16S 100A 200A Communication BMS Compatible With Inverters

User Manual

Heltec Energy

1. Introduction

This product is a intelligent protection board specially designed for 16-series battery packs, which can be applied to lithium batteries with different chemical properties, such as lithium ion, lithium polymer, lithium iron phosphate, etc.

The whole system adopts O2's analog front-end acquisition chip + MCU, with external communication port. Some parameters can be flexibly adjusted through the host computer according to customers' needs.

2. Function Configuration

Function	Configuration	Function	Configuration
Applicable Number of Strings	16S	RS485 Communication (isolated)	By Default
Applicable Continuous Current	200A	UART Communication (isolated)	No
Number of NTC	2 Internal, 4 External	CAN Communication	By Default
Switch Function	By Default	RS232 Communication	Optional
Charging Current Limiting Function	By Default	GPS Module	Optional
UART interface (non-isolated)	By Default	Heating Film Function	Optional
Battery Packs Used in Parallel	Support	Battery Packs Used in Series	Optional
Balance Function	Passive Balancing	Secondary Protection Function	Optional
History Storage Function	By Default	LCD Display	Optional
Pre-discharge Function	By Default	LED Indicator Interface	Optional

Buzzer	By Default	Bluetooth Module	Optional

*Remark: The UART interface (non-isolated) does not support communication with chargers or loads.

3. Technical Parameters

3.1 Basic Parameters

Cell Specification	16S LFP
Interface Type	Same Port
Charging Recommended Voltage	3.6V*16
Single Voltage Range	2.7~3.65V
Continuous Charging Current	200A
Continuous Discharging Current	200A
Operating Power Consumption	≤40mA
Sleep Power Consumption	≤0.4mA
BMS Conduction Internal Resistance	≤10mR
Operating Temperature	-30℃~75℃
Dimension	300（±0.5）*100（±0.5）*38（±2）mm (L*W*H)

*The test needs to be performed in an environment with a temperature of 25±2℃ and a relative humidity of 65±20%.

3.2 Main Parameters

	Item	Specifications			Unit
		Minimum Value	Typical Value	Maximum Value	
Function	Over-voltage Protection Voltage	3.620	3.650	3.680	V
	Overcharge Protection Delay	1000	2000	3000	mS

	Time				
	Overcharge Protection Recovery Voltage	3.330	3.380	3.430	V
	Over-discharge Protection Voltage	2.600	2.700	2.800	V
	Over-discharge Protection Delay Time	1000	2000	3000	mS
	Over-discharge Protection Recovery Voltage	2.85	2.95	3.05	V
	Over-discharge Protection Recovery Condition	Voltage self-recovery or charge recovery			
Charging Over-current Protection	Charging Over-current Protection Value	210	220	230	A
	Charging Over-current Delay Time	5	10	15	S
	Charge Over-current Release Condition	0.5	1	1.5	S
Discharge Over-current Protection	Discharge Over-current Protection Value 1	210	220	230	A
	Discharge Over-current Protection Delay	5	10	15	S

	Time 1				
	Discharge Over-current Protection Value 2	500	650	800	A
	Discharge Over-current Protection Delay Time 2	250	500	750	mS
	Discharge Over-current Release Condition	60S delay - automatic release			
Short Circuit Protection	Short Circuit Protection Current		1800		A
	Short Circuit Protection Delay Time	200	300	600	μs
	Short Circuit Protection recovery	Resume after disconnecting the load.			
	Description	Short-circuit current less than the minimum value or higher than the maximum value may cause short-circuit protection failure. If the short-circuit current exceeds 3000A, there is no guarantee of short-circuit protection, and it is not recommended to do a short-circuit protection test.			
Discharge High Temperature	Temperature protection value	67	70	73	℃

Protection (external)	Temperature protection release value	57	60	63	℃
Discharge Low Temperature Protection (external)	Temperature protection value	-23	-20	-17	℃
	Temperature protection release value	-18	-15	-12	℃
Charge High Temperature Protection (external)	Temperature protection value	62	65	68	℃
	Temperature protection release value	52	55	58	℃
Charge Low Temperature Protection (external)	Temperature protection value	-8	-5	-2	℃
	Temperature protection release value	-3	0	3	℃
FET Discharge High Temperature Protection (built-in)	Temperature protection value	110	115	120	℃
	Temperature protection release value	80	85	90	℃
Environment High Temperature Protection (built-in)	Temperature protection value	72	75	78	℃
	Temperature protection release value	62	65	68	℃
Environment Low	Temperature	-23	-20	-17	℃

Temperature Protection (built-in)	protection value				
	Temperature protection release value	-18	-15	-12	℃
Balancing Function	Balancing turn-on voltage (LFP)	3.470	3.500	3.530	V
	Opening voltage difference	-	30	-	V
	Balancing Current	20		60	mA
	Balancing Method	Static/Charge Balancing			
	Balancing Type	Time-sharing/Pulse Balancing			
Charging Current Limiting Function	Enable charging current limit	Turn on after charging over-current protection			
	Charge current limit	20±2A			
	Disable charging current limit	Charging current <1A or over-voltage protection			

*The test needs to be performed in an environment with a temperature of 25±2℃ and a relative humidity of 65±20%.

4. Function Description

4.1 Overcharge Protection and Recovery

4.1.1 Single Cell Overcharge Protection and Recovery

When the voltage of any cell is higher than the set value of the overcharge voltage of the single cell, and the duration reaches the overcharge delay of the single cell, the system enters the overcharge protection state, turns off the charging MOS, and cannot charge the battery.

After the single cell overcharge protection, when the voltage of all single cells drops below the single cell overcharge recovery value, the overcharge protection state will be released. It can also be released by discharge.

4.1.2 Overall Overcharge Protection and Recovery

When the overall voltage is higher than the overall over-voltage setting value, and the duration reaches the overall overcharge delay, the system enters the overcharge protection state, turns off the charging MOS, and cannot charge the battery. When the overall voltage drops below the total voltage over-voltage protection recovery value, the overcharge protection state will be released, and it can also be released by discharge.

4.2 Over-discharge Protection and Recovery

4.2.1 Single Cell Over-discharge Protection and Recovery

When the minimum cell voltage is lower than the cell over-discharge voltage setting value, and the duration reaches the cell over-discharge delay, the system enters the over-discharge protection state, turns off the discharge MOS, and cannot discharge the battery.

After the over-discharge protection of a single cell occurs, charging the battery pack can release the over-discharge protection state.

4.2.2 Overall Over-discharge Protection and Recovery

When the overall voltage is lower than the overall over-discharge voltage setting value and the duration reaches the overall over-discharge delay, the system enters the over-discharge protection state, turns off the discharge MOS, and cannot discharge the battery.

After the overall over-discharge protection occurs, charging the battery pack can release the over-discharge protection status.

4.3 Charge Over-current Protection and Recovery

When the charging current exceeds the charging over-current protection current and the duration reaches the over-current detection delay time, the system enters the charging over-current protection state and cannot charge the battery. After charging over-current protection occurs, it will automatically recover after a delay. If automatic

recovery is not required, the corresponding release time can be set longer; discharging can also release the charging over-current state.

4.4 Discharge Over-current Protection and Recovery

When the discharge current exceeds the discharge over-current protection current and the duration reaches the over-current detection delay time, the system enters the charge over-current protection state and turns off the discharge MOS. The system will automatically recover within 32 seconds after the discharge over-current occurs. If automatic recovery is not required, the corresponding release time can be set longer. Charging can also release the discharge over-current state. Discharge has two-level over-current protection function, which has different response speeds to different current values, and can protect the battery more reliably.

4.5 Temperature Protection and Recovery

4.5.1 Charge and Discharge High Temperature Protection and Recovery

When the NTC detects that the surface temperature of the cell is higher than the set high temperature protection temperature during charging and discharging, the management system enters the high temperature protection state, and the charging or discharging MOSFET is turned off, and the battery pack cannot be charged or discharged in this state.

When the temperature of the cell surface drops to the high temperature recovery setting value, the management system recovers from the high temperature state and turns on the charging and discharging MOS again.

4.5.2 Charge and Discharge Low Temperature Protection and Recovery

When the NTC detects that the surface temperature of the cell is lower than the set low temperature protection temperature during charging and discharging, the management system enters the low temperature protection state, and the charging or discharging MOSFET is turned off, and the battery pack cannot be charged or discharged in this state.

When the temperature of the cell surface rises to the low temperature recovery set value, the management system recovers from the low temperature state and turns on the charging and discharging MOS again.

4.5.3 Static Temperature Protection and Recovery

When static (no charge and discharge), if the temperature rises or falls to the protection board, the protection board will not make any protection action until

When the system detects that there is current, it will take corresponding protection actions.

4.6 Balancing Function

The management system adopts the resistance bypass method to balance the cells. During the charging process, the voltage of the highest single cell of the battery pack reaches the set balanced starting voltage value, and the voltage difference between the minimum voltage and the highest voltage of the single cells of the battery pack is greater than the set value. When the value is set, the cell balancing function that meets the conditions is turned on, and the two adjacent equalizers cannot be turned on at the same time.

Balancing stops when the cell voltage difference is less than the set value or the cell voltage is lower than the balancing start voltage. You can set the charge balancing mode and static balancing mode.

4.7 Capacity Calculation

The SOC calculation of the battery pack can be accurately calculated by integrating the current and time. The full capacity and cycle capacity of the battery pack can be set through the host computer, and the capacity can be automatically updated after a complete charge and discharge cycle. It has the function of calculating the number of charge and discharge cycles. When the cumulative discharge capacity of the battery pack reaches the set cycle capacity, the number of cycles will increase by one.

Note: For newly installed batteries, please set the nominal capacity and cycle

capacity according to the battery capacity, and perform a capacity learning, otherwise the capacity may not be accurate. Capacity learning operation: first fully charge to over-voltage protection, then discharge to under-voltage protection, and then charge again.

4.8 Sleep Function

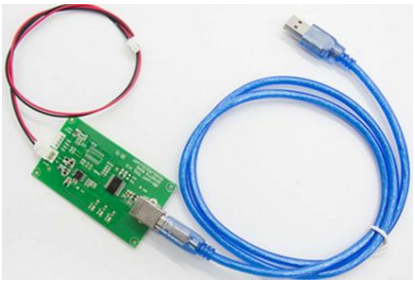
When the protection board is in a static state (no communication, no current, no balance and over-voltage protection.) After a delay of 5 minutes, it enters a dormant state. After entering this state, the protection board only reduces the frequency of detecting voltage and current and its own power consumption. Communication, switching, charging and discharging can automatically exit the sleep mode.

4.9 Communication Function

4.9.1 RS485/UART Communication

Various information of the battery can be monitored through the host computer, including battery voltage, current, temperature, status and battery production information, etc. The default baud rate is 9600bps.

UART Communication Box



RS485 Communication Box

4.9.2 CAN Communication

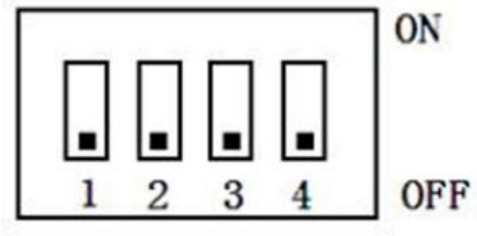
Environment configuration: To install the USBCAN Driver to the computer, you need to check the computer operating system first, and the 32-bit operating system and the 64-bit operating system match different driver files. (32-bit operating systems

match the file suffix "x86", 64-bit operating systems match the file suffix "x64"). Finally, you can check the port in the device manager of the computer to check whether the installation is successful.

Connection method: Insert the USB cable of the communication box into the USB port of the computer, and connect the other end to the corresponding interface of the battery protection board.

Communication format: CAN_ID_0 is selected by default for ID, CAN device is selected according to the type of communication box, baud rate is 500K by default, and channel selection is 0 by default.

4.9.3 DIP switch



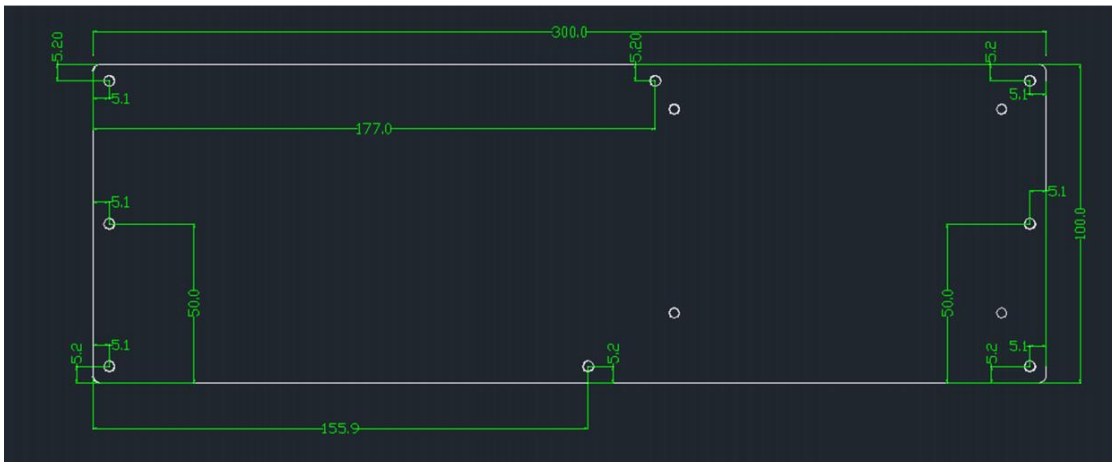
When the battery packs are used in parallel, different battery packs can be distinguished by setting the address through the DIP switch on the BMS. It is necessary to avoid setting the same address. For the definition of the BMS DIP switch, refer to the table below.

Binary Address	Switch Position				Explain
	1	2	3	4	
0000(0)	OFF	OFF	OFF	OFF	Select “MASTER(0000)” when using 485 alone for communication, serve as the master in parallel communication.
0001(1)	OFF	OFF	OFF	ON	Select “SLAVE1(0001)” for single-channel 485 communication
0010(2)	OFF	OFF	ON	OFF	Select “SLAVE2(0010)” for single-channel 485 communication

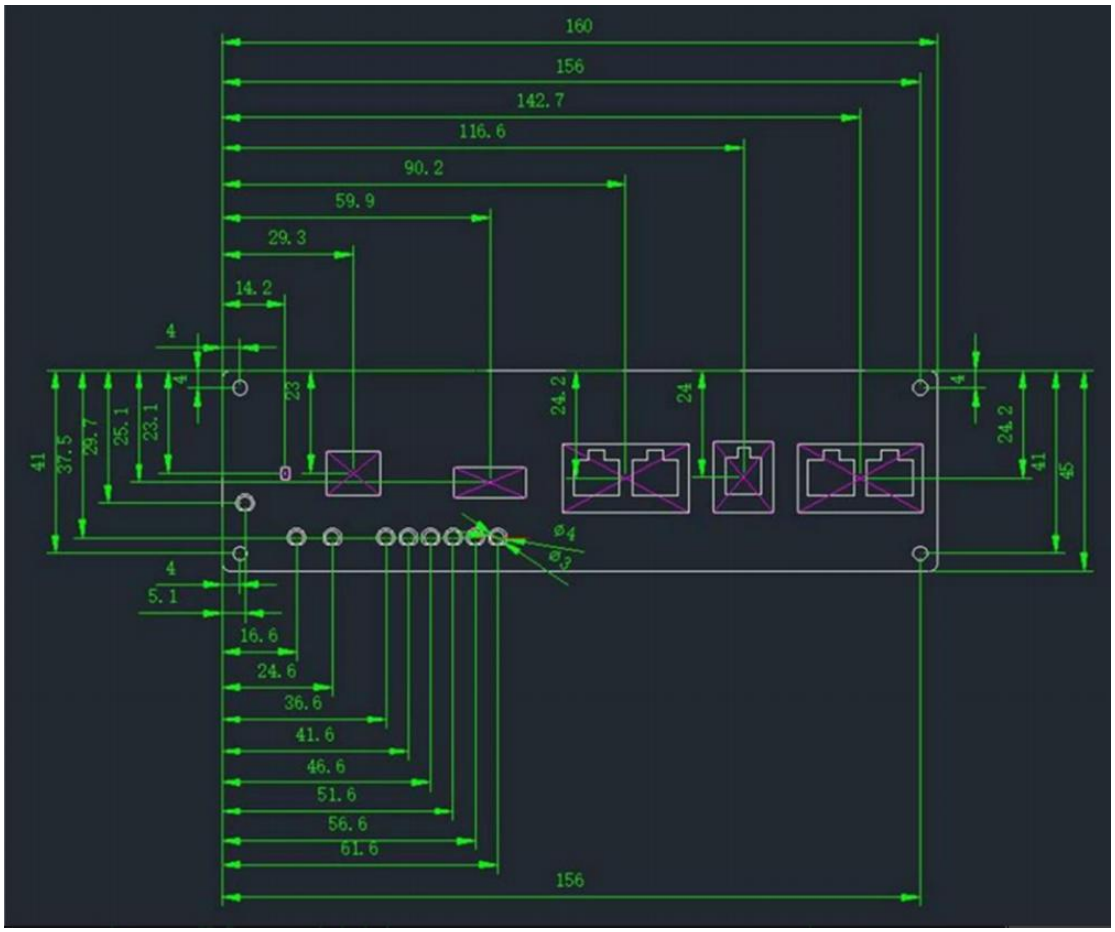
0011(3)	OFF	OFF	ON	ON	Select “SLAVE3(0011)” for single-channel 485 communication
0100(4)	OFF	ON	OFF	OFF	Select “SLAVE4(0100)” for single-channel 485 communication
0101(5)	OFF	ON	OFF	ON	Select “SLAVE4(0101)” for single-channel 485 communication
0110(6)	OFF	ON	ON	OFF	Select “SLAVE4(0110)” for single-channel 485 communication
0111(7)	OFF	ON	ON	ON	Select “SLAVE4(0111)” for single-channel 485 communication
1000(8)	ON	OFF	OFF	OFF	Select “SLAVE4(1000)” for single-channel 485 communication
1001(9)	ON	OFF	OFF	ON	Select “SLAVE4(1001)” for single-channel 485 communication
1010(10)	ON	OFF	ON	OFF	Select “SLAVE4(1010)” for single-channel 485 communication
1011(11)	ON	OFF	ON	ON	Select “SLAVE4(1011)” for single-channel 485 communication
1100(12)	ON	ON	OFF	OFF	Select “SLAVE4(1100)” for single-channel 485 communication
1101(13)	ON	ON	OFF	ON	Select “SLAVE4(1101)” for single-channel 485 communication
1110(14)	ON	ON	ON	OFF	Select “SLAVE4(1110)” for single-channel 485 communication
1111(15)	ON	ON	ON	ON	Select “SLAVE15(1111)” for single-channel 485 communication

5. Schematic and Dimensions

5.1 Main Board Dimensions

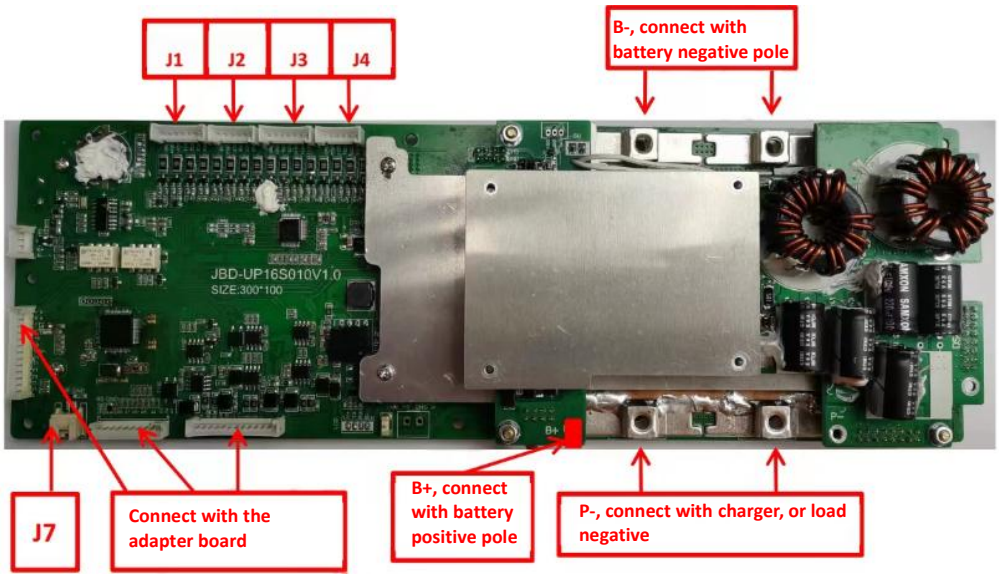


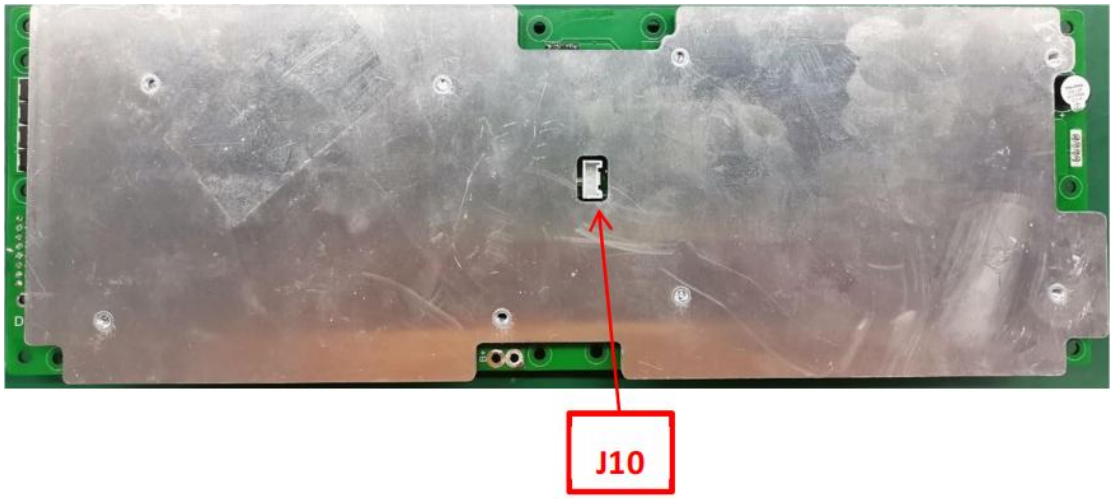
5.2 Adapter Board Dimensions



6. Signal Port Definition

6.1 The schematic diagram marks the interface label (refer to the figure below)



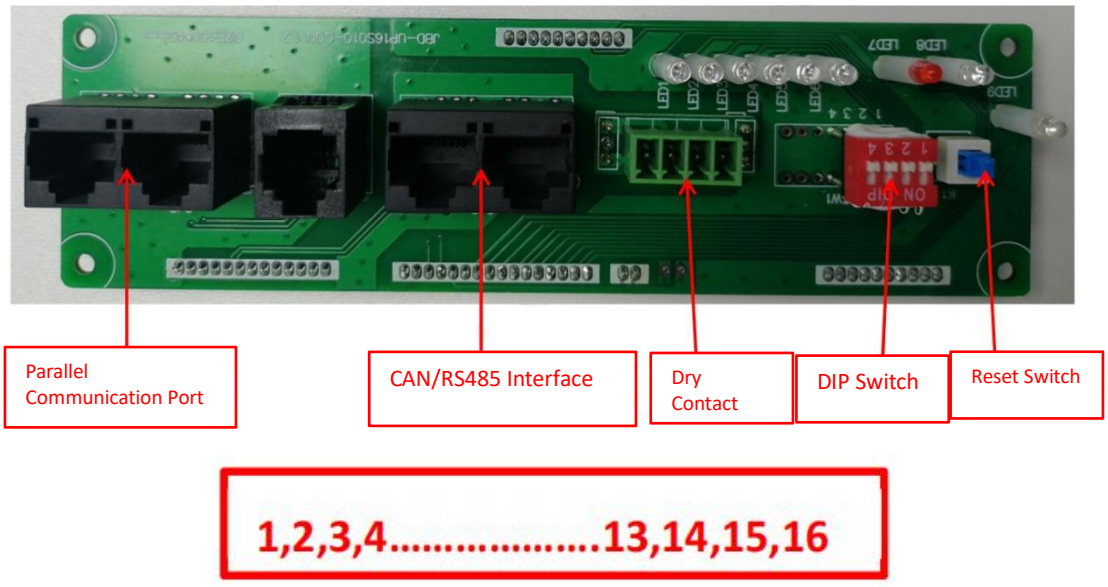


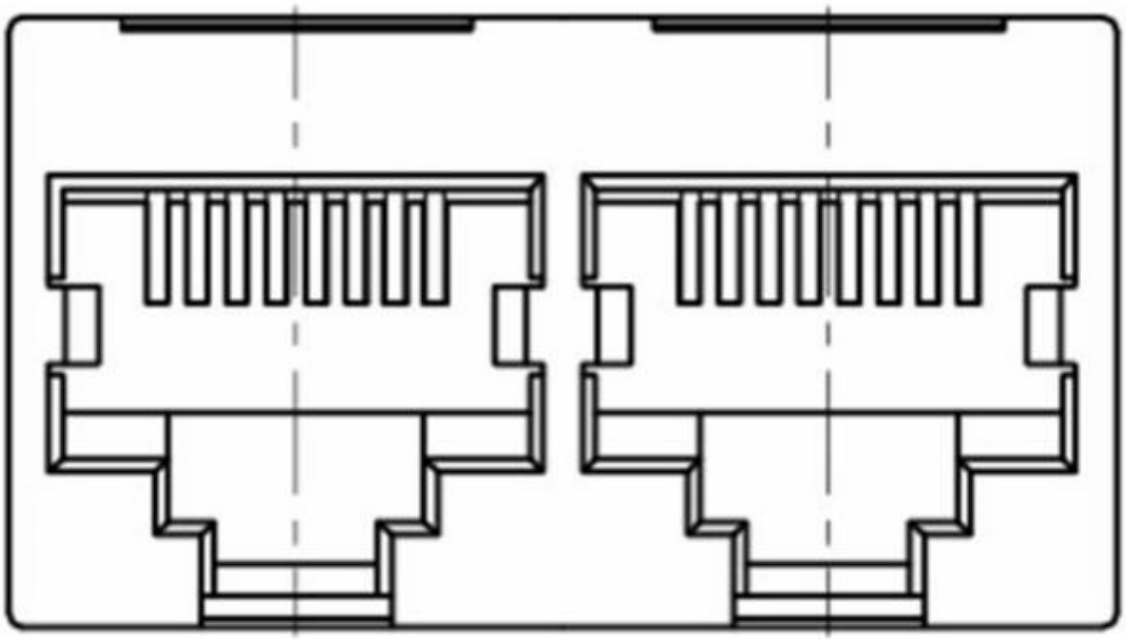
No.	Bit No.	Connector Function	Picture	PIN	PIN Function Definition
1	J1 (HY2.0-7P) (with buckle)	Voltage detection socket		1	Connect the temperature probe
				2	
				3	Connect to the negative pole of the lowest battery
				4	Connect the positive pole of the 1st cell

				5	Connect the positive pole of the 2nd cell
				6	Connect the positive pole of the 3rd cell
				7	Connect the positive pole of the 4th cell
2	J2 (HY2.0-6P) (with buckle)	Voltage detection socket		1	Connect the temperature probe
				2	
				3	Connect the positive pole of the 5th cell
				4	Connect the positive pole of the 6th cell
				5	Connect the positive pole of the 7th cell
				6	Connect the positive pole of the 8th cell
3	J3 (HY2.0-7P) (with buckle)	Voltage detection socket		1	Connect the temperature probe
				2	
				3	Connect the positive pole of the 9th cell
				4	Connect the positive pole of the 10th cell
				5	Connect the positive pole of the 11th cell
				6	Connect the positive pole of the 12th cell
4	J4 (HY2.0-6P)	Voltage detection		1	Connect the temperature probe
				2	

	(with buckle)	socket		3	Connect the positive pole of the 13th cell
				4	Connect the positive pole of the 14th cell
				5	Connect the positive pole of the 15th cell
				6	Connect the positive pole of the 16th cell
5	J7 (HY2.0-2P) (with buckle)	Secondary protection signal output terminal		1	Overcharge protection ground
				2	Overcharge current limiting high potential
6	J10 (HY2.0-4P) (with buckle)	External pre-discharge resistor interface		1	External pre-discharge resistor-1
				2	
				3	External pre-discharge resistor-2
				4	

6.2 Communication Port





RS485--8P8C vertical RJ45 socket		CAN--8P8C vertical RJ45 socket	
RJ45 PIN	Definition	RJ45 PIN	Definition
1,8	RS485-B1	9,10,11,14,16	NC
2,7	RS485-A1	12	CANL
3,6	GND	13	CANH
4,5	NC	15	GND

RS485--8P8C vertical RJ45 socket		CAN--8P8C vertical RJ45 socket	
RJ45 PIN	Definition	RJ45 PIN	Definition
1,8	RS485-B	9,16	RS485-B
2,7	RS485-A	10,15	RS485-A
3,6	GND	11,14	GND
4,5	NC	12,13	NC

7. Environmental Suitability

7.1 Working Conditions

The BMS protection board allows normal operation under the following

conditions:

Ambient temperature: -30℃ ~ +75℃;

Relative humidity: 5% ~ 90%;

Atmospheric pressure: 86kPa~106kPa.

7.2 Storage

The BMS protection board should be stored in a clean and well-ventilated warehouse with an ambient temperature of -5°C ~ +40°C, a relative humidity of no more than 70%, and no corrosive gases or media that affect electrical insulation in the air. Mechanical shock or heavy pressure. Protect from direct sunlight and keep at least 2m away from heat sources (heating equipment, etc.). Under the above storage conditions, the BMS protection board can be stored for one year.

7.3 Package

7.3.1 The packaging should meet the requirements of moisture-proof and vibration-proof. The packing box should be firm and reliable. The inside of the box should be lined with moisture-proof materials, and the product should not move around in the box.

7.3.2 External carton packing box, veneer anti-static bag plus bubble bag packaging.

7.4 Transportation

7.4.1 During transportation, the product shall not be corroded by severe mechanical impact, exposure to the sun, rain, chemical corrosive substances and harmful gases;

7.4.2 During the loading and unloading process, the product should be handled with care, and throwing and heavy pressure are strictly prohibited;

7.4.3 The stacking height of packing boxes is less than 5 layers.

8. Precautions

8.1 This management system cannot be used in series.

8.2 When multiple battery packs using this management system are connected in parallel, it should be ensured that the maximum voltage difference of each battery

pack before parallel connection is lower than 3V.

8.3 When multiple battery packs using this management system are used in parallel, the total charging surge current of the adapter may be applied to a single battery pack, and it should be ensured that the total charging surge current of the adapter does not exceed the maximum charging surge current of a single management system.

8.4 The short-circuit protection function of this management system is suitable for a variety of application scenarios, but it does not guarantee that it can be short-circuited under any conditions. When the total internal resistance of the battery pack and the short-circuit circuit is lower than 40mΩ, the capacity of the battery pack exceeds 20% of the rated value, the short-circuit current exceeds 1800A, the inductance of the short-circuit circuit is very large, or the total length of the short-circuit wire is very long, please test to determine whether You can use this tube management system.

8.5 When welding the battery leads, there must be no wrong connection or reverse connection. If it is indeed wrongly connected, the circuit board may be damaged and needs to be re-tested before it can be used.

8.6 During assembly, the management system should not directly touch the surface of the cell to avoid damage to the circuit board. Assembly should be firm and reliable.

8.7 Be careful not to touch the components on the circuit board with the lead wire, soldering iron, solder, etc. during use, otherwise the circuit board may be damaged.

8.8 Pay attention to anti-static, moisture-proof, waterproof, etc. during use.

8.9 Please follow the design parameters and conditions of use during use, and do not exceed the values in this specification, otherwise the management system may be damaged.

8.10 After combining the battery pack and the management system, if there is no voltage output or no charging when powering on for the first time, please check whether the wiring is correct.

8.11 The parameters, functions and appearance in this specification are for reference only, and the actual protection board shall prevail.