



# Battery Management System

Product Specifications

Master-Slave Architecture Version

V1.0

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# 1 Overview

## 1.1 Purpose

This article mainly introduces the principle architecture description, functional characteristics, interface specifications of each module and application scenarios of the master-slave architecture version of the BMS battery management system produced by ChengDu Heltec Energy Technology Co., Ltd.

## 1.2 Product Overview

### 1.2.1 Function introduction

HeltecBMS BMS battery management system can monitor the cell voltage, battery pack total voltage, cell temperature, charge and discharge current and other parameters of the lithium battery system in real time and with high precision, and perform rapid analysis and processing to provide the corresponding lithium battery overcharge , over-discharge, over-current, over-temperature, short-circuit and other protection mechanisms to ensure the safe and reliable operation of the lithium battery system and prolong the service life of the lithium battery.

The interior of the product adopts modular design, which is divided into master control module-BMU master control module, slave control acquisition unit-BCU voltage and temperature acquisition equalization module, BTU temperature acquisition expansion module, and BIU insulation detection module. According to the requirements of the charging and discharging operating conditions of the lithium battery pack in different application scenarios, the appropriate selection of the slave control module unit effectively improves the compatibility of the product for various terminal applications.



### 1.2.2 Main product features

- It has the functions of single voltage data acquisition, total voltage data acquisition, current acquisition, temperature acquisition, and battery pack insulation state detection.
- Has complete fault level alarm function, including voltage, current, temperature, insulation and other fault alarms
- With SOC estimation function
- With charge and discharge control function
- Features automatic balance management to improve battery pack consistency and extend battery life.

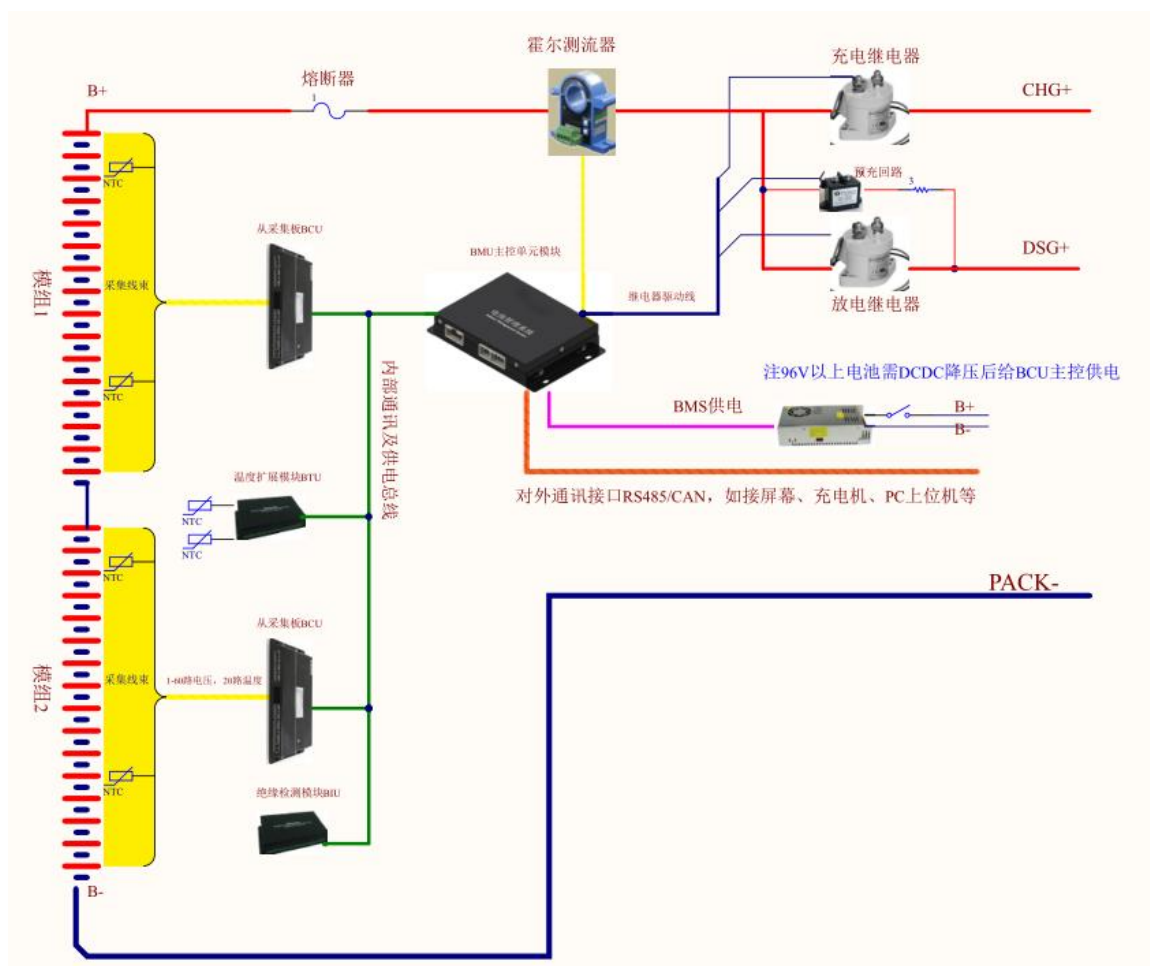
### 1.3 Main technical indicators of the product

<i>Parameters</i>	<i>Indicator</i>
Power supply	18-150V (Note, if the battery pack is lower than 96V, the total voltage of the battery can be used for power supply, no external DCDC)

System power consumption		Working mode: <10ma; Sleep mode: <1ma; Stop mode: <50UA
System startup method		External passive switch signal (default self-locking switch)
Number of cell collection strings		4~240S
Number of temperature acquisition channels		The default is 1/4 of the number of cell strings, which can be supported by the BTU temperature expansion module
Single cell voltage	Collection range	0~5V,support all lithium battery monitoring
	detection error	$\leq\pm 0.1\%$
Battery pack total voltage	Collection range	8~1000V
	detection error	$\leq\pm 0.2\%$
Charge and discharge current	Collection range	Hall detection method, typical $\pm 600A$ range, optional 100A、300A、600A、1200A
	detection error	$\pm 1\%$
temperature	Collection range	-40~125℃
	detection error	$\pm 1^{\circ}C$
SOC Estimation error		$\leq 5\%$
Cell Balance (Intelligent Balance)		Typical equalizing current 80mA
Number of relay control circuits		6 , 12V high side drive control
communication method		Up to 6 isolated CAN2.0B interfaces, vehicle communication: V_CAN, charging communication: C_CAN, internal communication I_CAN; debugging communication: D_CAN; reserved CAN: R1_CAN; reserved CAN: R2_CAN. 2 isolated RS485 interfaces, support Modbus protocol, and VCU or display 2-way UART, can be used to connect to Bluetooth module, GPS remote management or display screen, etc
Operating environment	operating temperature	-40~105℃
	Operating environment	10~90 %RH, No condensation, no corrosive gas
	altitude	$\leq 4500m$

## 2 System Architecture

### 2.1 Frame Schematic



**Note:** Different applications, electrical connection and networking methods are different, please confirm with the company's technical personnel according to specific needs

As shown in the figure above, the entire BMS is divided into the main module BMU and the slave acquisition modules such as BCU, BIU, BTU, etc. The functions of the two parts are as follows:

BMU: Receive the battery status information reported by the BCU, BIU, BTU and other modules through the internal CAN bus, perform logical operations, information

statistical operations (SOC\SOH\fault alarm information), and drive the charge and discharge protection module to achieve battery charge and discharge protection and balance. , and external communication interaction, communication supports RS485\CAN\UART.

BCU: Realize the collection of battery single string voltage and NTC temperature control, and report the current battery voltage, temperature and other status information to the BMU main control module through the internal CAN bus. At the same time, the BCU has the function of battery intelligent balancing and heating and cooling drive control. According to the reported battery status information, the BMU main control module controls whether the BCU turns on balance for a certain battery through internal CAN communication, so as to achieve the battery balance function, thereby prolonging the battery life. life.

BIU: Realize the insulation detection function of the battery package B+ B- to the box, and report the insulation detection data to the BMU through the internal CAN.

BTU: For some special application manufacturers, more temperature detection channels are required. BTU is an extended temperature detection module. A single BTU supports up to 60 channels of NTC temperature acquisition, and reports the temperature value to the BMU through the internal CAN. (Note: non-essential functions, used in special application scenarios)

## 2.2 Product Module Model List

Category	Model	description	Remark
BMU main control module	BMS-BMU-ST	Standard Edition Master	
BCU Acquisition equalization module	BMS-BCU12S4T	Support up to 12 channels of voltage	According to the actual battery



		acquisition, 4 channels of temperature acquisition	pack selection
	BMS-BCU24S8T	Supports up to 24 channels of voltage acquisition and 8 channels of temperature acquisition	
	BMS-BCU36S12T	Supports up to 36 channels of voltage acquisition and 12 channels of temperature acquisition	
	BMS-BCU36S16T	Supports up to 48 channels of voltage acquisition and 16 channels of temperature acquisition	
	BMS-BCU60S20T	Supports up to 60 channels of voltage acquisition and 20 channels of temperature acquisition	
BTUExtended temperature	BMS-BTU12T	Supports up to 12 channels of NTC	Special industry requirements are



acquisition module		temperature acquisition	used when the temperature of each battery is detected, and the selection is made according to the actual situation.
	BMS-BTU24T	Supports up to 24 channels of NTC temperature acquisition	
	BMS-BTU36T	Supports up to 36 channels of NTC temperature acquisition	
	BMS-BTU48T	Supports up to 48 channels of NTC temperature acquisition	
	BMS-BTU60T	Supports up to 60 channels of NTC temperature acquisition	
BIUInsulation detection module	BMS-BIU	Supports insulation resistance detection of battery pack (or module) PACK+ PACK- to the ground of the box	Optional, optional for general high-voltage systems or special application scenarios

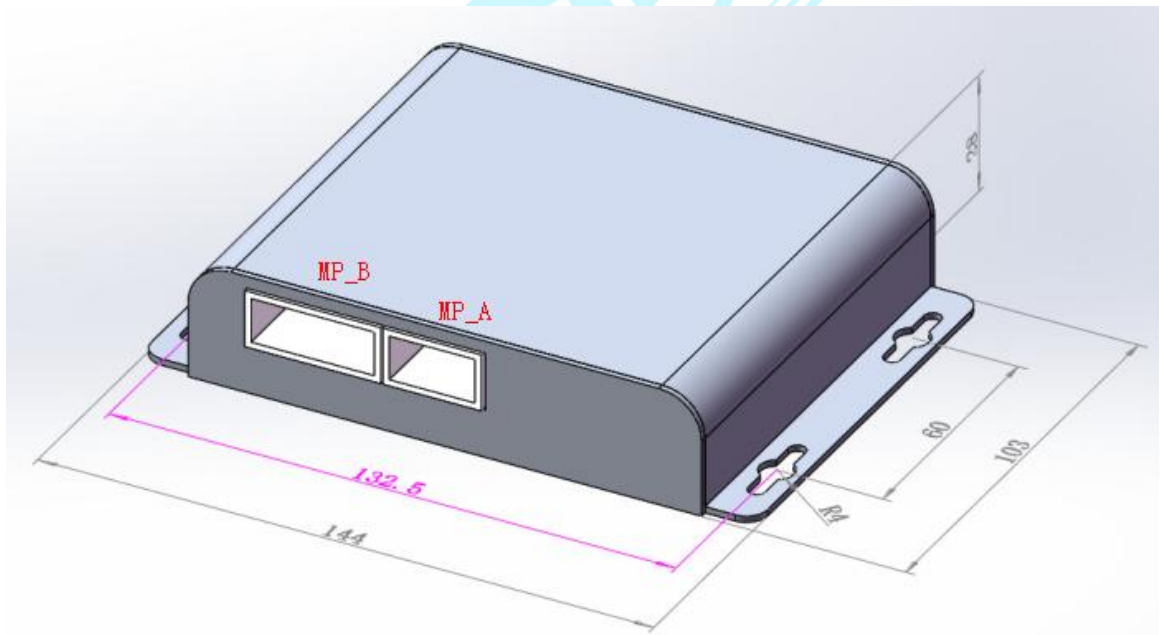
## 2.3 BMU Main control management module

### 2.3.1 BMU Model Description

BMU total of 1 model of the acquisition module:

model	Description/Key Features	Remark
BMS-BMU-ST	2 CAN, 1 RS485, 1 UART, 4 relay control	For low-speed vehicles, energy storage, industrial vehicles, robots, etc.

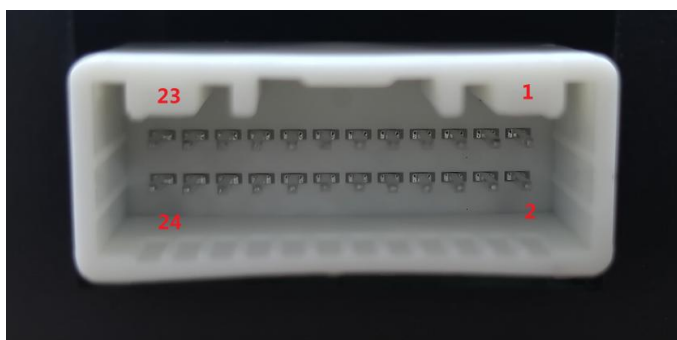
### 2.3.2 BMU Digital-analog diagram



BMS-BMU-ST

### 2.3.3 BMU Interface definition description table

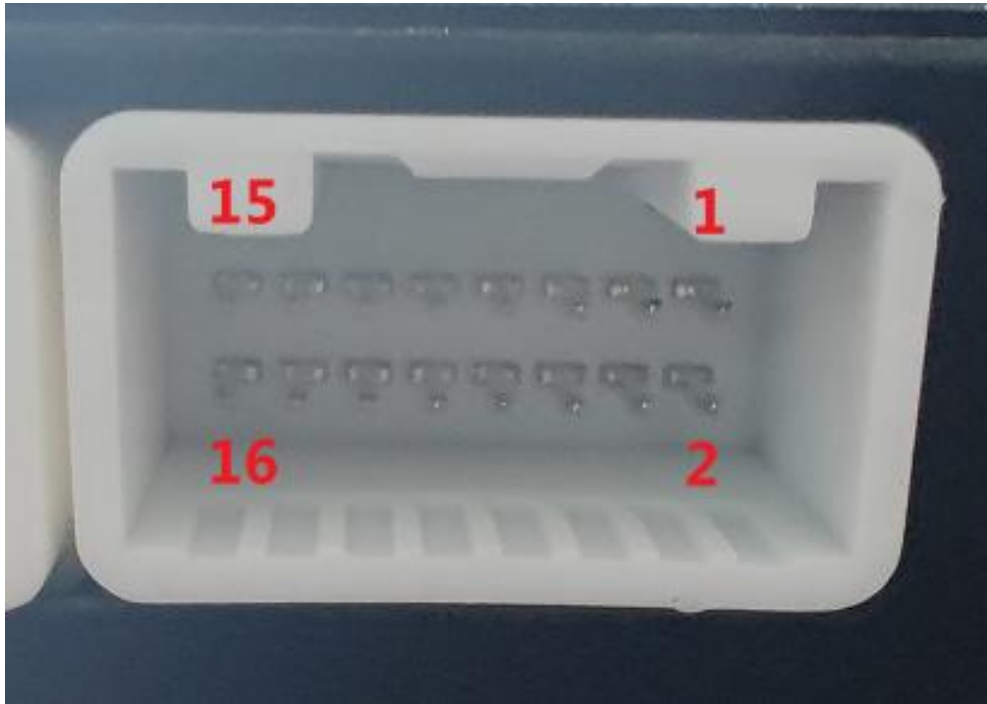
#### 2.3.3.1 BMS-BMU-ST interface definition table



"MP-B" port is the power supply and relay control interface, using TE brand 24PIN pitch 3mm connector

No.	Mainframe panel and wire number tube identification	definition	Remark
1	NC	reserved	
2	NC	reserved	
3	NC	reserved	
4	NC	reserved	
5	NC	reserved	
6	NC	reserved	
7	NC	reserved	
8	GND	GND	
9	PREDSG+	Pre-discharge relay control	12V high-side drive, the same below
10	GND	GND	
11	DSG+	Discharge relay control	
12	GND	GND	
13	CHG+	Charge relay control	
14	GND	GND	
15	NC	reserved	
16	NC	reserved	
17	HAL-	Hall signal line-	
18	HAL+	Hall signal lin+	
19	5V-	Hall 5V power supply-	
20	5V+	Hall 5V power supply+	
21	PWR-	Negative power supply	BMS system total power supply, rated default 24V power supply, range: 18-90V
22	PWR+	Positive power supply	

23	SW1	switch	The switch is shorted and the system is powered on
24	SW2		



"MP-A" port is the main communication interface, using TE brand 24PIN pitch 2.2mm connector

No.	Mainframe panel and wire number tube identification	definition	Remark
1	12V-	12V output-	Connect the slave board and supply power to the slave board
2	12V+	12V output+	Connect the slave board and supply power to the slave board
3	CAN1-L	CAN1 bus L	Internal CANL, connected to the slave board
4	CAN1-H	CAN1 bus H	Internal CANH
5	RS485A	RS485 communication A	
6	RS485B	RS485 communication B	
7	CAN2-L	CAN2 bus L	
8	CAN2-H	CAN2 bus H	
9	NC	reserved	
10	NC	reserved	

11	NC	reserved	
12	NC	reserved	
13	UART-TX	Serial communication TX	
14	UART-RX	Serial communication TX	
15	GND	GND	
16	5V OUT	5V active output	

## 2.4 BCU Voltage and temperature acquisition and equalization module

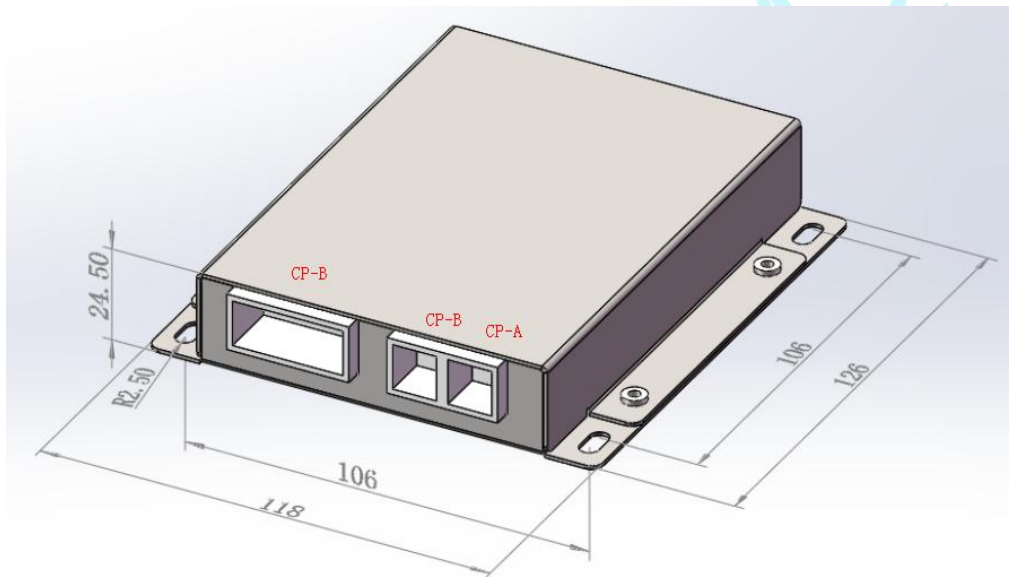
### 2.4.1 BCU Model Description

BCU 5 models of BCU acquisition module:

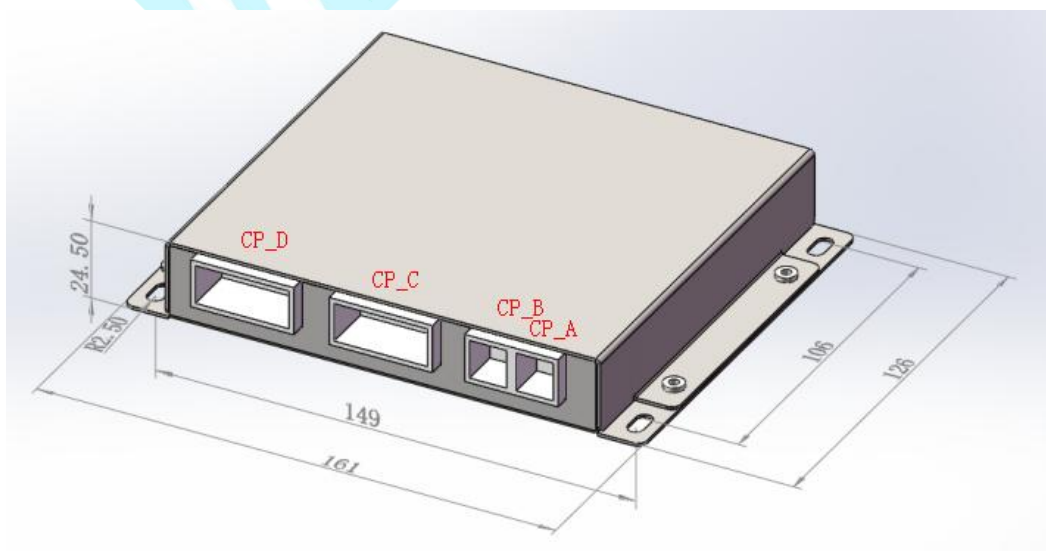
Model	Description	Remark
BMS-BCU12S4T	Support up to 12 channels of voltage acquisition, 4 channels of temperature acquisition	
BMS-BCU24S8T	Support up to 24 channels of voltage acquisition, 8 channels of temperature acquisition	
BMS-BCU36S12T	Support up to 36 channels of voltage acquisition, 12 channels of temperature acquisition	
BMS-BCU36S16T	Support up to 48 channels of voltage acquisition, 16	

	channels of temperature acquisition	
BMS-BCU60S20T	Support up to 60 channels of voltage acquisition, 20 channels of temperature acquisition	

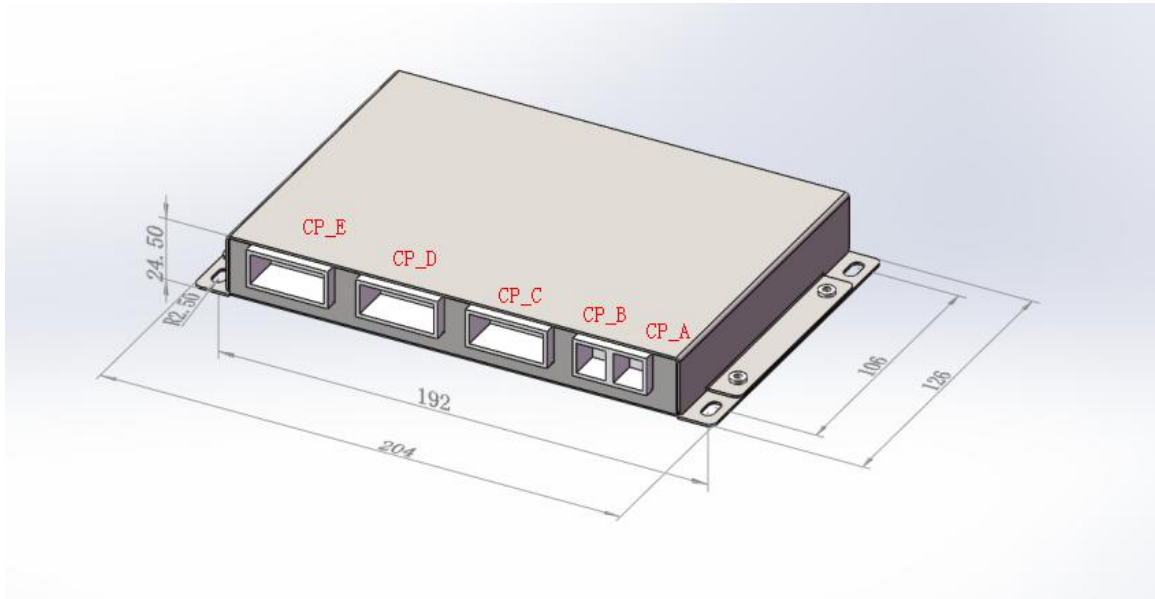
## 2.4.2 BCUDigital and analog diagram



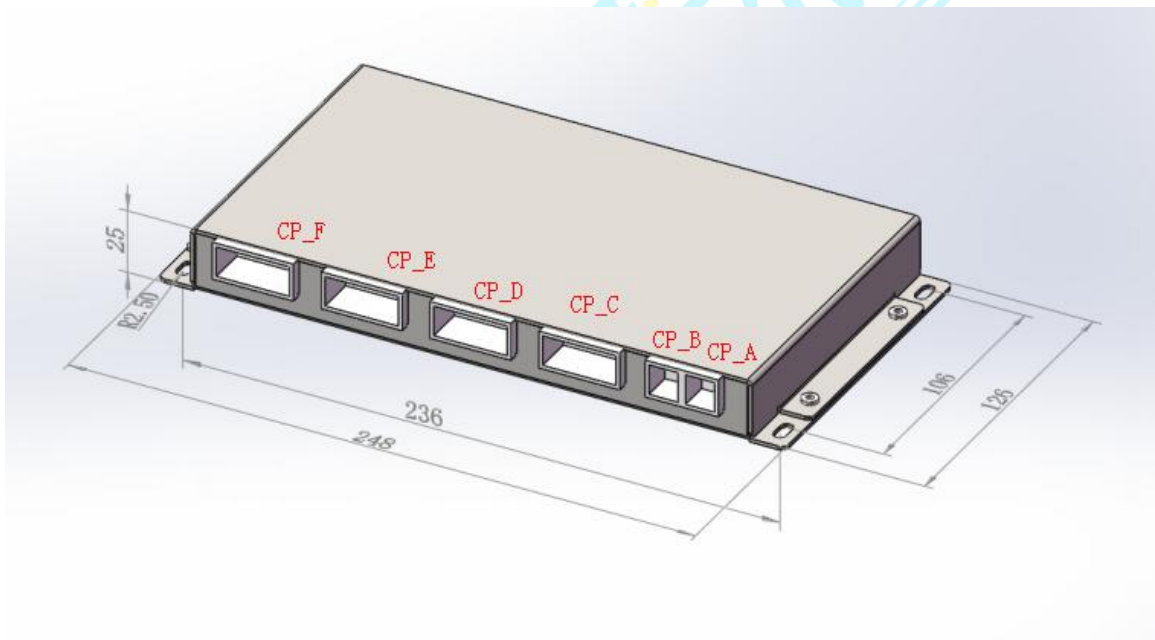
BMS-BCU12S4T



BMS-BCU24S8T

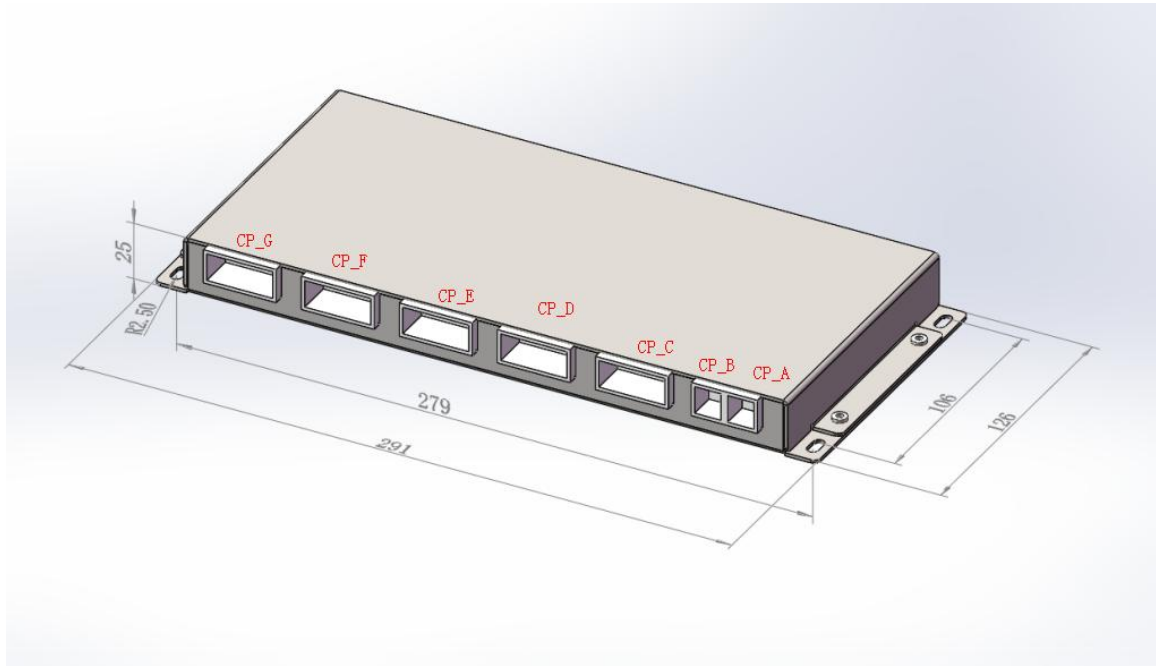


BMS-BCU36S12T



BMS-BCU48S20T



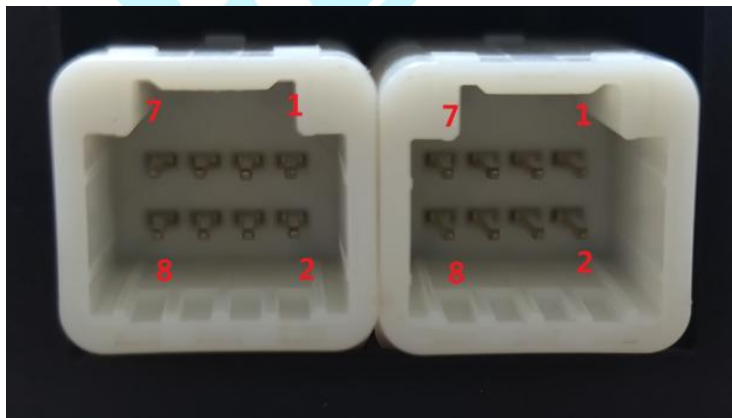


BMS-BCU60S20T

## 2.4.3 BCUInterface definition description table

### 2.4.3.1 CP-A、CP-B Interface definition

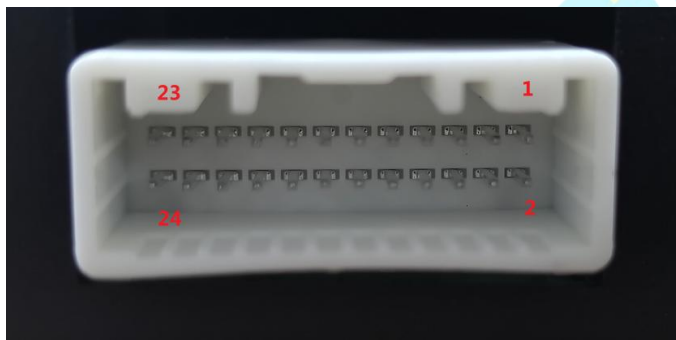
CP-A,CP-B are the internal CAN and power supply bus interfaces. The electrical properties of the two interfaces are the same, and the definitions are as follows:



No.	Mainframe panel and wire	Interface definition	Remark
1	VCC12V+	Module 12V power supply positive	The power supply of the acquisition module is connected to the 12V
2	VCC12-	Module 12V power supply negative	
3	NC		
4	NC		
5	I_CAN-H	Internal CAN bus high	Internal CAN communication interface
6	I_CAN-L	Internal CAN bus high low	
7	<b>Reserved debugging port</b>		
8	<b>Reserved debugging port</b>		

### 2.4.3.2 port CP\_C to CP\_G interface definition

CP\_C/CP\_D/CP\_E/CP\_F/CP-G These are voltage and temperature acquisition ports, and each interface has the same definition



No.	Mainframe panel and wire	definition	Remark
1	TEM_1	The first temperature input of this monitoring module	The wire harness end comes standard with NTC temperature sensor 10K 3435 (25°C)
2	GND		
3	TEM_2	The second temperature input of this monitoring module	The wire harness end comes standard with NTC temperature sensor 10K 3435 (25°C)
4	GND		
5	TEM_3	The third temperature input of this monitoring module	The wire harness end comes standard with NTC temperature sensor 10K 3435 (25°C)
6	GND		
7	TEM_4	The fourth temperature input of this monitoring module	The wire harness end comes standard with NTC temperature sensor 10K 3435 (25°C) 线束端
8	GND		
9	NC	reserved for dangling	
10	NC	reserved for dangling	

11	B0/B-	<b>Connect to the negative pole of the monitoring module</b>	
12	B1+	Connect to the positive pole of the 1st battery of this monitoring module	
13	B2+	Connect to the positive pole of the 2nd battery of this monitoring module	
14	B3+	Connect to the positive pole of the 3rd battery of this monitoring module	
15	B4+	Connect to the positive pole of the 4th battery of this monitoring module	
16	B5+	Connect to the positive pole of the 5th battery of this monitoring module	
17	B6+	Connect to the positive pole of the 6th battery of this monitoring module	
18	B7+	Connect to the positive pole of the 7th battery of this monitoring module	
19	B8+	Connect to the positive pole of the 8th battery of this monitoring module	
20	B9+	Connect to the positive pole of the 9th battery of this monitoring module	
21	B10+	Connect to the positive pole of the 10th battery of this monitoring module	
22	B11+	Connect to the positive pole of the 11th battery of this monitoring module	
23	B12+	Connect to the positive pole of the 12th battery of this monitoring module	
24	B+	<b>Connect to the positive pole of the battery of this monitoring module</b>	

**NOTE :** For drop-string use, the high-string collection line is not connected. For example, if only 8 strings are connected, then B9+ to

**B12+ are not connected.**

## 2.5 BTU Extended temperature acquisition module

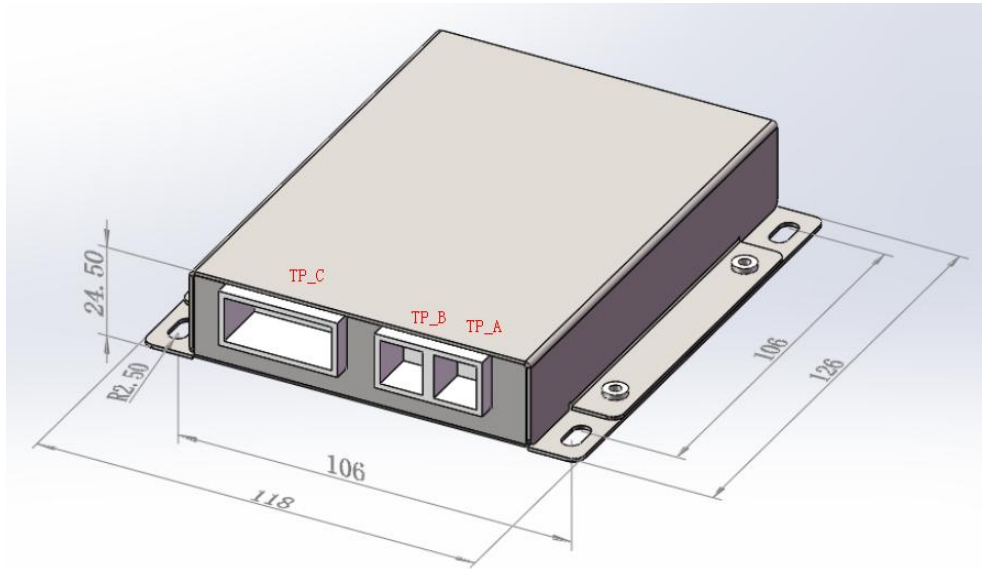
Note: The BTU extended temperature acquisition module is used to meet the needs of mining, military and special application scenarios where each battery needs to monitor the temperature. Conventional industrial use does not need to configure so many temperature monitoring units.

### 2.5.1 BTU Model Description

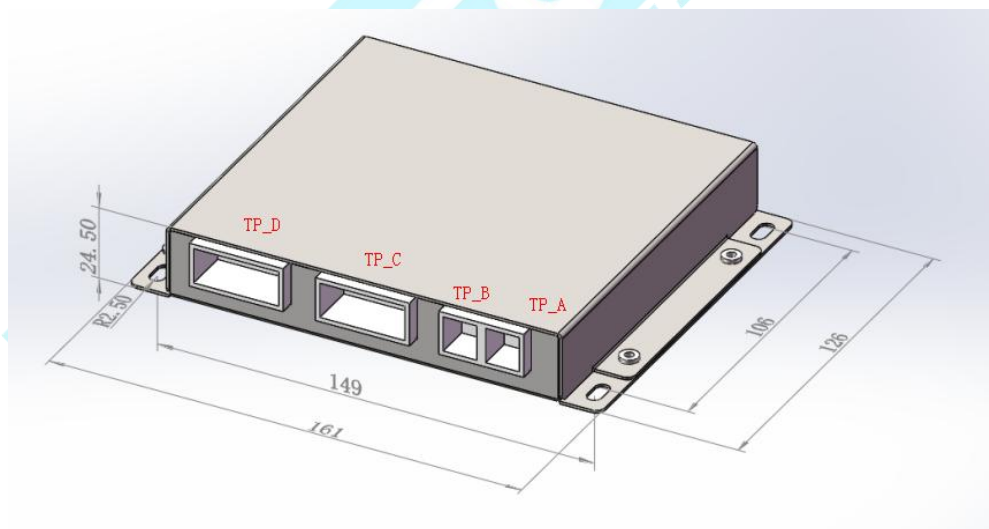
BTU 5 models of acquisition modules:

Model	Description	Remark
BMS-BTU12T	Supports up to 12 channels of NTC temperature acquisition	
BMS-BTU24T	Supports up to 24channels of NTC temperature acquisition	
BMS-BTU36T	Supports up to 36 channels of NTC temperature acquisition	
BMS-BTU48T	Supports up to 48channels of NTC temperature acquisition	
BMS-BTU60T	Supports up to 60 channels of NTC temperature acquisition	

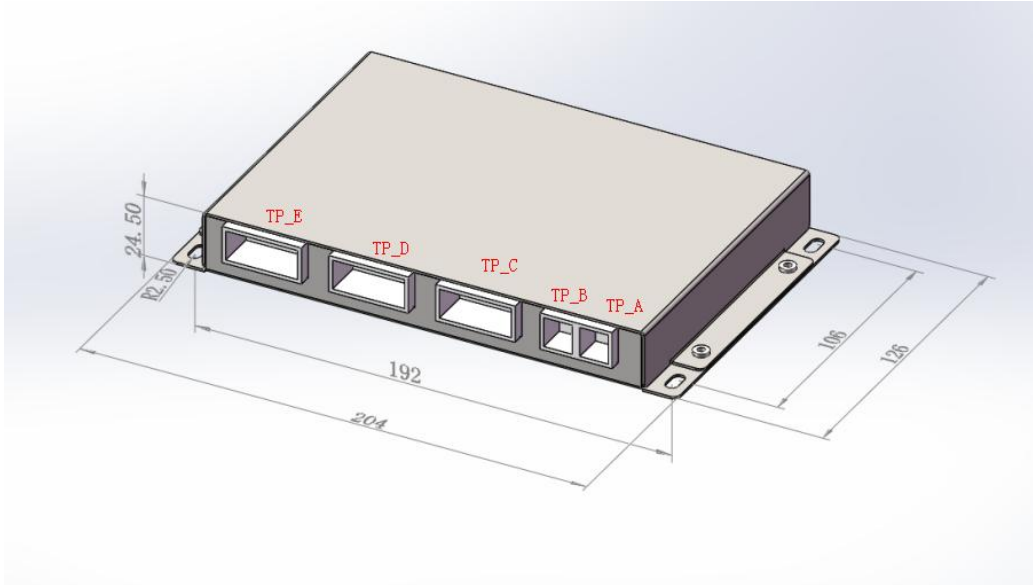
## 2.5.2 BTU Digital-analog diagram



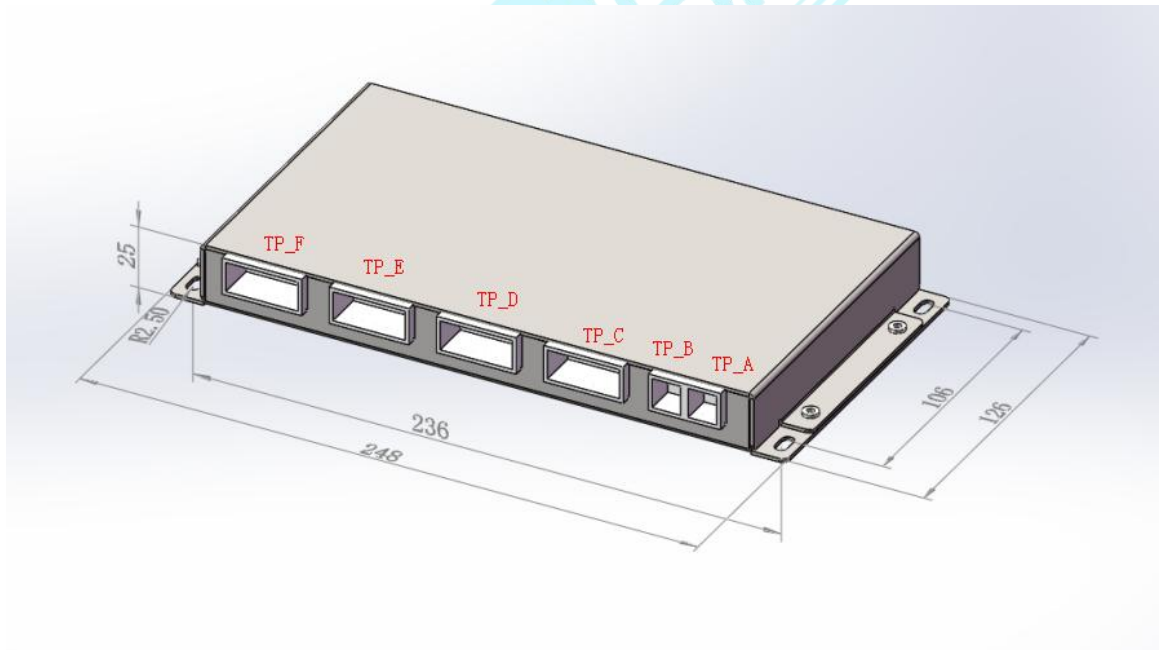
BMS-BTU12T



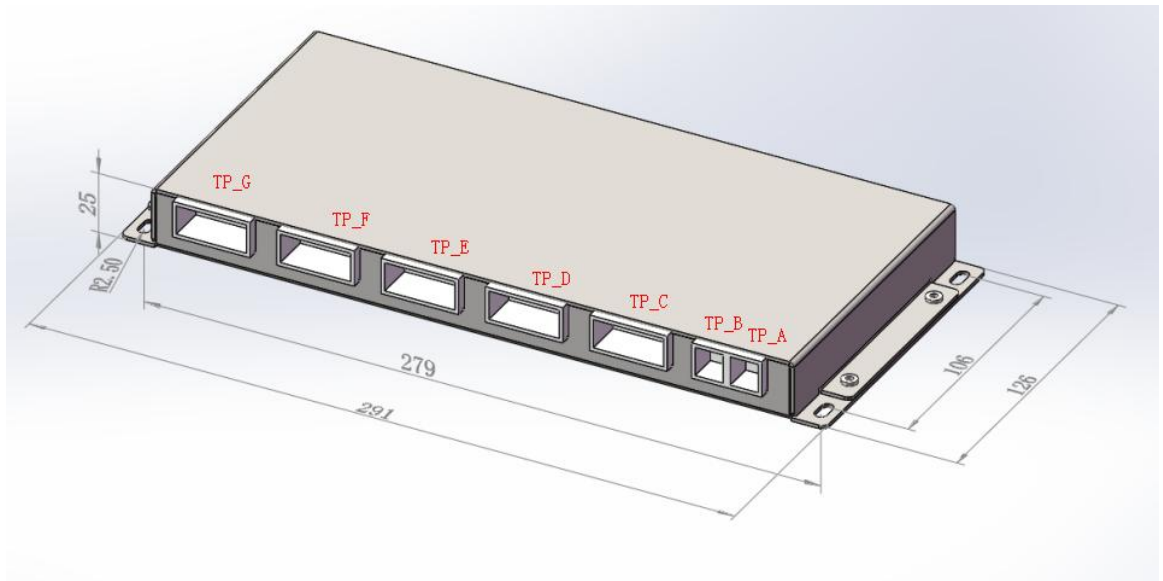
BMS-BTU24T



BMS-BTU36T



BMS-BTU48T



BMS-BTU60T

## 2.5.3 BTU Interface definition description table

### 2.5.3.1 TP-A/TP-B Interface definition

TP-A/TP-B are internal CAN and power supply bus interface, the electrical properties of the two interfaces are the same, and the definitions are as follows:

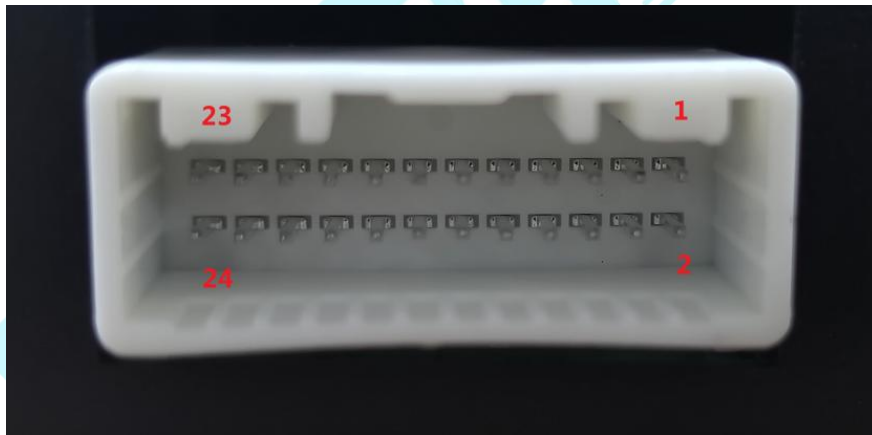




No.	Mainframe panel and wire number tube identification	Definition	Remark
1	VCC12V+	Module 12V power supply is positive	The power supply of the acquisition module is connected to the 12V power supply bus of the BMU master
2	VCC12-	Module 12V power supply is negative	
3	NC		
4	NC		
5	I_CAN-H	Internal CAN bus high	Internal CAN communication interface
6	I_CAN-L	Internal CAN bus low	
7	<b>Reserved debugging port</b>		
8	<b>Reserved debugging port</b>		

### 2.5.3.2 Interface definition of acquisition port TP\_C to TP\_G

TP\_C/TP\_D/TP\_E/TP\_F/TP-G All extended temperature acquisition ports, each interface has the same definition



No.	Mainframe panel and wire number tube identification	Wiring Definition	Remark
1	TEM_1	The first temperature input of this monitoring module	The wiring harness end comes standard with NTC temperature sensor 10K 3435 (25°C), the same below
2	GND		
3	TEM_2	The second temperature input of this monitoring module	
4	GND		

5	TEM_3	The third temperature input of this monitoring module	
6	GND		
7	TEM_4	The fourth temperature input of this monitoring module	
8	GND		
9	TEM_5	The fifth temperature input of this monitoring module	
10	GND		
11	TEM_6	The sixth temperature input of this monitoring module	
12	GND		
13	TEM_7	The seventh temperature input of this monitoring module	
14	GND		
15	TEM_8	The eighth temperature input of this monitoring module	
16	GND		
17	TEM_9	The ninth temperature input of this monitoring module	
18	GND		
19	TEM_10	The tenth temperature input of this monitoring module	
20	GND		
21	TEM_11	The eleventh temperature input of this monitoring module	
22	GND		
23	TEM_12	The twelfth temperature input of this monitoring module	
24	GND		

**NOTE :** Drop string use, high number of channels can not be connected to the temperature control probe

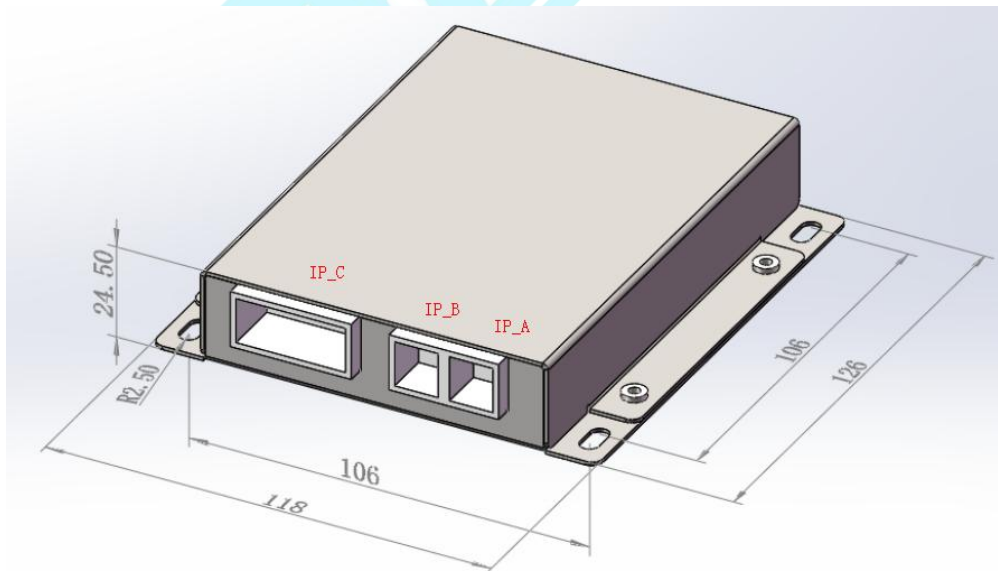
## 2.6 BIU Insulation detection module

### 2.6.1 BIU Model Description

BTU 1 model:

Model	Description	Remark
BMS-BIU	Support the insulation detection of battery module PACK+ PACK- to the ground of the box, and report it to the BMU main control module through the internal CAN	

### 2.6.2 BIU Digital and analog diagram

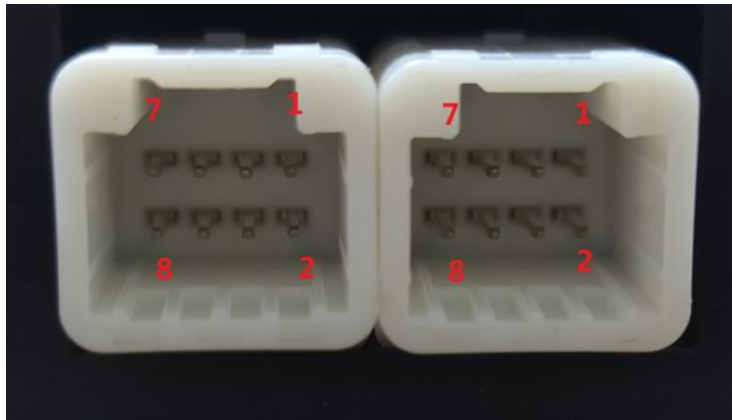


BMS-BIU

## 2.6.3 BIU Interface definition description table

### 2.6.3.1 IP-A/IP-B Interface definition

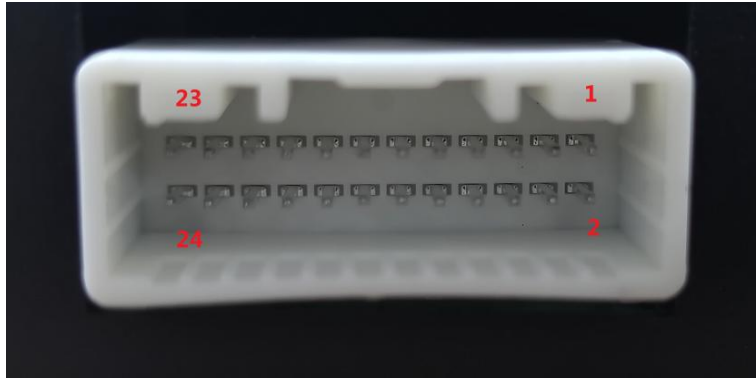
IP-A/IP-B are internal CAN and power supply bus interface, the electrical properties of the two interfaces are the same, and the definitions are as follows:



No.	Mainframe panel and wire number tube identification	Wiring Definition	Remark
1	VCC12V+	Module 12V power supply is positive	The power supply of the acquisition module is connected to the 12V power supply bus of the BMU master
2	VCC12-	Module 12V power supply is negative	
3	NC		
4	NC		
5	I_CAN-H	Internal CAN bus high	Internal CAN communication interface
6	I_CAN-L	Internal CAN bus low	
7	<i>Reserved debugging port</i>		
8	<i>Reserved debugging port</i>		

### 2.6.3.2 Acquisition port IP\_C interface definition

IP\_C Interface definition bit insulation resistance detection interface, the definition is as follows:



No.	Mainframe panel and wire number tube identification	Wiring Definition	Remark
1	PACK-	Battery negative detection, connect to battery negative	
2	PACK-	Battery negative detection, connect to battery negative	
3	NC		
4	NC		
5	NC		
6	NC		
7	NC		
8	NC		
9	NC		
10	NC		
11	NC		
12	GROUND		
13	GROUND		
14	NC		
15	NC		
16	NC		
17	NC		
18	NC		
19	NC		
20	NC		
21	NC		
22	NC		
23	PACK+	Connect to battery positive	
24	PACK+	Connect to battery positive	

---

**NOTE: Wiring should be done when the MSD service switch is off, otherwise electric shock may result! ! !**

## 2.7 Current detection module

The current detection of our company's products supports two modes of Hall current detection and shunt detection, among which:

Hall detection wiring is simple, isolated collection, can be worn on the main positive or main negative of the battery;

The shunt has low acquisition cost and large range, and can only be connected in series to the main negative of the battery.

## 3 Incidental matters

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