turn on | Single over voltage protection | 3650mV | Single high voltage alarm~4500mV |
| | | Single over voltage recovery | 3400mV | Cell high voltage recovery ~ Cell over voltage voltage |
| | | Over voltage recovery condition | 1. The cell voltage drops to the over voltage recovery point<br>2. The remaining capacity is lower than 96% of the intermittent recharging capacity.<br>**Note: Two conditions must be met to restore** | |
| | | | It is detected that the battery has a discharge current >3A | |
| | | | | |
| Single under voltage protection | turn on | Under voltage protection voltage | 2700mV | 1500mV~cell under voltage recovery |
| | | Brown-out recovery voltage | 3100mV | Single unit under-voltage protection ~ single unit low-voltage alarm |
| | | Single unit under voltage shutdown | Shut down after under-voltage protection and maintain communication for 1 minute | |
| | | Under voltage recovery conditions | Charging current (>1A) detected | |
| | | | | |
| Battery total voltage alarm | turn on | Total pressure high pressure alarm | 56.0V | Total pressure high pressure recovery~Total pressure over voltage protection |
| | | Total pressure high pressure recovery | 54.0V | 53.0V~total voltage high voltage |
| | turn on | Low total pressure alarm | 46.4V | Total pressure under voltage protection ~ total pressure low pressure recovery |

| | | | | |
|---|---|---|---|---|
| | | Total pressure low pressure recovery | 48.0V | Total voltage low voltage alarm ~55.0V |
| | | | | |
| Total voltage over voltage protection | turn on | Total voltage over voltage protection | 57.6V | Total voltage high voltage alarm~60.0V |
| | | Total pressure over voltage recovery | 54.0V | Total pressure high voltage recovery ~ total pressure over voltage voltage |
| | | Over voltage recovery condition | 1. The cell voltage drops to the over voltage recovery point<br>2. The remaining capacity is lower than 96% of the intermittent recharging capacity.<br>**Note: Two conditions must be met to restore** | |
| | | | It is detected that the battery has a discharge current >3A | |
| | | | | |
| Total voltage under voltage protection | turn on | Total voltage under voltage protection | 43.2V | 36.0V~Total voltage and under voltage recovery |
| | | Total voltage and under voltage recovery | 48.0V | Total pressure under voltage protection ~ total pressure low pressure alarm |
| | | Total voltage under voltage shutdown | Shut down after under-voltage protection and maintain communication for 1 minute | |
| | | Under voltage recovery conditions | Charging current (>1A) detected | |
| | | | | |
| Battery core temperature prohibits charging | turn on | Charging high temperature alarm | 50℃ | Charging high temperature recovery ~ charging over-temperature protection |
| | | Charging high temperature recovery | 47°C | 35℃~ charging high temperature alarm |

| | | | | |
|---|---|---|---|---|
| | | Charging over-temperature protection | 55℃ | Charging over temperature recovery ~80℃ |
| | | Charging over-temperature recovery | 50℃ | Charging high temperature recovery ~ charging over-temperature protection |
| | | Charging low temperature warning | 2℃ | Charging under temperature protection ~ charging low temperature recovery |
| | | Charge low temperature recovery | 5℃ | Charging low temperature warning ~10℃ |
| | | Charging under temperature protection | -10°C | -20℃~charging under-temperature recovery |
| | | Charge under temperature recovery | 0°C | Charging under temperature protection ~ charging low temperature recovery |
| | | | | |
| Cell temperature forbidden | turn on | Discharge high temperature alarm | 52°C | Discharge high temperature recovery~Discharge over-temperature protection |
| | | Discharge high temperature recovery | 47°C | 35℃~discharge high temperature alarm |
| | | Discharge over temperature protection | 55℃ | Discharge over-temperature recovery ~80℃ |
| | | Discharge over temperature recovery | 50℃ | Discharge high temperature recovery~Discharge over-temperature protection |
| | | Discharge low temperature warning | -10°C | Discharge under temperature protection ~ discharge low temperature recovery |
| | | Discharge low temperature recovery | 3℃ | Discharge low temperature alarm ~10℃ |
| | | Discharge under temperature protection | -15°C | -30℃~discharge under-temperature recovery |

| | | | | |
|---|---|---|---|---|
| | | Discharge under temperature recovery | 0°C | Discharge under temperature protection ~ discharge low temperature recovery |
| | | | | |
| Ambient temperature protection | turn on | Ambient high temperature warning | 50℃ | Environmental high temperature recovery~Environmental over-temperature protection |
| | | Environmental high temperature recovery | 47°C | -20℃~environmental high temperature alarm |
| | | Environmental over-temperatur e protection | 60℃ | Ambient over-temperature recovery ~80℃ |
| | | Environment over-temperatur e recovery | 55℃ | Environmental high temperature recovery~Environmental over-temperature protection |
| | | Ambient low temperature warning | 0°C | Environmental low temperature protection~environment al low temperature recovery |
| | | Ambient low temperature recovery | 3℃ | Ambient low temperature warning ~60°C |
| | | Environmental under temperature protection | -10°C | -30℃~Environment low temperature recovery |
| | | Environmental under temperature recovery | 0°C | Environmental low temperature protection~environment al low temperature recovery |
| | | | | |
| power temperature protection | turn on | Power high temperature warning | 90°C | Power high temperature recovery ~ power over temperature protection |
| | | Power High Temperature Recovery | 85°C | 60℃~ power high temperature alarm |

| | | | | |
|---|---|---|---|---|
| | | Power over temperature protection | 100℃ | Power high temperature alarm ~120℃ |
| | | Power over temperature recovery | 85°C | Power high temperature recovery ~ power over temperature protection |
| | | | | |
| Charge current limit | closure | Active current limiting | 10A | Charger current is greater than 10A, open current limit |
| | turn on | Passive current limiting | | The charger current is greater than the charging over current alarm (note: the value can be set), and the current limit is turned on. |
| | | Charging current limit delay | 5 minutes | After the current limit is enabled, re-check whether the current limit is enabled after 5 minutes |
| | | | | |
| Charging over current alarm | turn on | Charging over current alarm | 200A | Charging over current recovery ~ charging over current protection |
| | | Charging over current recovery | 195A | 0A~charging over current alarm |
| | | | | |
| Charging over current protection | turn on | Charging over current protection | 210A | Charging over current warning ~250A |
| | | Charging over current delay | 10S | 0S~10S |
| | | Over current recovery condition | Discharge resumes immediately, or automatically after 60S | |
| | | | | |
| Effective charging current | Charging into the current | | 600mA | |
| | Charge Exit Current | | 500mA | |
| | | | | |
| Discharge over current | turn on | Discharge over current alarm | -205A | Discharge over current protection ~ discharge over current recovery |

| | | | | |
|---|---|---|---|---|
| alarm | | discharge over current recovery | -203A | Discharge over current alarm~0A |
| | | | | |
| Discharge over current protection | turn on | Discharge over current protection | -210A | Transient over current protection ~ discharge over current alarm |
| | | Discharge over current delay | 10S | 0S~10S |
| | | Over current recovery condition | Charging resumes immediately, or automatically after 60S | |
| | | | | |
| Transient over current protection | turn on | Transient over current protection | -300A | Discharge over current protection value~300A |
| | | Transient over current delay | 30M | 0mS~100mS |
| | | Transient over current recovery | Charging resumes immediately, or automatically after 60S | |
| | closure | Transient over current lockout | Continuous two-level over current, exceeding the number of over current lockouts | |
| | | Number of over current lockouts | 5 times | |
| | | Momentary lock release | Connect the charger | |
| | | | | |
| Output short circuit protection | turn on (Currently does not support off settings) | Short circuit protection current and time delay | Write program (note: not settable) | |
| | | short circuit protection recovery | Charging resumes immediately, or automatically after 60S | |
| | turn on | Short circuit protection lockout | Continuous output short circuit, exceeding the number of over-current lockouts | |
| | | Short circuit lockout times | 5 times | |
| | | Short circuit lock release | Connect the charger | |
| | | | | |
| Effective | discharge into current | | -500mA | |

| | | | | |
|---|---|---|---|---|
| discharge current | Discharge exit current | | -400mA | |
| | | | | |
| Cell balancing function | turn on | Standby equalization | Turn on equalization in no charging and discharging state | |
| | | Standby equalization time | 10 hours | Can be set |
| | turn on | Charge balancing | Turn on equalization in charging state and float charge state | |
| | Turn on voltage condition | Balanced turn-on voltage | 3400mV | Can be set |
| | | Balanced opening pressure difference | 30mV | |
| | | Equilibrium end pressure difference | 20mV | |
| | | | | |
| | turn on | Equilibrium Temperature Limit | According to (note: determined by the ambient alarm temperature) the balanced shutdown temperature range | |
| | | Equilibrium high temperature prohibited | 50℃ | Can be set |
| | | Equilibrium Low Temperature Prohibition | 0℃ | |
| | | | | |
| Battery core failure alarm | turn on | Cell failure voltage difference | 500mV | Can be set |
| | | Cell recovery voltage difference | 300mV | |
| | | | | |
| Battery capacity setting | Battery rated capacity | | 200Ah | 5Ah~300Ah |
| | Battery remaining capacity | | Estimated by cell voltage | Can be set |
| | Cycle Cumulative Capacity | | 80% | Number of cycles (configurable) |

| | | | | |
|---|---|---|---|---|
| | turn on | Remaining capacity warning | 15% | |
| | turn on | Reserved capacity protection | 5% | close output |
| | | | | |
| PRE charge function | 2000ms | 0~5000ms can be set | BMS starts the PRE charging function instantly when it is turned on | |
| BMS power consumption management | turn on | Maximum standby time | 48h (the charger is not in and there is no effective discharge current) | |
| Battery core low temperature heating | turn on | Battery core low temperature heating | 0°C | Can be set |
| | | Battery core heating recovery | 10℃ | |
| | | Heating start logic | When the charger is online and the temperature of the battery core reaches the opening condition, turn on the heating. No heating in standby state and discharge state | |
| external switch | turn on | When the BMS is in standby mode, the external switch can be operated to turn off and turn on the BMS | | |
| LCD screen | turn on | Simplified monitoring software, you can view data such as battery cells, temperature, current, etc. | | |
| Manual charging activation | turn on | 1 point | After the under voltage protection, the BMS shuts down, manually press the button to activate and clear the forced output of the under voltage protection | Can be set |
| Compensation impedance | Compensation point 1 | 0mΩ | 9 | Can be set |
| | Compensation point 2 | 0mΩ | 13 | |

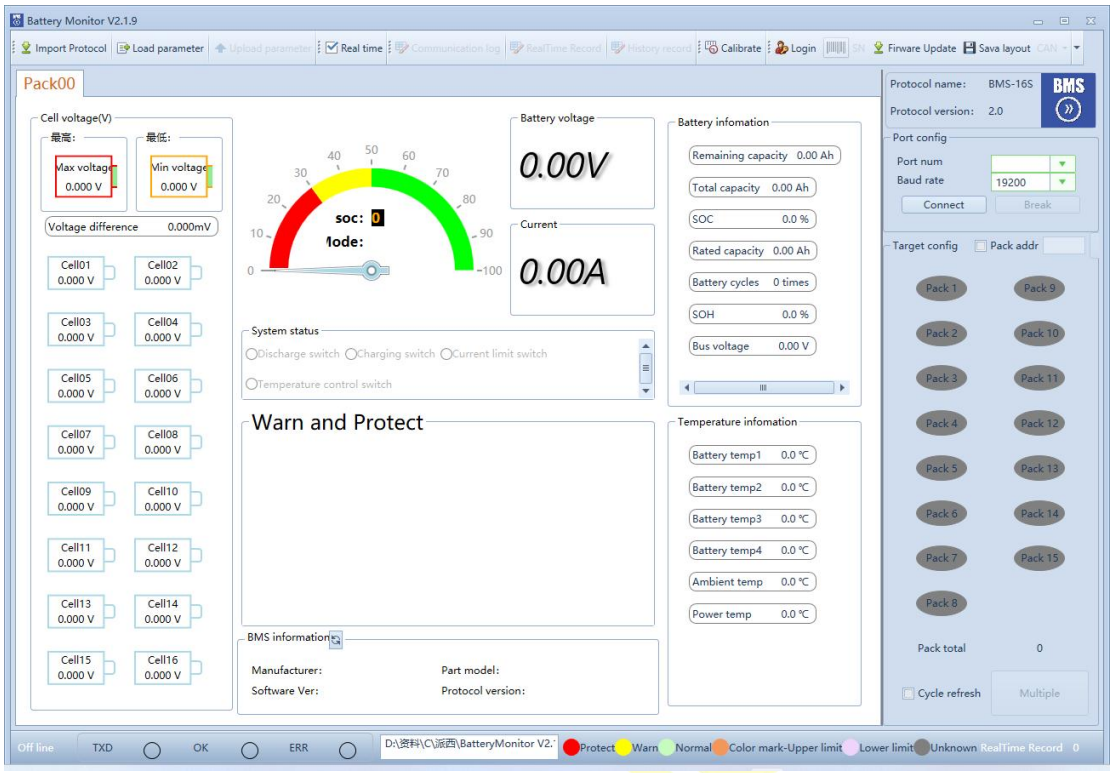
## 4.3 Status indication

| system status | Operating status | RUN | ALM | SOC | | | | illustrate |
|---|---|---|---|---|---|---|---|---|
| | | ● | ● | ● | ● | ● | ● | |
| shutdown | sleep | off | off | off | off | off | off | wipe out |
| standby | normal | Flash 1 | off | off | off | off | off | standby mode |
| Charge | normal | Always on | off | According to the battery indicator | | | | Highest LED Flash 2 |
| | Over current warning | Always on | Flash 2 | According to the battery indicator | | | | Highest LED Flash 2 |
| | Over voltage protection | Flash 1 | off | off | off | off | off | |
| | temperature, over current protection | Flash 1 | Flash 1 | off | off | off | off | |
| discharge | normal | Flash 3 | off | According to the battery indicator | | | | Steady light indicator based on power |
| | alarm | Flash 3 | Flash 3 | | | | | |
| | Temperature, over current, short circuit, etc. protection | off | Always on | off | off | off | off | Stop discharging. When the mains power is offline, there will be no action after 48 hours to force sleep. |
| | under voltage protection | off | off | off | off | off | off | Stop discharging |

## 4.4 computer software program

You can modify and store related parameters and data through computer software programs.

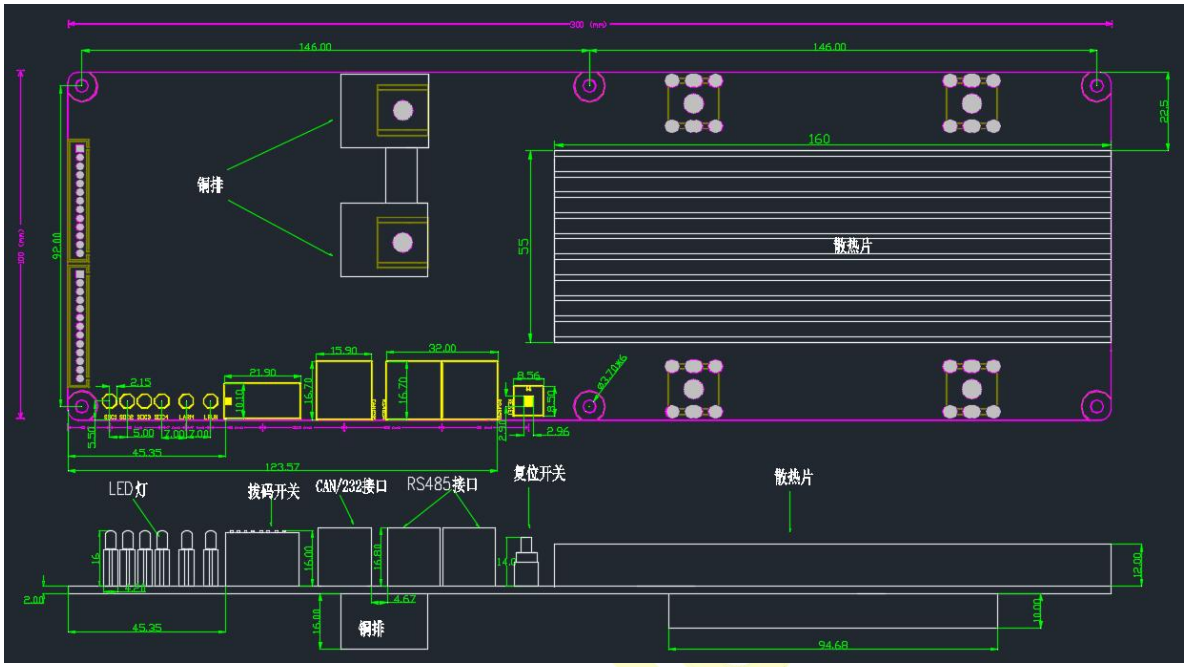
**Storage content includes**: protection and alarm, their categories, recovery time of protection and alarm, voltage of single cell, total voltage of battery pack, charge/discharge capacity, charge/discharge current, temperature, etc. Recorded in year/month/day/hour/minute/second format, or through settings, information content within a certain time period can also be recorded. The storage capacity of information is not less than 300 entries. Historical data can be read through the host computer and saved as an excel file to the computer.



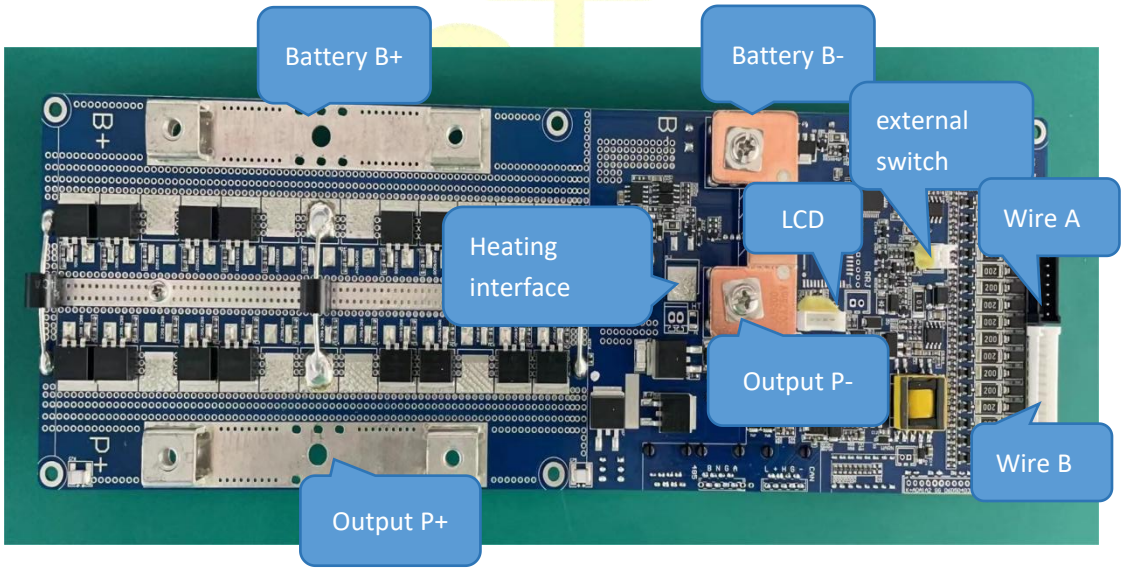

## 4.5 Turn on or off

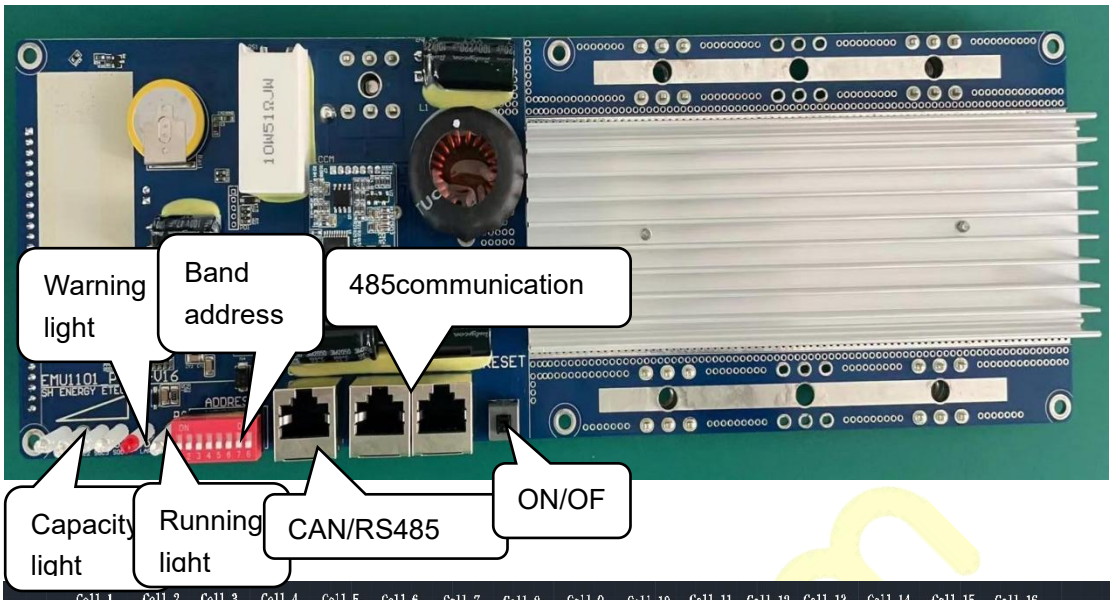
| Number | Function | Definition |
|---|---|---|
| 1 | Turn on / Start up | The BMS is in a sleeping state. Press the reset button and the BMS will be activated. The LED indicator lights will flash in sequence before entering normal operation. |
| 2 | Shut down/Sleep | When the BMS is in standby or discharge state, pressing this key will put the BMS into sleep mode after 6 seconds. The LED indicator lights up one by one and then enters the sleep state. After sleeping, the BMS has no power consumption. |
| 3 | External switch | The external switch can control the power on/off of BMS, and the priority is given to the switch. |

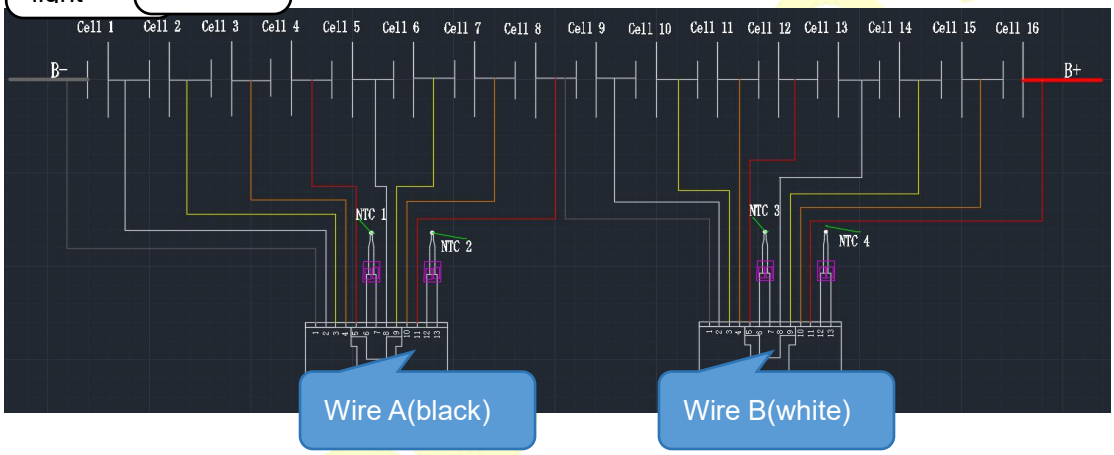
## 4.6 Dimensional location drawing



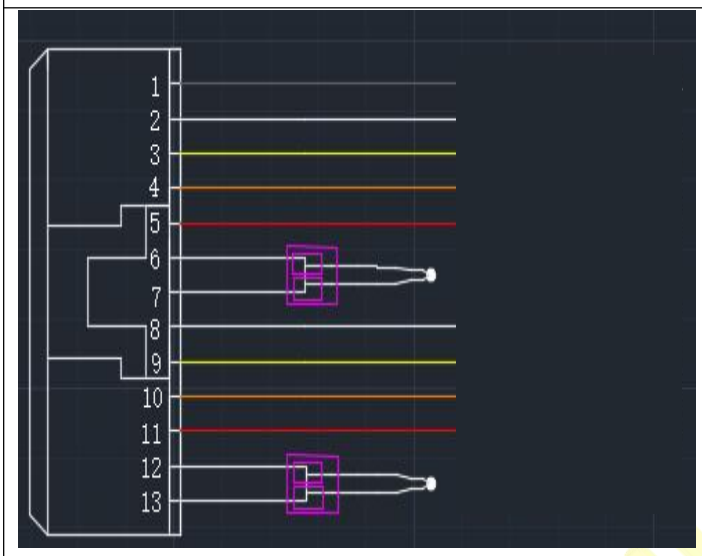

## 4.7 Reference Diagram and Connection Instructions

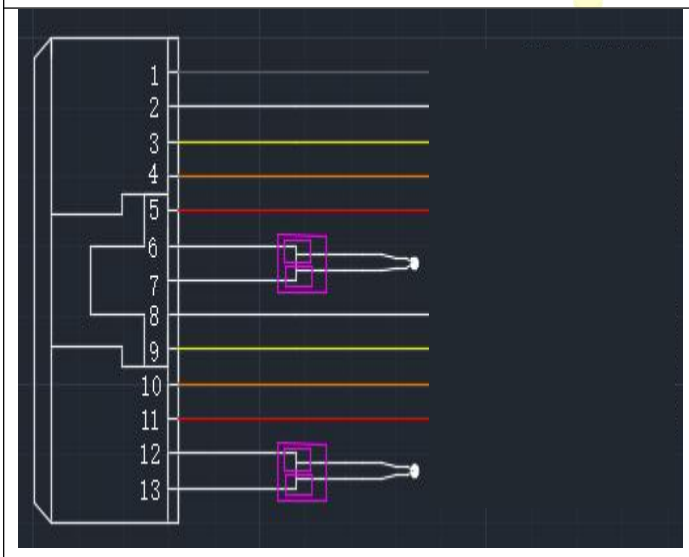



Warning light
Band address
485communication
Capacity light
Running light
CAN/RS485
ON/OF


Cell 1
Cell 2
Cell 3
Cell 4
Cell 5
Cell 6
Cell 7
Cell 8
Cell 9
Cell 10
Cell 11
Cell 12
Cell 13
Cell 14
Cell 15
Cell 16
B-
B+
NTC 1
NTC 2
NTC 3
NTC 4
Wire A(black)
Wire B(white)

## 4.8 Connection definition

| Wire A（black） | | |
|---|---|---|
|  | CELL1− | Negative of the first battery |
| | CELL1+ | Positive of the first battery |
| | CELL2+ | Positive of the 2nd battery |
| | CELL3+ | Positive of the 3rd battery |
| | CELL4+ | Positive of the 4th battery |
| | NTC1+ | Connect NTC1 |
| | NTC1− | Connect NTC1 |
| | CELL5+ | Positive of the 5th battery |
| | CELL6+ | Positive of the 6th battery |
| | CELL7+ | Positive of the 7th battery |
| | CELL8+ | Positive of the 8th battery |
| | NTC2+ | Connect NTC2 |
| | NTC2− | Connect NTC2 |

| Wire B（white） | | |
|---|---|---|
|  | CELL9− | Negative of the 9th battery |
| | CELL9+ | Positive of the 9th battery |
| | CELL10+ | Positive of the 10th battery |
| | CELL11+ | Positive of the 11th battery |
| | CELL12+ | Positive of the 12th battery |
| | NTC3+ | Connect NTC3 |
| | NTC3− | Connect NTC3 |
| | CELL13+ | Positive of the 13th battery |
| | CELL14+ | Positive of the 14th battery |
| | CELL15+ | Positive of the 15th battery |
| | CELL16+ | Positive of the 16th battery |
| | NTC4+ | Connect NTC4 |
| | NTC4− | Connect NTC4 |

**Note: CELL8+ and CELL9- are connected to the positive electrode of the 8th cell and the negative electrode of the 9th cell, providing sampling accuracy for the cell; CELL16+ is the B+ end of the cell.**

## 4.9 Power-on and Power-off Sequence

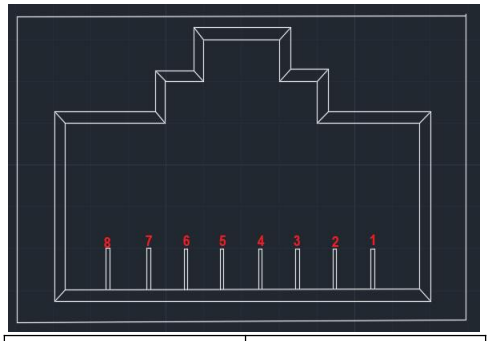
1）Power-on sequence: First connect the main board B-, then connect the wiring harness A, followed by the wiring harness B, then connect the main board B+, and finally connect the P+ and P- to the charger or load (Note: The main board is in off state after connecting the wires, press the reset button to turn on or close the external switch, charging can also activate the BMS).
2）Power-off sequence is completely opposite: First disconnect the charger or load (Note: Press the 6S reset button or disconnect the external switch, the flow indicator lights will turn off once to shut down), then disconnect B+, sequentially disconnect the wiring harness B, then disconnect the wiring harness A, and finally disconnect B-.
3）Input and Output During charging: The positive terminal of the charger is connected to the "P+" of the protection board, and the negative terminal of the charger is connected to the "P-" of the protection board. During discharging: The positive terminal of the load is connected to the "P+" of the protection board, and the negative terminal of the load is connected to the "P-" of the protection board.

## 4.10 Communication Description

1）CAN and RS485 Communication The BMS has a battery group upload CAN communication function with a baud rate of 500K. The CAN communication interface uses an 8P8C network cable interface. Through the CAN interface, it can communicate with the inverter or CAN TEST. When the battery group is assembled, it is connected through RS485 communication, and finally uploads the battery group data, status, and information to PCS through CAN communication.
2）The BMS has a battery group upload RS485 communication function with a baud rate of 9600bps. The RS485 communication interface uses an 8P8C network cable interface. When the battery group is assembled, it is connected through RS485 communication, and finally uploads the battery group data, status, and information to PCS or inverter through RS485 communication.
3）CAN communication is based on the protocol of each inverter for communication and can connect to inverters for communication. (Note: It is compatible with PaiNeng, GoodWe, Deye, PengCheng, TBB by default, and can switch to Gruidel, Victron, SMA, ShouHang, JinLang, Studer) RS485 communication is based on the protocol of each inverter for communication and can connect to inverters for communication. (Note: It can automatically identify the protocols of PaiNeng, Gruidel, ShuoRi)

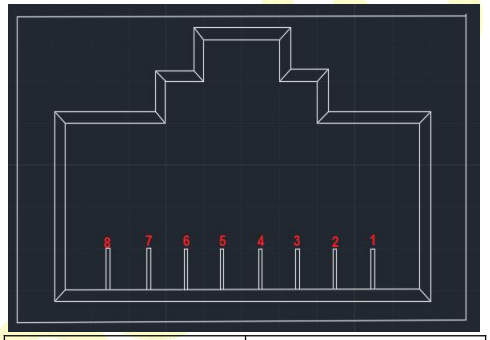
Definition of CAN and RS485 communication interfaces:

CAN:




| PIN | Definition |
|---|---|
| 1、8 | RS485-B |
| 2、7 | RS485-A |
| 4 | CAN-H |
| 5 | CAN-L |
| 3、6 | GND |

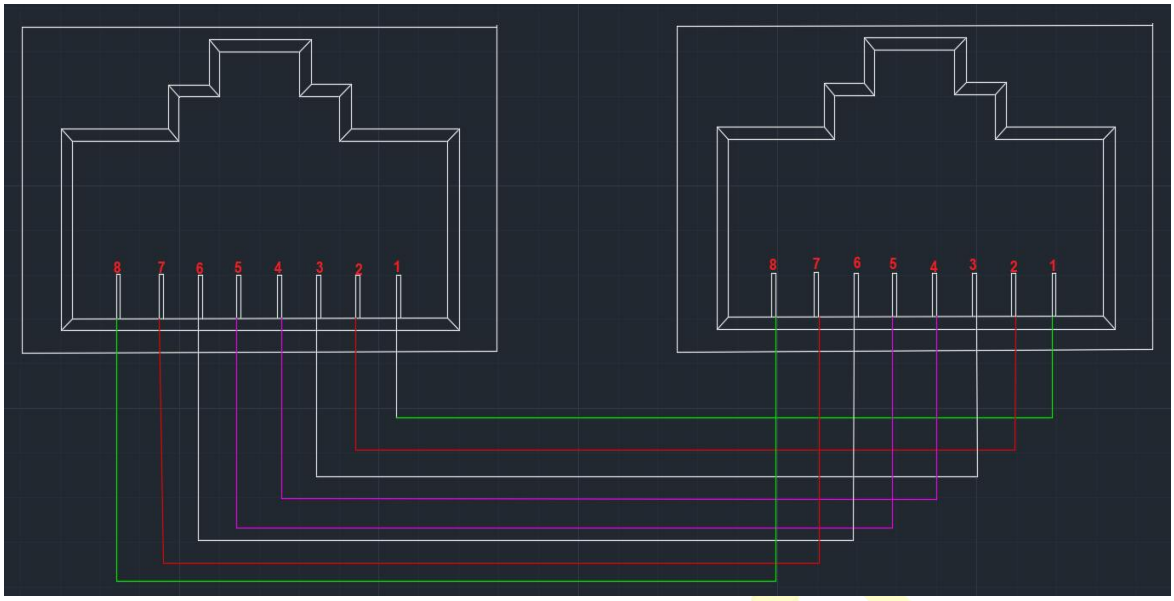
RS485




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

## 4.11 Parallel Machine Communication

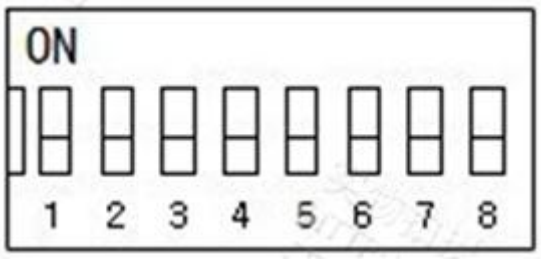
When multiple machines are paralleled, the RS485 interface serves as the parallel communication interface, and the CAN interface serves as the upper communication interface. The terminal device can read the sum of all battery data from the parallel PACKS through the CAN interface. When multiple machines are paralleled, the connection of the RS485 interface is shown in the following diagram:




## 4.12 Band address selection (manual dialing method)

**Definition of paralleling switch**: In the case of parallel connection of battery packs, multiple machine communication is used, and the switch is used to distinguish different Pack addresses. The hardware address can be set through the switch on the board. (Note: Support for 8 groups of paralleling is included, while 16 groups require special requests, with default being 8 groups)

**Definition of DIP switch bits 1 to 8**: bits 1 to 4 are used to set the address, and bits 5 to 8 are used for the number of slave devices.
**Host setting**: bits 1 to 4 are set to 0, and the host address is fixed at 0. Bits 5 to 8 are set according to the number of parallel connected slave devices. (See Table 2)
**Slave setting**: bits 1 to 4 are set according to the device order, with slave address ranging from 1 to 15. Bits 5 to 8 are fixed at 0. (See Table 1)



## Slave Setup (Table 1)

| Address | Band switch position | | | | Explanation |
|---|---|---|---|---|---|
| | #1 | #2 | #3 | #4 | |
| 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 |

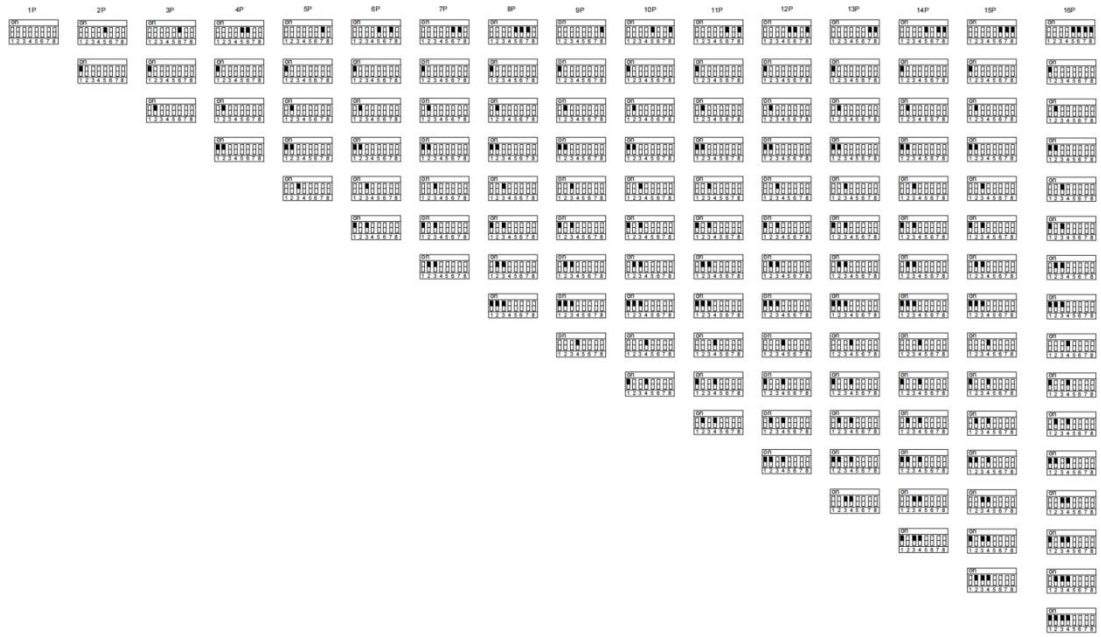
## Host setting(Table 2)

| Number | Band switch position | | | | Explanation |
|---|---|---|---|---|---|
| | #5 | #6 | #7 | #8 | |
| 2 | ON | OFF | OFF | OFF | 2Parallel |
| 3 | OFF | ON | OFF | OFF | 3Parallel |
| 4 | ON | ON | OFF | OFF | 4Parallel |
| 5 | OFF | OFF | ON | OFF | 5Parallel |
| 6 | ON | OFF | ON | OFF | 6Parallel |
| 7 | OFF | ON | ON | OFF | 7Parallel |
| 8 | ON | ON | ON | OFF | 8Parallel |
| 9 | OFF | OFF | OFF | ON | 9Parallel |
| 10 | ON | OFF | OFF | ON | 10Parallel |
| 11 | OFF | ON | OFF | ON | 11Parallel |
| 12 | ON | ON | OFF | ON | 12Parallel |
| 13 | OFF | OFF | ON | ON | 13Parallel |
| 14 | ON | OFF | ON | ON | 14Parallel |
| 15 | OFF | ON | ON | ON | 15Parallel |

## Example of parallel machine dial code setting

| Number | Band switch position | | | | | | | | Explanation |
|---|---|---|---|---|---|---|---|---|---|
| | #1 | #2 | #3 | #4 | #5 | #6 | #7 | #8 | |
| 1p | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | 1p |
| 2p | OFF | OFF | OFF | OFF | ON | OFF | OFF | OFF | First mainframe |
| | ON | OFF | OFF | OFF | OFF | OFF | OFF | OFF | Second slave machine |
| 3p | OFF | OFF | OFF | OFF | OFF | ON | OFF | OFF | First mainframe |
| | ON | OFF | OFF | OFF | OFF | OFF | OFF | OFF | Second slave machine |
| | OFF | ON | OFF | OFF | OFF | OFF | OFF | OFF | Third slave machine |
| ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ |
| ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ |
| 16p | OFF | OFF | OFF | OFF | ON | ON | ON | ON | First mainframe |
| | ON | OFF | OFF | OFF | OFF | OFF | OFF | OFF | Second slave machine |
| | OFF | ON | OFF | OFF | OFF | OFF | OFF | OFF | Third slave machine |
| | ON | ON | OFF | OFF | OFF | OFF | OFF | OFF | Fourth slave machine |
| | OFF | OFF | ON | OFF | OFF | OFF | OFF | OFF | Fifth slave machine |
| | ON | OFF | ON | OFF | OFF | OFF | OFF | OFF | Sixth slave machine |
| | OFF | ON | ON | OFF | OFF | OFF | OFF | OFF | Seventh slave machine |
| | ON | ON | ON | OFF | OFF | OFF | OFF | OFF | Eighth slave machine |
| | OFF | OFF | OFF | ON | OFF | OFF | OFF | OFF | Ninth slave machine |
| | ON | OFF | OFF | ON | OFF | OFF | OFF | OFF | Tenth slave machine |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | OFF | ON | OFF | ON | OFF | OFF | OFF | OFF | Eleventh slave machine |
| | ON | ON | OFF | ON | OFF | OFF | OFF | OFF | Twelfth slave machine |
| | OFF | OFF | ON | ON | OFF | OFF | OFF | OFF | Thirteenth slave machine |
| | ON | OFF | ON | ON | OFF | OFF | OFF | OFF | Fourteenth slave machine |
| | OFF | ON | ON | ON | OFF | OFF | OFF | OFF | Fifteenth slave machine |
| | ON | ON | ON | ON | OFF | OFF | OFF | OFF | Sixteenth slave machine |



# 5 Product dimensions and interface specifications

Product dimensions: L750*W439*H252, unit: mm. Input/output interface: M8 screw


## 5.1 Instructions for use and precautions

### 5.1.1 Instructions for use

(1) Before using the battery, please carefully read the instruction manual and the markings on the surface of the battery.
(2) Please use the battery in a normal, indoor environment. Temperature: -20 to +35°C, relative humidity: 55±20%.
(3) During use, keep away from heat sources, high voltage, and prevent children from playing with the battery. Do not drop or strike the battery.
(4) This battery can only be charged with the matching charger. Do not charge the

battery in the charger for more than 24 hours.
(5) Do not short-circuit the positive and negative terminals of the battery, do not disassemble or assemble the battery by yourself, and do not let the battery get wet to avoid danger.
(6) When not in use for a long time, please store the battery properly. Keep the battery in a semi-charged state and wrap it with a non-conductive material to avoid direct contact between metal and the battery, which may cause damage. Store the battery in a cool and dry place.
(7) Dispose of the battery properly and safely. Do not throw it into fire or liquid.

**5.1.2 Precautions**

(1) Please do not use the battery in environments with strong sunlight exposure to prevent overheating, deformation, and smoking. Avoiding these conditions will help maintain battery performance and prolong its lifespan.
(2) The battery is equipped with a protection circuit to prevent various accidents. Avoid using the battery in places with static electricity, as high-voltage static electricity can damage the protection board, causing the battery to malfunction, overheat, deform, smoke, or even catch fire.
(3) The recommended charging temperature range is 0-45°C. Charging the battery in environments outside this range may result in decreased battery performance and reduced lifespan.
(4) Before using the battery, please read the user manual carefully and refer to it whenever necessary.
(5) Please use a dedicated charger and follow the recommended charging method to charge the battery in the recommended environmental conditions.
(6) If you notice any abnormalities such as dirtiness or strange odors when using the battery for the first time, do not continue using it and contact the retailer to return the battery.
(7) Children should be guided by parents and supervised during battery usage to ensure proper handling.
(8) Keep the battery out of reach of children to prevent them from removing it from the charger or playing with it.
(9) If skin or clothing comes into contact with battery leakage, rinse with water to avoid discomfort.
(10) When purchasing the battery, please take note of the contact information of the retailer for timely communication and consultation when needed.
(11) The warranty period is twelve months from the date of manufacture. However, if the battery is misused rather than having a quality issue, the manufacturer will not provide free replacement even within the warranty period.
(12) If using the battery for other devices, please discuss with the supplier about the adequacy of protection functions. At least consult regarding high current, fast charging, and special applications related to the battery.

## 5.2 Accessory list

| Name | Model specifications | Quantity |
|---|---|---|
| Epoxy board | Single-sided 3M adhesive | 24 |
| EVA foam | Single-sided 3M adhesive, perforated, black | 2 |
| EVA foam | Single-sided 3M adhesive, gray | 20 |
| Insurance sheet | two round holes at both ends of 80V300A | 1 |
| Fuse holder | 80V300A, two round holes, ANM-B base | 1 |
| Soft copper Bus bar (DK-1) | Pure copper sheet crimping and bending (Fuse - P+) | 1 |
| Soft copper Bus bar (DK-2) | Pure copper sheet crimping and bending (Fuse - Plate) | 1 |
| Soft copper Bus bar (DK-3) | Pure copper sheet crimping and bending (Connector) | 1 |
| Soft copper Bus bar (DK-4) | Pure copper sheet crimping and bending (B-Connector) | 1 |
| Soft copper Bus bar (DK-5) | Pure copper sheet crimping and bending (B+ Connector) | 1 |
| Aluminum Bus bar | Two oval screw holes | 15 |
| Copper Bus bar | Two-hole rivet nut | 1 |
| Positive terminal connector | Twist spring energy storage connector, single-core energy storage connector, new energy photovoltaic energy storage cabinet connector, 200A high-current high-voltage connector | 2 |
| Negative terminal connector | Twist spring energy storage connector, single-core energy storage connector, new energy photovoltaic energy storage cabinet connector, 200A high-current high-voltage connector | 2 |
| Thermal conductive silicone gel | | 1 |
| Gasket | Galvanized thick washer | 32 |
| Nut | Flange nut with anti-slip feature (for securing battery terminal connectors) | 32 |
| Screw | Galvanized hexagonal combination screw with recessed head (for securing copper bus Bar terminals) | 7 |
| Screw | Galvanized hexagonal combination screw with recessed head (for securing iron press) | 8 |
| Screw | Galvanized hexagonal combination screw with recessed head (for securing plug board) | 7 |
| Screw | Galvanized hexagonal combination screw with recessed head (for securing pressure plate) | 12 |

| | | |
|---|---|---|
| Screw | Galvanized hexagonal combination screw with recessed head (for securing fuse holder) | 2 |
| Screw | White stainless steel round head cross screw (for securing automatic buckle) | 12 |
| Screw | Black stainless steel flat head cross screw (for securing panel, top cover) | 26 |
| Screw | Black stainless steel round head cross screw (for securing positive and negative terminal connectors) | 16 |
| Screw | Galvanized hexagonal combination screw with round head (for display screen and main board installation) | 10 |
| Data acquisition board | 8S | 2 |
| Display screen | Pecifically for 16S BMS | 1 |
| Battery terminal connector | | 15 |
| Display screen panel sticker | Display screen + keypad panel sticker | 1 |
| Light touch switch key cap | Yellow plastic | 4 |
| Display screen cable | | 1 |
| Data acquisition board A cable | One end black, one end white | 1 |
| Data acquisition board B cable | Both ends white | 1 |
| Spring automatic buckle | 304 stainless steel double spring lock less automatic buckle | 1 |

## 5.3 Warning

(1) Do not mix the battery with other types of primary or secondary batteries, as abnormal charging or discharging may result in battery overheating, smoking, deformation, or combustion.
(2) Keep the battery out of reach of children to prevent them from biting or swallowing it. If the battery is swallowed, seek immediate medical attention.
(3) If the charger continues to charge for an unusually long time beyond the normal charging duration, stop charging. Abnormal charging may cause the battery to overheat, smoke, deform, or catch fire.
(4) Do not place the battery in a microwave or other pressure containers, as rapid heating or structural damage can cause the battery to overheat, smoke, deform, or catch fire.
(5) If battery leakage is detected (or there is an odor), keep the battery away from any sources of fire. Otherwise, the leaked electrolyte may ignite, leading to other hazards.
(6) If the battery emits an odor, deforms, changes color, or becomes distorted, remove it from the phone or charger and discontinue its use. Using an abnormal battery may result in overheating, smoking, deformation, or combustion.