# Specification

Product Name：51V40A Lithium Battery Management System

Product Model：5140-1CE-EJ01-15S

| Ver | Date | Modify | Version revision notes |
|---|---|---|---|
| V1.0 | 2024.09.25 | Zhou Guinan | Create the first draft |
| V1.0 | 2025.04.16 | Zhang Jiamin | Add English versions |
| | | | |
| | | | |
| | | | |
| | | | |

# Function configuration table

| | | |
|---|---|---|
| Customer | | |
| Cell type | ☑ lithium iron phosphate | |
| Cell series number | ☐8S ☐9S ☐10S ☐11S ☐12S ☐13S ☐14S ☑15S ☐16S ☐17S | |
| 10A current-limiting | ☐Active ☐Passive ☑Null | |
| Precharge | ☑Yes ☐No | |
| Memory | ☐Yes ☑No | |
| Inverter communication mode | ☑CAN ☑RS485 | Note: 485 self-adaptation does not require protocol switching |
| Optional features | ☐Secondary tripping function ☐LCD | |
| | Card type：☐Integrated ☑Split | Note: The communication port, dial code and capacity lamp of the split board can be independently drawn out |
| Other parameters | Battery Capacity （AH）： | |

| Signature and seal of the supplier | Customer's signature and seal |
|---|---|
| | |

| | | | | | |
|---|---|---|---|---|---|
| Draw up | Xie Huajun | Verify | Wei Qi | Approve | Huang Bin |
| Date | | Date | | Date | |

# Content

# 1、System survey

## 1.1、Summary

This product is a fully functional system that supports up to 17 series-connected lithium-ion battery packs. It features protection and recovery functions for individual overvoltage/under-voltage, total overvoltage/under-voltage, charging/discharge overcurrent, high temperature, low temperature, and short circuit. It achieves precise SOC measurement during charging and discharging processes, SOH health status statistics, and voltage balancing during the charging process.

Note: The upper computer baud rate is 19200

## 1.2、Internal product model definition within the company

**51 40-1C E-EJ 01-15S**

A B C D E F G

| 序号 | 定义 | 内容 |
|---|---|---|
| A | Voltage | 45V |
| B | Current | 40A |
| C | Current-limiting | Null |
| D | Communication | CAN、RS485 |
| E | Customer | Composed of the first letter of the customer's Chinese name, for example: Enjie first letter EJ |
| F | Model | The same customer orders different models, and the models are added up repeatedly |
| G | sampling strings | 07S、08S、09S、10S、11S、12S、13S、14S、15S、16S、17S |

# 2、Normative reference documents

The following documents are essential for the application of this document. For dated references, only the dated version applies to this document. For undated references, the latest version (including all amendments) applies to this document.

| | |
|---|---|
| GB/T 191 | Packaging storage and transportation diagram signs |
| GB/T 2408-2008 | Determination of burning performance of plastics, horizontal method and vertical method |
| YD/T 983-2013 | Electromagnetic compatibility limits and measurement methods for communication power supply equipment |
| GB/T 17626.5-2008 | Electromagnetic compatibility test and measurement technology surge (impact) immunity test |
| GB/T 17626.2-2006 | Electromagnetic compatibility test and measurement technology electrostatic discharge immunity test |
| YD/T 2344.1—2011 | Communication lithium iron phosphate battery pack Part 1: Integrated battery pack |
| YD/T 2344.2—2015 | Communication lithium iron phosphate battery pack Part 2: discrete battery pack |
| YD/T 1363.3 | Communication Bureau (station) power supply, air conditioning and environmental centralized monitoring and management system Part 3: Front-end intelligence Equipment protocol |
| YD/T 1058-2015 | High frequency switching power supply system for communication |

# 3、Functional features

## 3.1、Cell and battery voltage detection

The voltage of the series cell is collected and monitored in real time to realize overvoltage and undervoltage alarm and protection. The voltage detection accuracy of the cell is ±10mV under the condition of 0~45℃.

The alarm and protection parameter setting value can be changed by the upper computer.

## 3.2、Cell, environment and power temperature detection

The NTC collects and monitors the temperature of 4 cells, 1 ambient temperature and 1 power temperature in real time to realize high temperature and low temperature alarm and protection. The temperature detection accuracy is ±2℃.

The cell temperature sensor uses 10K and B value 3435。

The alarm and protection parameter setting value can be changed by the upper computer.

## 3.3、Battery charge and discharge current detection

The current detection resistor connected in the main charge-discharge circuit is used to collect and monitor the charge-discharge current of the battery pack in real time, so as to realize the alarm and protection of charging current and discharging current, and the current accuracy is better than ±2%.

The alarm and protection parameter setting value can be changed by the upper computer.

## 3.4、Short circuit protection function

It has the function of detecting and protecting output short circuit。

## 3.5、Battery capacity and cycle times

The calculation of real-time battery remaining capacity and the learning of total charge and discharge capacity are completed at one time, and the estimation accuracy of SOC is better than ±5%.

It has the function of calculating the number of charge and discharge cycles. When the cumulative discharge capacity of the battery pack reaches 80% of the set full capacity, the number of cycles is increased once.

The battery cycle capacity parameter setting value can be changed by the upper

computer.

## 3.6、Charge、discharge's switch of MOSFET

Low internal resistance, large current, optimized design for large capacity capacitive load startup, zero switching and double charging withstand voltage for backup power supply applications.

## 3.7、Balance of intelligent single cell

The unbalanced cells can be balanced during charging or standby, which can effectively improve the use time and cycle life of the battery.

The equilibrium opening voltage and equilibrium voltage difference can be set by the upper computer.

## 3.8、Upper monitor

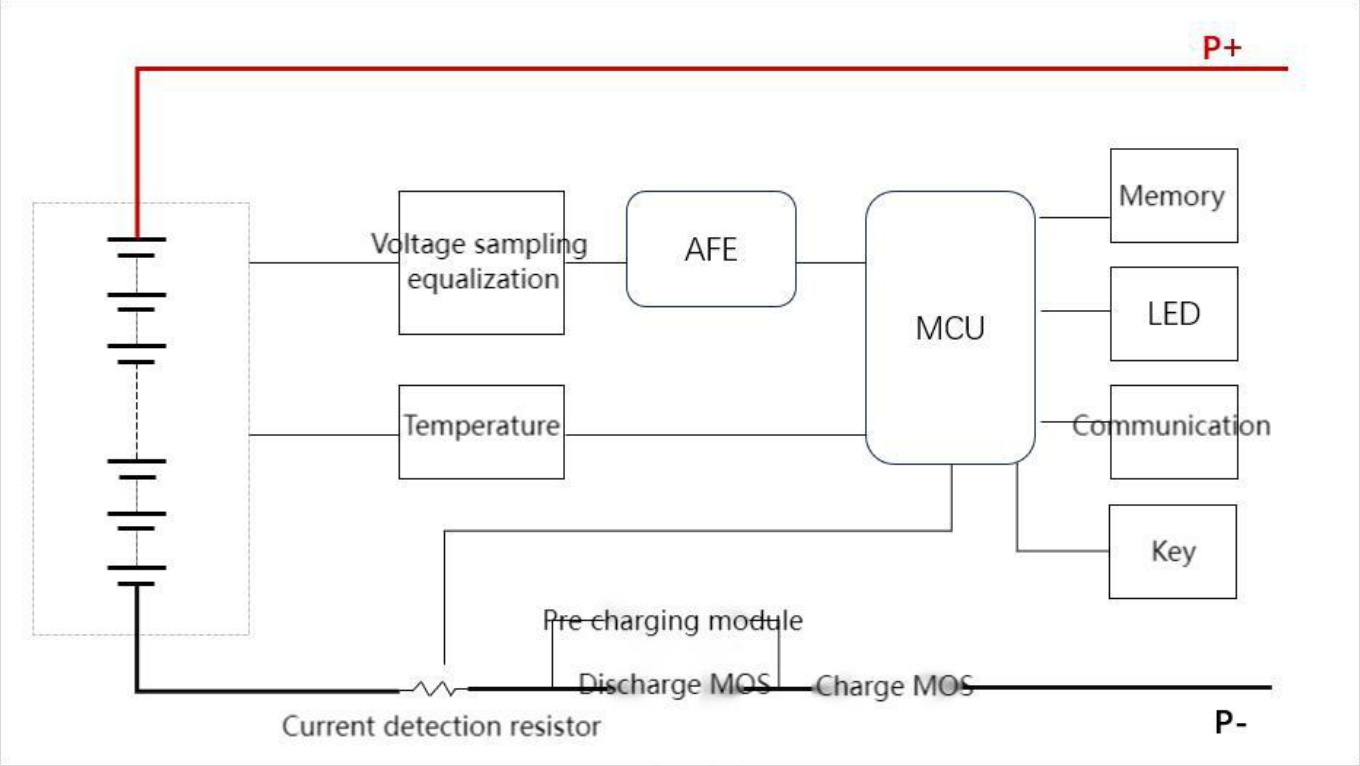
The upper computer uses version BatteryMonitorV2.1.13 and can switch between Chinese and English (the English protocol is loaded when switching to English). The protocol is loaded (Chinese file name: 16S_V20_ADDR, English protocol name: 16S_V20_ADDR_EN). For the operation instructions, please refer to the operation method in the upper computer file.

## 3.9、Program upgrades

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

The upper computer is connected to the BMS through RS485.

# 4、Functional framework diagram




# 5、Electrical character

| Project | Min | Max | Type | Unit |
|---|---|---|---|---|
| Normal working voltage | 30 | 60 | 45 | V |
| Normal charging voltage | / | 60 | 54 | V |
| Operating temperature range | -20 | 70 | 25 | ℃ |
| Storage environmental temperature | -40 | 85 | 25 | ℃ |
| Use ambient humidity | 10 | 85 | / | % |
| Continue to charge the current | / | 50 | 40 | A |
| Continuous discharge current | / | 50 | 40 | A |
| Discharge output internal resistance | <2 | | | mΩ |
| Normal operating power consumption | <40 | | | mA |
| Sleep power consumption | | 50 | 0 | uA |

# 6、Essential parameter

## 6.1、Basic parameter Settings

| Function name | Settings | Projects | Value | Set the scope |
|---|---|---|---|---|
| Single voltage alarm | Open | Single high voltage alarm | 3500mV | Single high voltage recovery~Single overvoltage protection |
| | | Single high voltage recovery | 3400mV | 3000mV~Single high voltage alarm |
| | Open | Single low voltage alarm | 2900mV | Single unit undervoltage protection~Single voltage recovery |
| | | Single low voltage recovery | 3100mV | Single low voltage alarm~3300mV |
| | | | | |
| Single overvoltage protection | Open | Single overvoltage protection | 3650mV | Single high voltage alarm~4500mV |
| | | Single overvoltage recovery | 3400mV | Single high voltage recovery~Overvoltage of a single unit |
| | | Overvoltage recovery conditions | 1、The maximum cell voltage is lower than the overvoltage protection value of the single cell<br>2、The discharge current continues to delay for 5S<br>3、The battery discharge current is detected to be>5A | |
| | | | **Note: Three conditions must be met to restore** | |
| | | | | |
| Single unit undervoltage protection | Open | Under-voltage protection voltage | 2500mV | 1500mV~Single unit undervoltage recovery |
| | | Under-voltage recovery voltage | 2900mV | Single unit undervoltage protection~Single low voltage alarm |
| | | The unit is shut down under low voltage | Power off after under-voltage protection | |

| | | | | |
|---|---|---|---|---|
| | | Conditions for under-voltage recovery | 1、The minimum cell voltage is greater than the undervoltage protection value of the single cell<br>2、The charging current continues to delay for 5S<br>3、The battery is detected to have a charging current>1A | |
| | | | **Note: Three conditions must be met to restore** | |
| | | | | |
| Battery total voltage alarm | Open | Total voltage high voltage alarm | 52.5V | High total voltage restore~Overvoltage protection |
| | | High total voltage restore | 51.0V | 23.19V~The total high voltage |
| | Open | General low voltage alarm | 43.5V | Total voltage under-voltage protection~Low total voltage restore |
| | | Low total voltage restore | 46.5V | Total voltage low voltage alarm~58.43V |
| | | | | |
| Overvoltage protection | Open | Overvoltage protection is always in place | 54.7V | Total voltage high voltage alarm~63.75V |
| | | Overvoltage recovery of total voltage | 51.7V | High voltage recovery of total voltage~The total high voltage |
| | | Overvoltage recovery conditions | 1、The maximum cell voltage is lower than the overvoltage protection value of a single cell<br>2、The discharge current continues to delay for 5S<br>3、The detected discharge current is> 5A | |
| | | | **Note: Three conditions must be met to restore** | |
| | | | | |
| General under-voltage protection | Open | Total voltage under-voltage protection | 37.5V | 14.87V~Total under-voltage restored |
| | | Total under-voltage restored | 43.5V | Total voltage under-voltage protection~Total voltage low pressure alarm |
| | | Shuts down because of total under-voltage | Power off after under-voltage protection | |

| | | | | |
|---|---|---|---|---|
| | | Conditions for under-voltage recovery | 1、The minimum cell voltage is greater than the undervoltage protection value of the single cell<br>2、The charging current continues to delay for 5S<br>3、The battery is detected to have a charging current> 1A | |
| | | | **Note: Three conditions must be met to restore** | |
| | | | | |
| Do not charge when the cell temperature is unusual | Open | High temperature alarm | 50℃ | Charge high temperature recovery~Overtemperature protection after charging |
| | | Charge high temperature recovery | 47℃ | 35℃~High temperature alarm |
| | | Overtemperature protection after charging | 55℃ | Overheating recovery after charging~80℃ |
| | | Overheating recovery after charging | 50℃ | Charge high temperature recovery~Overtemperature protection after charging |
| | | Charging low temperature alarm | 2℃ | Charge under temperature protection~Charging at low temperature restores |
| | | Charging at low temperature restores | 5℃ | Charging low temperature alarm~10℃ |
| | | Charge under temperature protection | -10℃ | -20℃~Charge under temperature recovery |
| | | Charge under temperature recovery | 0℃ | Charge under temperature protection~Charging at low temperature restores |
| | | | | |
| Do not discharge the cell temperature is unusual | Open | High temperature discharge alarm | 55℃ | High temperature recovery after discharge~Overtemperature protection of discharge |
| | | High temperature recovery after discharge | 47℃ | 35℃~High temperature discharge alarm |
| | | Overtemperature protection of discharge | 60℃ | Overtemperature recovery of discharge~80℃ |

| | | | | |
|---|---|---|---|---|
| | | Overtemperature recovery of discharge | 50℃ | High temperature recovery after discharge~Overtemperature protection of discharge |
| | | Discharge low temperature alarm | -10℃ | Undertemperature protection of discharge~Discharge low temperature recovery |
| | | Discharge low temperature recovery | 3℃ | Discharge low temperature alarm~10℃ |
| | | Undertemperature protection of discharge | -15℃ | -30℃~Undertemperature recovery of discharge |
| | | Undertemperature recovery of discharge | 0℃ | Undertemperature protection of discharge~Discharge low temperature recovery |
| | | | | |
| Environmental temperature protection | Open | Environmental high temperature alarm | 50℃ | Environmental high temperature recovery~Over temperature protection of the environment |
| | | Environmental high temperature recovery | 47℃ | -20℃~Environmental high temperature alarm |
| | | Over temperature protection of the environment | 60℃ | Environmental overheating recovery~80℃ |
| | | Environmental overheating recovery | 55℃ | Environmental high temperature recovery~Over temperature protection of the environment |
| | | Environmental low temperature alarm | 0℃ | Environmental under-temperature protection~Environmental low temperature recovery |
| | | Environmental low temperature recovery | 3℃ | Environmental low temperature alarm~60℃ |
| | | Environmental under-temperature protection | -10℃ | -30℃~The environment is recovering from the low temperature |

| | | | | |
|---|---|---|---|---|
| | | The environment is recovering from the cold | 0℃ | Environmental under-temperature protection~Environmental low temperature recovery |
| | | | | |
| Power temperature protection | Open | Power high temperature alarm | 80℃ | Power high temperature recovery~Power overheating protection |
| | | Power high temperature recovery | 75℃ | 60℃~Power high temperature alarm |
| | | Power overheating protection | 100℃ | Power high temperature alarm~120℃ |
| | | Power overheating recovery | 85℃ | Power high temperature recovery~Power overheating protection |
| | | | | |
| Overcurrent alarm after charging | Open | Overcurrent alarm after charging | 22A | Overcurrent recovery after charging~Overcurrent protection after charging |
| | | Overcurrent recovery after charging | 21A | 0A~Overcurrent alarm after charging |
| | | | | |
| Overcurrent protection after charging | Open | Overcurrent protection after charging | 25A | Overcurrent alarm after charging~200A |
| | | Charging overcurrent delay | 15S | Can be set in 120S |
| | | Overcurrent recovery conditions | 1、The timing reaches the overcurrent recovery delay release<br>2、The discharge current is greater than 5A and the delay is 5S | |
| | | | | |
| Overcurrent discharge alarm | Open | Overcurrent discharge alarm | -45A | Overcurrent protection of discharge~Overcurrent recovery of discharge |
| | | Overcurrent recovery of discharge | -42A | Overcurrent discharge alarm~0A |
| | | | | |

| | | | | |
|---|---|---|---|---|
| Overcurrent protection of discharge | Open | Overcurrent protection of discharge | -50A | Transient overcurrent protection~Overcurrent discharge alarm |
| | | Discharge overcurrent delay | 15S | Can be set in 120S |
| | | Overcurrent recovery conditions | 1、The timing reaches the overcurrent recovery delay release<br>2、The charging current is greater than 1A and the delay is 5S | |
| | | | | |
| Transient overcurrent protection | Open | Transient overcurrent protection | -70A | Discharge overcurrent protection value~300A |
| | | Transient overcurrent delay | 100mS | Can be set in 250ms |
| | | Transient overcurrent recovery | 1、The timing reaches the overcurrent recovery delay release<br>2、The charging current is greater than 1A and the delay is 5S | |
| | Open | Transient overcurrent lockout | Continuous overcurrent, exceeding the number of overcurrent lock | |
| | | Number of overcurrent lockouts | 5Times | |
| | | Transient lock release | The charging current is greater than 1A and the delay is 5S | |
| | | | | |
| Output short circuit protection | Close | Short circuit protection current and delay | Write-in program (note: not set) | |
| | | Short circuit protection restored | Charge immediately or automatically after 60S | |
| | Open | Short circuit protection locked | Continuous output short circuit, exceeding the number of overcurrent lock | |
| | | Number of short circuit locks | 5Times | |

| | | | | |
|---|---|---|---|---|
| | | Short circuit lock release | The charging current is greater than 1A and the delay is 5S | |
| | | | | |
| Cell balancing function | Open | Standby balance | Turn on the balance when there is no charge or discharge | |
| | | Standby balancing time | 10Hours | Can be set in 18 hours |
| | Open | Charging is balanced | Turn on the balance in both charging and standby states | |
| | Set the voltage conditions | Set the opening voltage | 3400mV | Can set |
| | | Balance the opening voltage difference | 30mV | |
| | | Balance the end voltage difference | 20mV | |
| | | | | |
| | Open | Balance temperature limits | According to (note: the ambient alarm temperature determines) the balanced shutdown temperature range | |
| | | High temperature which stop balance | 50℃ | Can set |
| | | Low temperature which stop balance | 0℃ | |
| | | | | |
| Battery capacity Settings | Battery rated capacity | | 100Ah | 5Ah~300Ah |
| | Remaining battery capacity | | Estimate the cell voltage | Can set |
| | Cumulative capacity over time | 80% | Cycle index （Can set） | |
| | Open | Residual capacity Alarm | 15% | |
| | Open | Residual capacity protection | 5% | Close the output |
| | | | | |

| | | | |
|---|---|---|---|
| Precharge function | Presto time（1mS~5000mS）Can Set | | The precharge function is started at the moment of BMS startup |
| BMS Power Management | Open | Maximum standby time | 48h（The charger is not present and there is no valid discharge current，Can Set） |
| LCD | Open | Simplify the monitoring software, you can view the cell, temperature, current and other data | |

## 6.2、Basic working mode

| | | |
|---|---|---|
| Charging mode | When BMS detects that the charger is connected and the external charging voltage is more than 0.5V higher than the internal battery voltage, it enters the charging mode when the charging current reaches the effective charging current. | |
| Discharge mode | When the BMS detects that the load is connected and the discharge current reaches the effective discharge current, it enters the discharge mode. | |
| Standby mode | When neither of the above two modes is satisfied, it enters standby mode. | |
| Shut down mode | Shut-off condition：<br>1）Normal standby 48 hours (optional)；<br>2）The battery triggers undervoltage protection；<br>3）Press Reset。 | Wake up conditions：<br>1）Charge activation；<br>2）Press Reset。 |

## 6.3、LED lighting instructions

### 6.3.1、LED light sequence

1 running light, 1 alarm light and 4 capacity indicator lights

| | | | |
|---|---|---|---|
| ● | ● | \ | |
| **LRUN** | **LARM** | | |
| ● | ● | ● | ● |
| **SOC1** | **SOC2** | **SOC3** | **SOC4** |

## 6.3.2、Capacity indication

| Status | | Charge | | | | Discharge | | | |
|---|---|---|---|---|---|---|---|---|---|
| SOC Lamp | | L4● | L3● | L2● | L1● | L4● | L3● | L2● | L1● |
| SOC Value | 0～25% | off | off | off | flash | off | off | off | on |
| | 25～50% | off | off | flash | on | off | off | on | on |
| | 50～75% | off | flash | on | on | off | on | on | on |
| | ⩾75% | flash | on | on | on | on | on | on | on |

## 6.3.3、Flash description

| Flash mode | On | Off |
|---|---|---|
| Flash | 0.5s | 0.5s |
| Breath quicken | 0.25s | 3.75s |

## 6.3.4、Status indication

| System state | Running state | RUN | ALARM | SOC | | | |
|---|---|---|---|---|---|---|---|
| | | ● | ● | ●L4 | ●L3 | ●L2 | ●L1 |
| Shut down | Sleep | Off | Off | Off | Off | Off | Off |
| Standby | Normal | Breath quicken | Off | Based on the power display | | | |
| | Alarm | Breath quicken | Flash | Based on the power display | | | |
| | Protect | Breath quicken | On | Based on the power display | | | |
| Charge | Normal | On | Off | Based on the power display | | | |
| | Alarm | On | Flash | Based on the power display | | | |
| | Protect | On | On | Based on the power display | | | |
| Discharge | Normal | Flash | Off | Based on the power display | | | |
| | Alarm | Flash | Flash | Based on the power display | | | |
| | Protect | Flash | On | Based on the power display | | | |

# 7、 Functional description

## 7.1、 Running state

| Num | Function | Definition |
|---|---|---|
| 1 | Power on / start | The BMS is in a dormant state. Press the reset button to start the BMS, After the LED indicator lights flash in turn, it enters the normal working state. |
| 2 | Shut down / sleep | When the BMS is in standby or discharge state, press the RESET button for 15s. After that, the BMS will be put to sleep. The LED indicator light will flash in turn and then enter the sleep state. After the sleep, the BMS has no power consumption. |
| 3 | stand by | 1) In the protection state of no overvoltage, undervoltage, overcurrent, short circuit, overheating, undervoltage, etc., press the reset button to start up, and the BMS is in standby state.<br>2) In standby mode, the running light flashes and the battery can be charged and discharged. |

## 7.2、Overcharge protection and recovery

| | | | |
|---|---|---|---|
| Overcharge | Single | protect | When any section is higher than the single overcharge protection setting value, the charging equipment cannot charge the battery. |
| | | recover | The maximum single cell voltage is lower than the recovery value of the single cell overcharge protection, and the overcharge protection state is relieved. It can also be discharged to relieve. |
| | total | protect | When the battery voltage is higher than the overcharge protection set value, BMS enters the overcharge protection state, and the charging equipment cannot charge the battery. |

| | | | |
|---|---|---|---|
| | | recover | When the battery pack voltage is below the overvoltage protection recovery value, the overcharge protection state is released. It can also be discharged to release. |

## 7.3、Overprotection and restoration

| | | | |
|---|---|---|---|
| Overdischarge | Single | protect | When any section is lower than the over-discharge protection setting value of the single battery, BMS enters the over-discharge protection state and the load cannot discharge the battery. After 1 minute communication, BMS shuts down. |
| | | recover | After the over-discharge protection, charging the battery pack can release the over-discharge protection state. Or press the reset button, BMS will start up and recheck whether the battery pack voltage reaches the recovery value. |
| | total | protect | When the total pressure is lower than the over-discharge protection set value, the BMS enters the over-discharge protection state and the load cannot discharge the battery. After 1 minute of communication, the BMS shuts down. |
| | | recover | After the over-discharge protection, the battery pack can be charged to release the over-discharge protection state. Or press the reset button, and the BMS will start up and recheck whether the battery pack voltage reaches the recovery value. |

## 7.4、Overcurrent protection and recovery

| | | |
|---|---|---|
| Overcurrent charging | protect | When the overcharge current protection setting value is exceeded and the delay time is reached, BMS enters the overcharge current protection and the charging device cannot charge the battery. |
| | recover | After overcurrent protection, BMS automatically delays recovery and rechecks the current of the external charger. Discharge can also release the charging overcurrent protection. |

| | | |
|---|---|---|
| Overcurrent discharge | protect | When the discharge overcurrent protection setting value is exceeded and the delay time is reached, the BMS enters the discharge overcurrent protection and the load cannot charge the battery. |
| | recover | After overcurrent protection, BMS automatically delays recovery and rechecks the external load current. Charging can also release the discharge overcurrent protection. |

**Note: The discharge overcurrent protection has two levels of protection, and the transient overcurrent protection is restored just like the discharge overcurrent protection. The transient overcurrent protection will be locked when the number of occurrences reaches the condition, and the recovery must be restored by shutting down and then starting up or charging.**

## 7.5、Temperature protection and recovery

**Note: BMS has 6 temperature detection ports to monitor the temperature change and implement protective measures.**

| | | | |
|---|---|---|---|
| charge-discharge | high temperature | protect | When any cell NTC is higher than the high temperature protection set value, BMS enters high temperature protection. BMS stops charging or discharging. |
| | | recover | When the cell temperature is lower than the high temperature recovery value, BMS resumes charging or discharging. |
| | Low temperature | protect | When any cell NTC is lower than the low temperature protection set value, BMS enters low temperature protection. BMS stops charging or discharging. |
| | | recover | When the cell temperature is higher than the low temperature recovery value, BMS resumes charging or discharging. |
| Environmental | Over temperature | protect | When the NTC detects that the ambient temperature is higher than the ambient high temperature set value, the BMS enters the environmental over-temperature |

| | | | |
|---|---|---|---|
| temperature protection | | | protection. The BMS stops charging and discharging. |
| | | recover | When the ambient temperature is lower than the ambient recovery value, BMS resumes charging or discharging. |
| | Under temperature | protect | When the NTC detects that the ambient temperature is lower than the ambient low temperature set value, the BMS enters the ambient under-temperature protection. The BMS stops charging and discharging. |
| | | recover | When the ambient temperature is higher than the ambient recovery value, BMS resumes charging or discharging. |
| Power temperature protection | When the power temperature is higher than the power protection set value detected by NTC, BMS enters the power high temperature protection. BMS stops charging and discharging. After starting the power overtemperature protection, when the power temperature is lower than the power overtemperature protection recovery value, the power overtemperature protection is released. | | |

## 7.6、Optional features

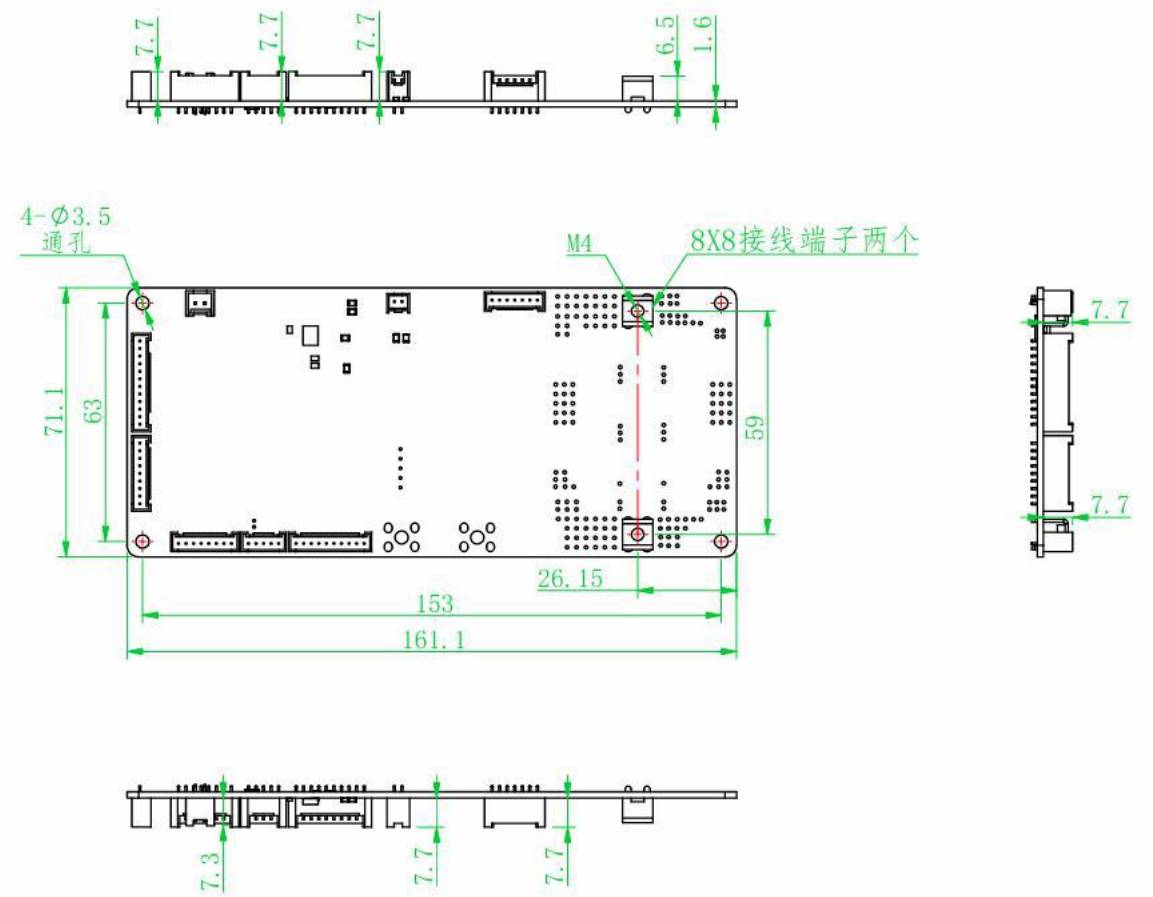
| | | |
|---|---|---|
| Optional features | Secondary tripping | The secondary tripping signal realizes double protection by controlling the external executive device.<br>Triggering tripping conditions:<br>1) Failure of temperature sensor;<br>2) The maximum voltage of the single cell is greater than "single cell overvoltage protection + 50mV";<br>3) The minimum voltage of the single cell is less than "single cell undervoltage protection-200mV";<br>4) The current is still greater than the "discharge overcurrent protection value" after discharge overcurrent protection;<br>5) The current is still greater than the "charging overcurrent protection value" after charging overcurrent protection;<br>One of the above five triggers and maintains the status for more than 5 seconds, and executes and continues to disengage;<br>Recovery conditions: BMS needs to be restarted. |

## 7.7、Other features

| | | | |
|---|---|---|---|
| Other features | Balanced function | The BMS system adopts an energy-consumption balanced circuit, and the balanced opening voltage software is adjustable. The balanced opening condition is that any one section of the cell voltage is higher than the balanced opening voltage and the pressure difference together reaches the condition. When the charging is stopped or the cell pressure difference is less than the set value, the balancing stops. | |
| | Sleep function | Automatic hibernation:<br>In the absence of external charge and discharge, the battery automatically sleeps for 48 hours. When the battery pack is over-discharge protected, the BMS enters the sleep state. | Manual hibernation:<br>1) By manually pressing the reset button for 15S, the 6 LED lights are lit in turn, and the BMS enters sleep.<br>2) Standby sleep can be set through the upper computer. |
| | Precharge function | The precharge function is started at the instant of machine startup or discharge tube opening. The precharge time can be set (1mS to 5000mS) to deal with various capacitive load scenarios and avoid BMS output short circuit protection. | |

# 8、Size positioning map

IMU1740:



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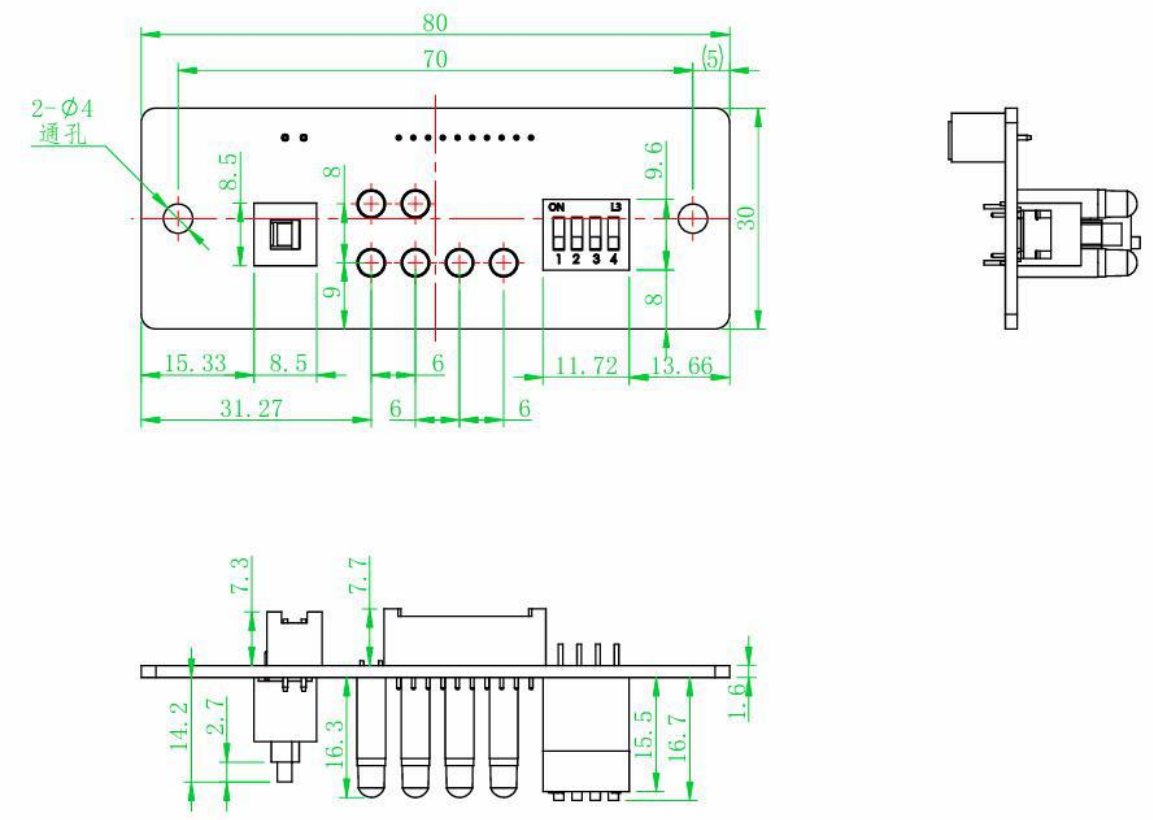
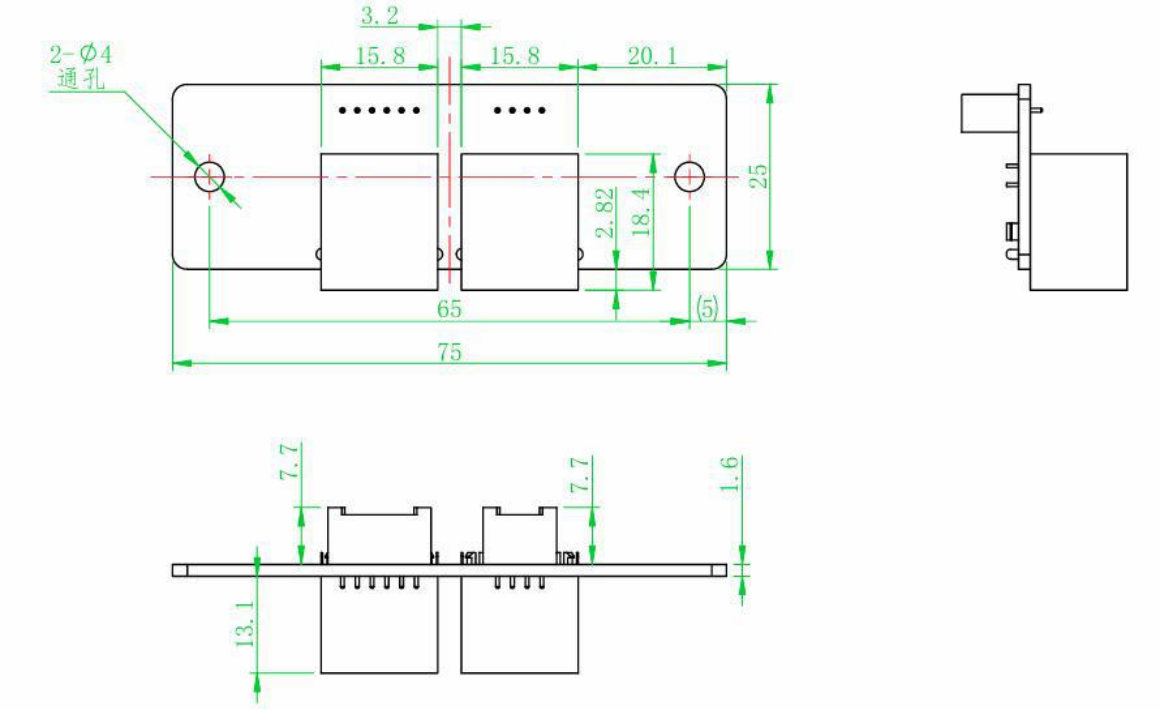
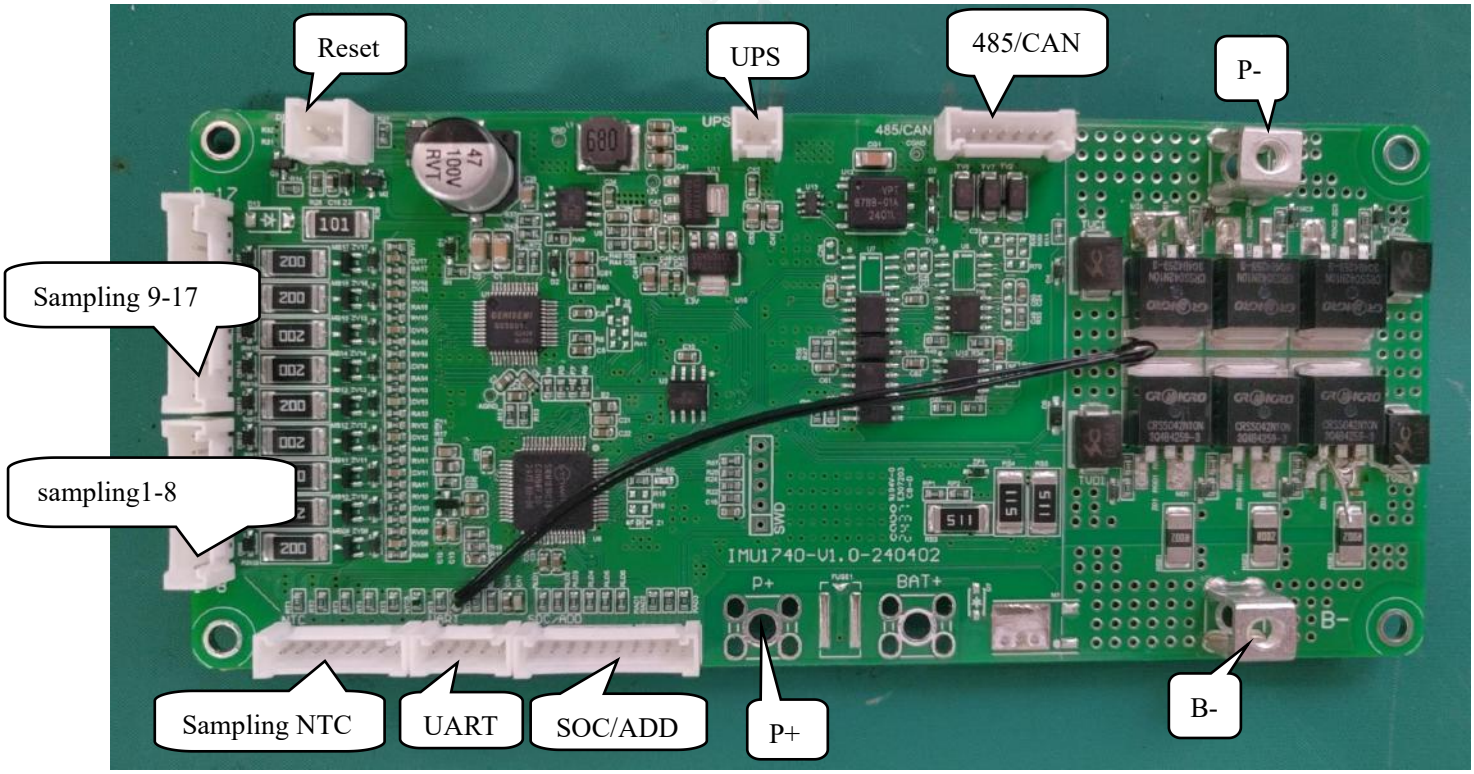
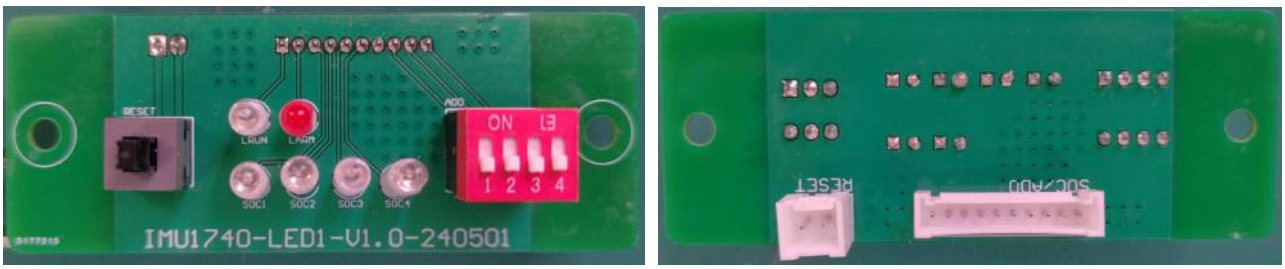


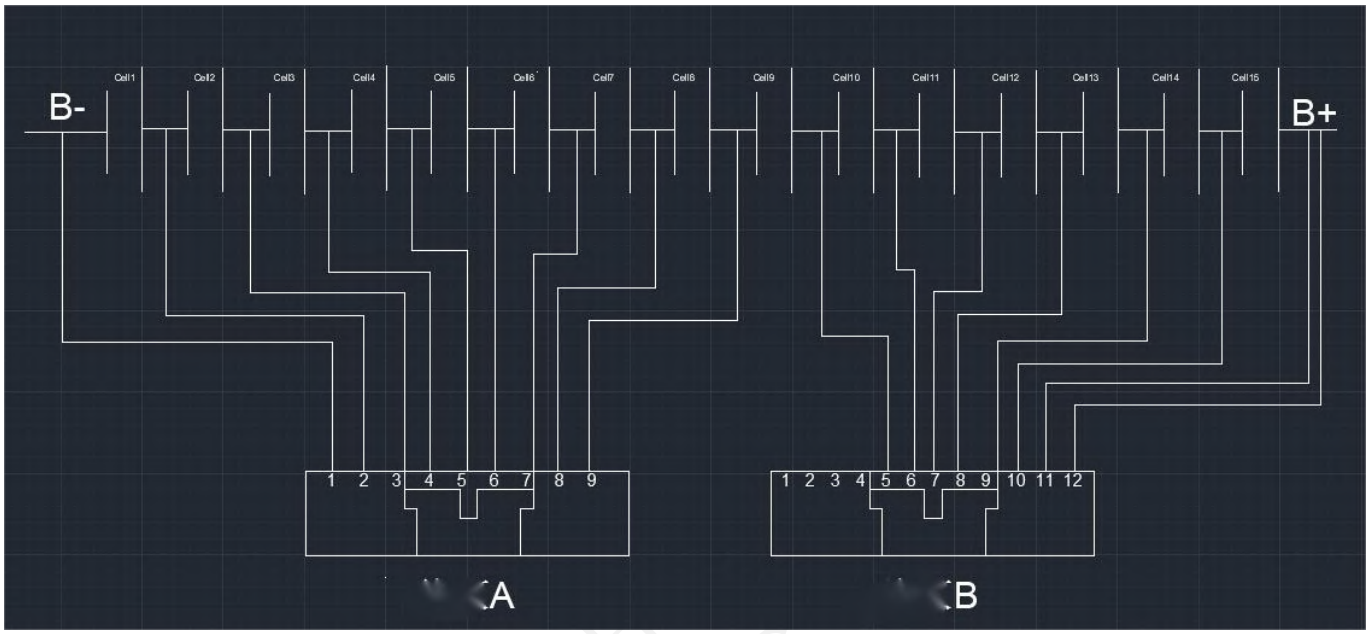

IMU1740-COM1:




# 9、Physical reference drawings

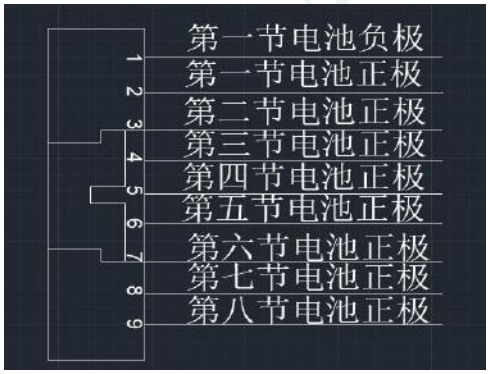




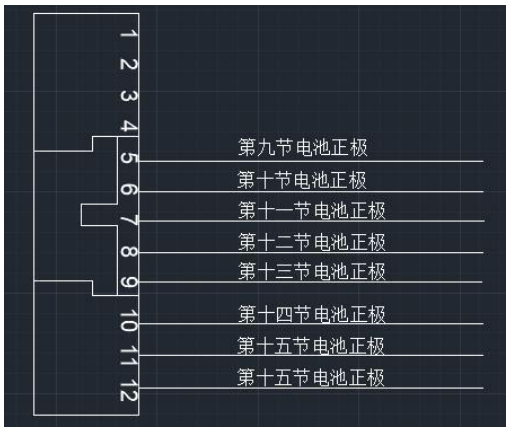




Note: There may be some differences between the actual product and the physical picture of the above products

## 9.1、Wiring definition

| wiring harness A（9PIN） | | |
|---|---|---|
|  | PIN1 | Connect the negative terminal of the first battery |
| | PIN2 | Connect the positive terminal of the first battery |
| | PIN3 | Connect the positive terminal of the second battery |
| | PIN4 | Connect the positive terminal of the third section battery |
| | PIN5 | Connect the positive terminal of the battery in section 4 |
| | PIN6 | Connect the positive terminal of the battery in section 5 |

| | | |
|---|---|---|
| | PIN7 | Connect the positive terminal of the battery in section 6 |
| | PIN8 | Connect the positive terminal of the battery in section 7 |
| | PIN9 | Connect the positive terminal of the battery in section 8 |

| wiring harness B（12PIN） | | |
|---|---|---|
|  | PIN5 | Connect the positive terminal of the ninth section battery |
| | PIN6 | Connect the positive terminal of the tenth section battery |
| | PIN7 | Connect the positive terminal of the eleventh section battery |
| | PIN8 | Connect the positive terminal of the twelfth section battery |
| | PIN9 | Connect the positive terminal of the 13th section battery |
| | PIN10 | Connect the positive terminal of the 14th section battery |
| | PIN11 | Connect the positive terminal of the 15th section battery |
| | PIN12 | Connect the positive terminal of the 15th section battery |

## 9.2、Power up and down sequence

1) Power up in the following order: First connect the motherboard B-, then sequentially connect the harness (the voltage sampling line is connected last, while other harnesses can be connected without specific sequence). Next, connect the motherboard P-to the charger or load negative terminal. Finally, connect the battery B+ and the power supply or load positive terminal (Note: After connecting the motherboard, it will be in a powered-off state; press the reset button to turn it on or activate the BMS during charging).

2) Confirm that the BMS is in standby state by disconnecting the voltage sampling line to turn off the BMS, then disconnect B-and P-, and then unplug the cable harness in turn.

3) Input and output

When charging: the negative terminal of the charger is connected to "P-" of the protection board, and the positive terminal of the charger is connected to "B+" of the battery.

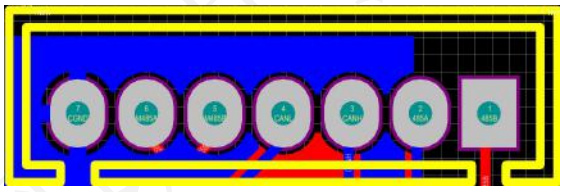
When discharging: the negative terminal of the load is connected to "P-" of the protection board, and the positive terminal of the load is connected to "B+" of the battery.

# 10、Communication instructions

## 10.1、CAN and RM485 communication

485/CAN communication signal interface, which can realize communication with the upper computer and other external devices as well as parallel communication between BMS. The communication mode can be 485 or CAN.

CAN and RM485 communication interface definition:



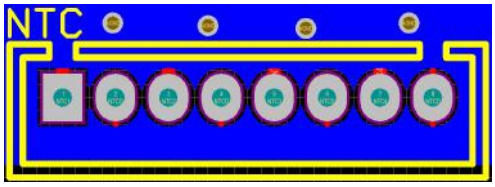
Plug model on the board: HX20020-7A

| Num | Pin | Name | Describe |
|---|---|---|---|
| 1 | PIN1 | 485B | Upper computer communication 485-B signal |
| 2 | PIN2 | 485A | Upper computer communication 485-A signal |
| 3 | PIN3 | CANH | CAN-H signal |
| 4 | PIN4 | CANL | CAN-L signal |
| 5 | PIN5 | M485B | 485-B signal for parallel machine communication |
| 6 | PIN6 | M485A | 485-A signal for parallel machine communication |
| 7 | PIN7 | CGND | CGND |

## 10.2、Definition of NTC interface pins

Temperature sampling interface, external sampling resistance is used to sample the cell and environmental temperature.

NTC Interface definition:



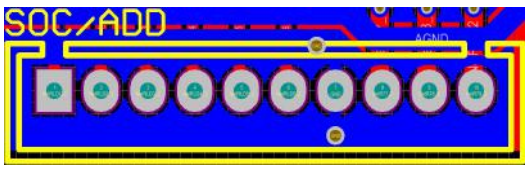

Plug model on the board: HX20020-8A

| Num | Pin | Name | Describe |
|---|---|---|---|
| 1 | PIN1 | NTC1 | Temperature sampling signal 1 |
| 2 | PIN2 | NTCD | Temperature sampling negative electrode |
| 3 | PIN3 | NTC2 | Temperature sampling signal 2 |
| 4 | PIN4 | NTCD | Temperature sampling negative electrode |
| 5 | PIN5 | NTC3 | Temperature sampling signal 3 |
| 6 | PIN6 | NTCD | Temperature sampling negative electrode |
| 7 | PIN7 | NTC4 | Temperature sampling signal 4 |
| 8 | PIN8 | NTCD | Temperature sampling negative electrode |

## 10.3、SOC/ADD Interface pin definition

The cell power indicator light, status indicator light and parallel code signal detection interface are used to display the cell power, BMS operating state and alarm information, as well as the setting of parallel serial number.

SOC/ADD Interface definition:




Plug model on the board: HX20020-10A

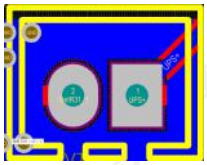
| Num | Pin | Name | Describe |
|---|---|---|---|
| 1 | PIN1 | Run light | Run indicator light |
| 2 | PIN2 | Alarm light | Alarm indicator light |
| 3 | PIN3 | SOC1 | SOC 25% indicator light |
| 4 | PIN4 | SOC2 | SOC 50% indicator light |

| | | | |
|---|---|---|---|
| 5 | PIN5 | SOC3 | SOC 75% indicator light |
| 6 | PIN6 | SOC4 | SOC 100% indicator light |
| 7 | PIN7 | GND | GND |
| 8 | PIN8 | Dial 1 | Check pin 1 of the parallel machine by dialing |
| 9 | PIN9 | Dial 2 | Check pin 2 of the parallel machine by dialing |
| 10 | PIN10 | Dial 3 | Check pin 3 of the parallel machine by dialing |

## 10.4、Definition of the RESET interface pin

The BMS switch interface can be short pressed for 1s to start up in the shutdown state, and long pressed for more than 5s to shut down in the startup state. This interface can be connected with non-self-locking buttons to realize the start and shutdown of BMS.

RESET Interface definition:



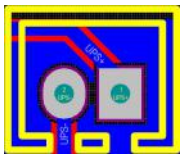
Plug model on the board: XHB-2A（2pin、2.54Gap）

| Num | Pin | Name | Describe |
|---|---|---|---|
| 1 | PIN1 | + | Positive pole |
| 2 | PIN2 | - | Negative pole |

## 10.5、Definition of UPS interface pins

The external signal control switch can be used to control the on/off state of BMS through external communication signals. For details of the implementation logic, see the software description.

UPS Interface definition:



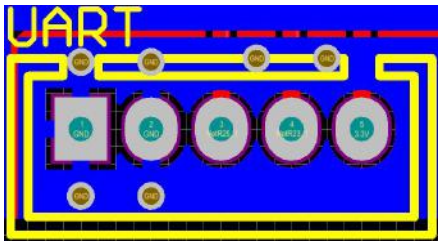
Plug model on the board: HX20020-2A

| Num | Pin | Name | Describe |
|---|---|---|---|
| 1 | PIN1 | + | Positive pole |
| 2 | PIN2 | - | Negative pole |

## 10.6、UART interface pin definition

The UART interface is reserved for UART communication with external devices and can provide 3.3V output voltage externally.

UART Interface definition:




型号：HX20020-5A

| Num | Pin | Name | Describe |
|---|---|---|---|
| 1 | PIN1 | GND | GND |
| 2 | PIN2 | GND | GND |
| 3 | PIN3 | RXD | UART-R signal |
| 4 | PIN4 | TXD | UART-T signal |
| 5 | PIN5 | 3.3V | 3.3V Power supply (output) |

# 11、Compatible with inverter brands

| Brand | Name of agreement | communication | Change method |
|---|---|---|---|
| GOODWE | GOODWE communication protocol | CAN | Upper computer switching PN-GDLT |
| Solis | CAN communication protocol | CAN | Upper computer switching GINL |
| SUNGROW | CAN-Bus-protocol-PYLON | CAN | Upper computer switching PN-GDLT |
| CHINT POWER | Chint+Power CAN bus protocol V1.0.0 | CAN | Upper computer switching PN-GDLT |
| Senergy | SenergyINV&BMS_CAN_Protocols_EN | CAN | Upper computer switching PN-GDLT |
| SOFAR | Sofar protocol | CAN | Upper computer switching SMA-SF |
| AISWEI | CAN-Bus-protocol-PYLON | CAN | Upper computer switching PN-GDLT |

| | | | |
|---|---|---|---|
| Growatt-SPF/SPH | Growatt BMS CAN-Bus-protocol-low-voltage | CAN | Upper computer switching GRWT |
| SMA | FSS-ConnectingBat-TI-en-20W | CAN | Upper computer switching SMA-SF |
| Victron | can-bus_bms_protocol | CAN | Upper computer switching VCTR |
| hoymiles | CAN-Bus-protocol-PYLON | CAN | Upper computer switching PN-GDLT |

| | | | |
|---|---|---|---|
| Luxpowertek | Luxpowertek Battery CAN Protocol | CAN | Upper computer switching PN-GDLT |
| AOTAI | Aotai lithium battery BMS platform CAN protocol V1.02 | CAN | Upper computer switching PN-GDLT |
| Sol-Ark | Sol-Ark CAN Bus Protocol | CAN | Upper computer switching PN-GDLT |
| Studer | Technical specification Studer BMS Protocol | CAN | Upper computer switching Studer |
| TBB | TBB protocol V1.02 | CAN | Upper computer switching PN-GDLT |
| Deye | CAN-Bus-protocol-PYLON-v1.3 | CAN | Upper computer switching PN-GDLT |
| Sunsynk | CAN-Bus-protocol-PYLON | CAN | Upper computer switching PN-GDLT |
| LIVOLTEK | LIVOLTEK CANBUS Protocol of Low Voltage SystemV1.0 | CAN | Upper computer switching PN-GDLT |
| SOROCEC | 2_CAN protocol 1.0 | CAN | Upper computer switching PN-GDLT |
| MEGAREVO | MEGAREVO Protocol V1.01 | CAN | Upper computer switching PN-GDLT |
| Afore | CAN-Bus-protocol-PYLON | CAN | Upper computer switching PN-GDLT |
| Sacolar | Growatt BMS CAN-Bus-protocol-low-voltage | CAN | Upper computer switching GRWT |
| Must | CAN-Bus-protocol-PYLON | CAN | Upper computer switching PN-GDLT |
| invt | CAN-Bus-protocol-PYLON | CAN | Upper computer switching PN-GDLT |
| RENAC | CAN-Bus-protocol-PYLON | CAN | Upper computer switching PN-GDLT |

| | | | |
|---|---|---|---|
| EACH ENERGY | CAN 协议-PN_GDLT-V2.0.pdf | CAN | Upper computer switching PN-GDLT |
| OLU | CAN 协议-PN_GDLT-V2.0.pdf | CAN | Upper computer switching PN-GDLT |
| hinen | CAN 协议-PN_GDLT-V2.0.pdf | CAN | Upper computer switching PN-GDLT |
| Hypontech | CAN 协议-PN_GDLT-V2.0.pdf | CAN | Upper computer switching PN-GDLT |

| | | | |
|---|---|---|---|
| srne | PACE BMS Modbus Protocol for RS485 | 485 | Automatic adaptation |
| Deye | RS485-protocol-pylon-low-voltage | 485 | Automatic adaptation |
| Growatt-SPF | SPF BMS RS485 | 485 | Automatic adaptation |
| SMKSOLAR | SMKSOLAR protocol V1.0 | 485 | Automatic adaptation |
| Voltronic | Voltronic Inverter and BMS 485 communication protocol | 485 | Automatic adaptation |
| CHISAGE ESS | RS485-protocol-pylon-low-voltage | 485 | Automatic adaptation |
| EASUN | Voltronic Inverter and BMS 485 communication protocol | 485 | Automatic adaptation |
| MPP Solar | Voltronic Inverter and BMS 485 communication protocol | 485 | Automatic adaptation |
| EPEVER | BMS-LinkV1.4.pdf | 485 | Automatic adaptation |
| Bentterson | RS485-protocol-pylon-low-voltage | 485 | Automatic adaptation |
| xindun | SPF BMS RS485 | 485 | Automatic adaptation |
| Techfine | RS485-protocol-pylon-low-voltage | 485 | Automatic adaptation |
| CVTE | RS485-protocol-pylon-low-voltage | 485 | Automatic adaptation |
| GivEnergy | BMS Communication Protocol V1.04 | 485 | Automatic adaptation |
| NEXT | RS485-protocol-pylon-low-voltage | 485 | Automatic adaptation |

# 12、List of components

| Num | Name of accessory | Number | configure |
|---|---|---|---|
| 1 | Voltage pickup line | 1 | optional |
| 2 | Conventional switch line | 1 | optional |
| 3 | Conventional transfer board line | 1 | optional |
| 5 | Screw | 2 | optional |
| 6 | LCD | 1 | optional |
| 7 | Conventional transfer board | 1 | optional |

# 13、Attention

- The battery management system cannot be used in series.
- The BMS power component is rated at 100V.
- If the cell module is assembled in the form of long wires and long copper bars, it must communicate with BMS manufacturers to do impedance compensation. Otherwise, it will affect the consistency of the cell.
- The external switch on the BMS is prohibited from connecting to other devices. If necessary, please confirm with the technical team. Otherwise, BMS will not be liable for any damage.
- Do not directly contact the surface of the cell with the protective plate during assembly to avoid damage to the cell. The assembly should be firm and reliable.
- When using, pay attention to the lead head, soldering iron, solder and other 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 conditions during use, and do not exceed the values in this specification, otherwise the protection board may be damaged.
- After the battery pack and protection board are combined, if no voltage output or charging is found when the battery pack is first powered on, check whether the wiring is correct.
- The final right of interpretation belongs to the company.