

BMS SPECIFICATION

Product name	BMS
Model No.	
Version	V1.0
Date	2020.3.17

Function	Requirement
Current Limiter	10A
DISPLAY	NO
Storage	NO
Reverse connect protection	YES
Heating film	NO
Dry contact point	NO
Pre-charge	YES

■ Introduction

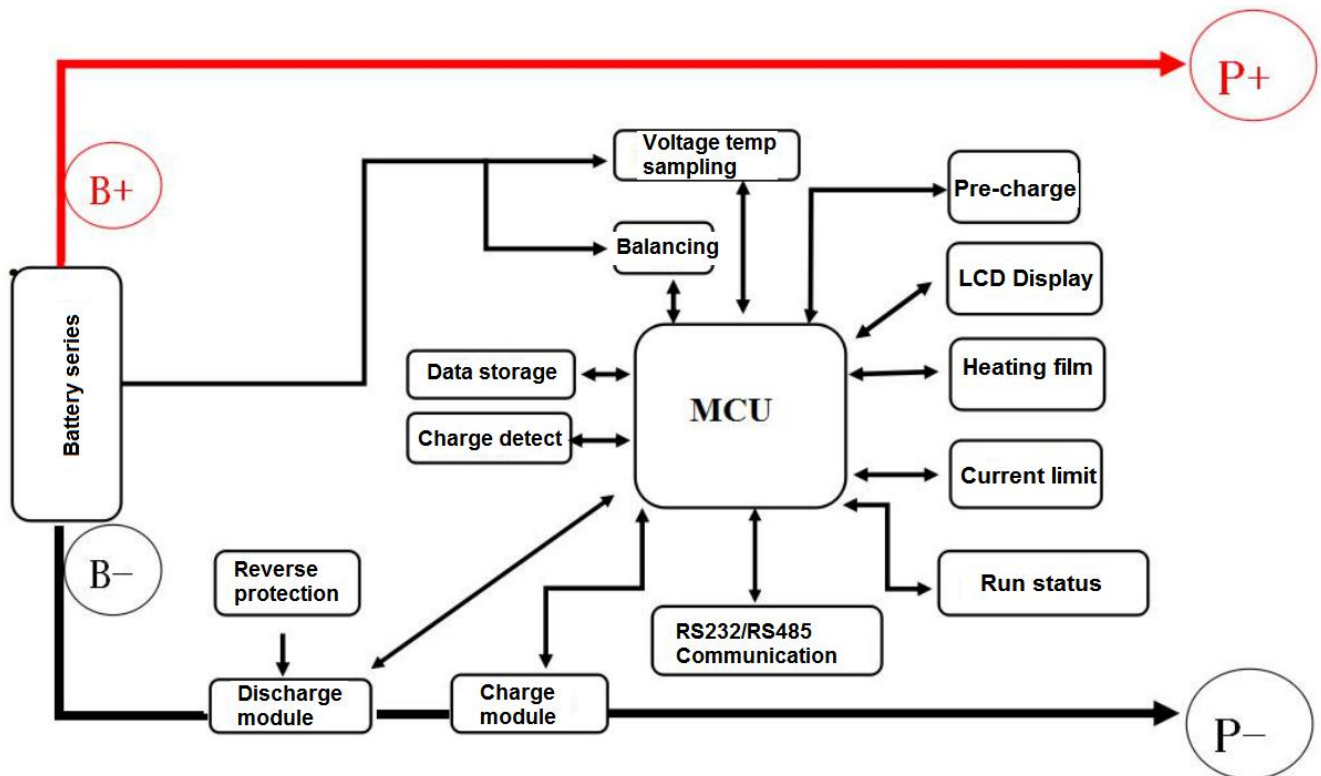
With the wide application of lithium iron phosphate battery in the communication industry, high performance, high reliability are required for the battery management system. This product is specially designed for communication base station backup type of lithium power supply BMS, using integrated, modular design, the battery data collection, management, communication and other functions integrated in one. The product is equipped with voltage collection, current collection, temperature collection and various protection mechanisms, and also provides intelligent charging balance, power estimation, serial communication interface, LED display, etc., as well as some optional functions: data storage, charging current limit, intelligent heating film control, LCD display, etc. It can be widely used in indoor and outdoor telecom stations, such as integrated base station, marginal station, repeater, acer station, solar base station, etc.

■ characteristics

- **batteries and battery voltage detection:** batteries and battery over voltage and low voltage alarm and overvoltage, undervoltage protection. 15 batteries voltage precision under the condition of 0 ~ 45 °C for ± 10 mv, under the condition of - 20 ~ 70 °C to ± 30 mv.
- **Core, Environment and Power Temperature Detection:** Core, Environment and Power High Temperature, Low Temperature Warning and High Temperature and Low Temperature Protection. Four core temperature sensors, one environmental temperature sensor and one power temperature sensor. The accuracy of temperature measurement is (± 2 °C)
- **Battery Charge and Discharge Current Detection:** Battery Charge Current, Discharge Current Warning and Protection, Battery Output Short Circuit Protection. The typical value of continuous charging and discharging current is 50A, the temperature rise is less than 35°C, and the accuracy of current detection is better than 2%.
- **Battery capacity and cycle times:** Real-time calculation of battery residual capacity, one-time completion of the total capacity of learning, capacity estimation accuracy is better than 5%.
- **Charging and discharging MOSFET switch:** Low internal resistance, high current, for backup power supply applications, large capacitive load start-up, zero switching, double charging withstand voltage optimization design.
- **Intelligent Balance of Single Battery Core:** Balance strategies such as charging and static can be set flexibly, which can effectively improve the service time and cycle life of batteries.
- **Six LED indicators:** indicating the remaining battery capacity, working mode and alarm protection status.

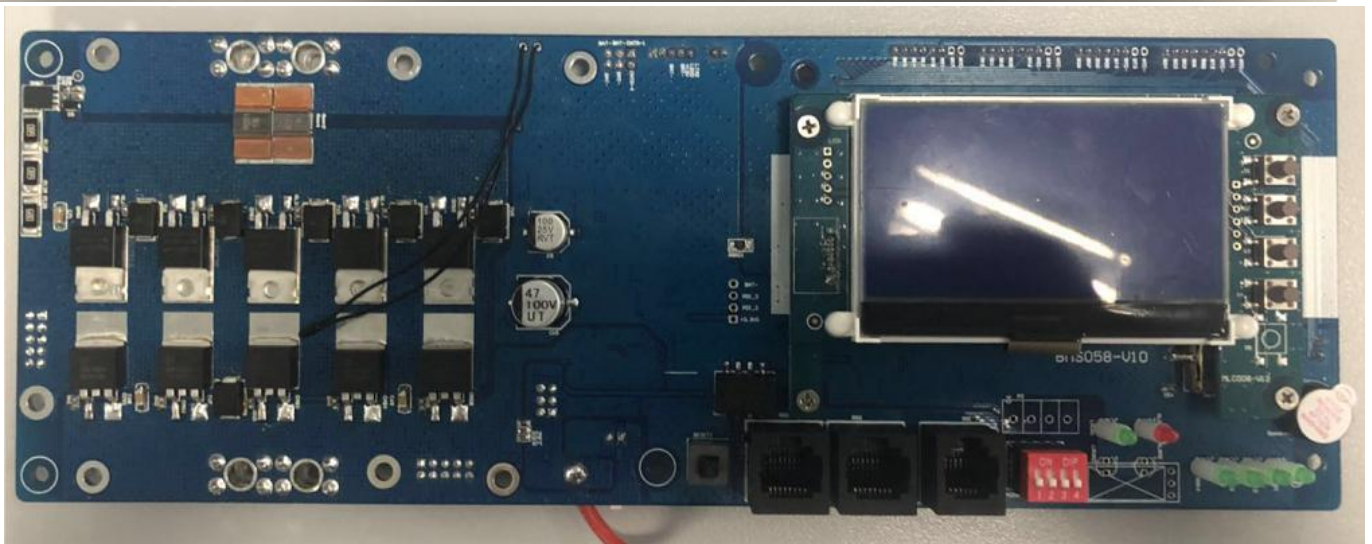
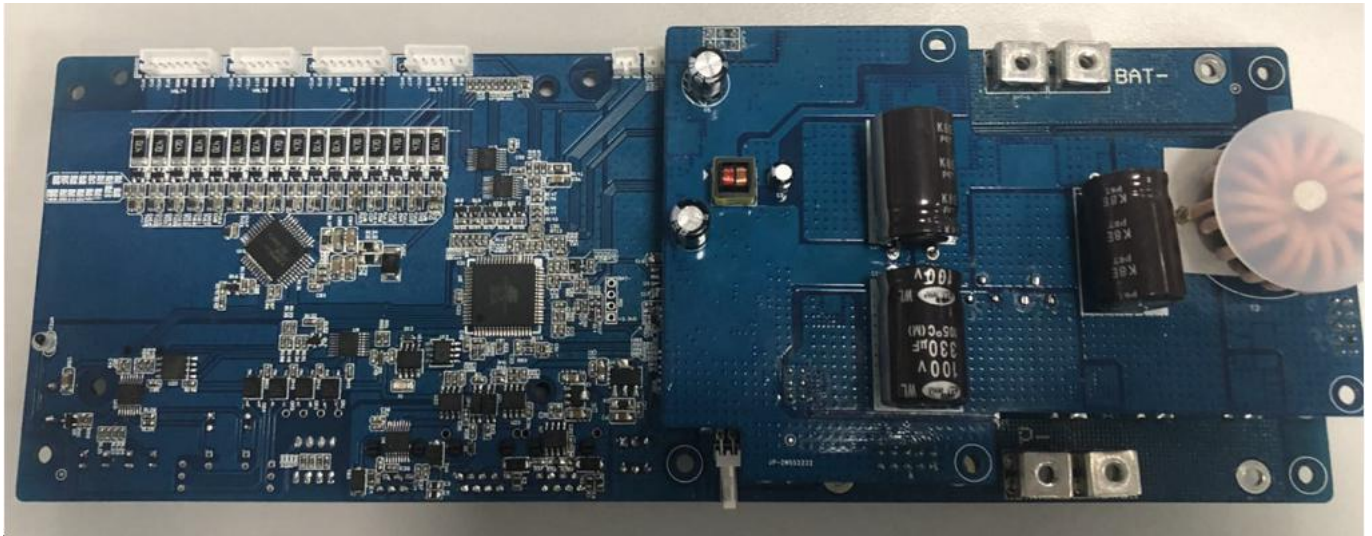
- **Turn on, turn off and reset buttons:** Batteries in shutdown state can be turned on manually, batteries in non-standby state can be turned off manually, BMS can be reset and abnormal states can be removed by pressing reset key for a long time.
- **RS485, RS232 communication interface:** PC or intelligent front-end can realize data monitoring, operation control and parameter setting of batteries through commands such as telemetry, tele-communication, tele-adjustment and remote control.
- **Various battery management parameter settings:** single battery overvoltage and undervoltage, total battery overvoltage and undervoltage, charging overcurrent, discharge overcurrent, load short circuit, high and low temperature of battery, environment high and low temperature, balance strategy, number of batteries in series, battery capacity and other battery management parameters can be re-set by upper computer.
- **Various battery management function settings:** voltage-related function, temperature-related function, current-related function (output short circuit function does not support shutdown settings), reverse connection function, pre-charging function, capacity-related function, display-related function can be opened or closed through the host computer settings.
- **Configurable 10A current limit module:** convenient for large current charge or limited charge current;

■ Function diagram



■ Structure

Complete PCB size: length * width * height = 280mm*100mm*50mm



Remark: The actual product and the product figure may be different.

■ Default Parameter Settings

Title	Set	Item	Set value	Set Range
Monomer cell voltage alarm	Disabled	High voltage alarm	3550mV	3400mV~3550mV
		High voltage alarm restore	3500mV	3400mV~3550mV
	Enabled	low voltage alarm voltage	2600mV	2500mV~2900mV
		Low voltage alarm restore	2800mV	2500mV~3000mV
Single cell over voltage protection	Enabled	Over voltage protection voltage	3650mV	3600mV~3750mV
		Over voltage recovery voltage	3500mV	3400mV~3550mV
		Over voltage Recovery conditions	1、 The total voltage is lower than the over voltage recovery point, , or 2、 Detect battery effective discharge current $\geq 1A$ 3、 Remain capacity < 95%	
Single battery Under voltage protection	Enabled	Under voltage protection voltage	2500mV	2000mV~2900mV
		Under voltage recovery	2800mV	2500mV~3000mV
		Under voltage recovery conditions	Detect the effective charging current (>1A) city power	
Total battery voltage alarm	Disabled	High voltage alarm voltage	57.0V	56.0~57.0V
		High voltage alarm recovery	56.4V	56.4~57.0V
	Enabled	Low voltage alarm voltage	44.0V	43.2~48.0V
		Low voltage alarm recover	46.0V	46.2~49.0V
Battery over voltage protection	Enabled	Over voltage protection voltage	58.0V	57.6~60.0V
		Over voltage recovery voltage	56.4V	56.4~57.0V

		Over voltage recovery condition	1、 The total voltage drops to the recovery point and recharges automatically. 2、 Detect battery effective discharge current $\geq 1A$, And discharge for a period of time or a certain discharge 3、 Remain capacity $<95\%$	
Battery under voltage protection	Enabled	Under voltage protection voltage	42.0V	40.0~42.0V
		Under voltage recovery voltage	46.0V	46.2~49.0V
		under voltage recovery condition	Detect the effective charging current (charging current $>1A$)	
Batteries temperature forbidden to charge	Enabled	Charging high temperature alarm	55°C	55°C~70°C
		High temperature alarm recovery	55°C	45°C~55°C
		Charging over temperature protection	65°C	55°C~70°C
		Charging over temperature recovery	55°C	45°C~55°C
		Charging battery low temperature alarm	3°C	-5°C~5°C
		low temperature alarm recovery	5°C	-5°C~10°C
		Charging battery under temperature protection	0°C	-20°C~0°C
		Charging battery under temperature protection recovery	5°C	-10°C~5°C
Batteries temperature forbidden to	Enabled	Discharging battery high temperature alarm	55°C	55°C~70°C

discharge		Discharging battery over temperature recovery	55°C	45°C~55°C
		Discharging battery high temperature protection	65°C	55°C~70°C
		Discharging battery over temperature protection recovery	55°C	45°C~55°C
		Discharging battery low temperature alarm	3°C	-5°C~5°C
		Discharging battery low temperature alarm recovery	5°C	-5°C~10°C
		Discharging battery under temperature protection	-10°C	-20°C~0°C
		Discharging battery under temperature protection recover	0°C	-10°C~5°C
Environmental temperature alarm	Enabled	Environmental high temperature alarm	60°C	50°C~60°C
		Environmental over temperature protection	65°C	55°C~65°C
		Environmental over temperature recovery	60°C	45°C~55°C
		Environmental low temperature alarm	0°C	-10°C~5°C

		Environmental under temperature protection	-10°C	-20°C~0°C
		Environmental under temperature protection recovery	0°C	-10°C~5°C
Power temperature protection	Enabled	Power high temperature protection	120°C	65°C~80°C
		Power high temperature recovery	110°C	55°C~70°C
Charge over current alarm	Enabled	Charging alarm current	110A	0A~Charging protection current
		Charging alarm current recovery	105A	0A~Charging protection current
Charge over current protection	Enabled	Charging protection current	65A	Charging alarm current ~100A
		Charging over current delay	15±1S	1 S to 600S
		Charging secondary over current protection	80A	Charging protection current~200A
		Charging secondary over current delay	500mS	1 S to 600S
		Charging overcurrent recovery	/	/
		Overcurrent recovery condition	Retest every 1min, the detection value <overcurrent protection value or discharge current	

Charging Current Limiting Function	Enabled	Charging Limited Current	10A (Setting to 0 will turn off the charging current limiting function)	0A~25A
		Pulse duration	30 mins	1min-30mins
Effective charging current	Charging enter current		500mA	
	Charging exit current		300mA	
Discharging over current alarm	Enabled	Discharging alarm current	-105A	0A~Discharging protection current
		Discharging alarm recovery	-105A	0A~Discharging alarm current
Discharging over current protection	Enabled	Discharging protection current	-125A	Discharging alarm protection~ Second protection current
		Discharging over current delay	5±1S	1S~600S
		Discharge overcurrent recovery	/	/
		Over current recovery condition	Every 1 min test once again , the readings ≤ over-current protection values or has a charging current	
	Enabled	Secondary overcurrent protection	-150A	Discharge protection current to 200A
		Secondary overcurrent delay	500mS	1 mS to 600mS
	Shut	Discharge secondary overcurrent locking	Continuous discharge secondary overcurrent, exceeding the number of overcurrent locking	
		Level 2 locking release	Reset or disconnect B+ and restart	
Output Short Circuit	Enabled (Closing)	Short circuit protection current	-412A	

Protection	settings are not currently supported)	Short circuit protection delay	540uS	1 uS to 1000uS	
		Short circuit protection recovery	Charge recovery or recheck after 1 minute to recover		
	Enabled	Short circuit protection locking	Continuous output short circuit, more than the number of over-current locking		
		Short Circuit Locking Release	Reset or Disconnect B+ and restart		
Effective discharging current	Discharge enter current		-750mA		
	Discharge exit current		-500mA		
Over current automatic recovery	Automatic Recovery Delay (Charging and discharging overcurrent and short circuit are the same settings)		60S	1 S to 600S	
Continuous over current lock	Continuous over current definition		An over-current event with an interval of no more than five minutes is called a continuous over-current.		
	Overcurrent locking times (Charging and discharging overcurrent and short circuit are the same settings)		10 times	1 ~100 times	
Battery cell balancing function	Enabled	Battery charging balancing open condition	In condition of effective charging current,		
		Balancing open voltage	3500mV	3000mV to 4500mV	
		Balancing open voltage tolerance	50mV	End pressure difference evenly to 100mV	

		Balancing finish voltage tolerance	30mV	10mV to Open pressure difference evenly
		Balance temperature limit	According to the environmental temperature setting temperature range balance open	
	Enabled	Balance high temperature forbid	50°C	Balance low temperature forbid to 70°C
		Balance low temperature forbid	0 °C	-20°C to Balance high temperature forbid
	Enabled	Batteries static balance	Open condition : All the states of the non discharge.	
	Shut	Static Equilibrium Timing	10H	
		Balancing timeout cancellation	Effective charge and discharge current, clear static balance timeout mark.	
Battery failure alarm	Enabled	Battery failure voltage tolerance	500mV	Battery recovery voltage tolerance to 1500mV
		Battery recovery voltage tolerance	300mV	150mV to Battery failure voltage tolerance
Battery Cell low temperature heating	Enabled	Cell heating open	-5°C	-40°C~25°C
		Cell heating stop	15°C	-40°C~25°C
Battery capacity setting	Battery rated capacity		200Ah	5Ah to 200Ah
	Residual capacity of battery		According to the batteries voltage forecasts	

	Timing compensation function		After the over voltage protection : the battery remaining capacity drops below 95 % or meet regularly charging conditions (1 time to repair electrical / 1 day), if the voltage under over-voltage protection setting back charge
	Enabled	Remaining capacity alarm	10%
	Enabled	Intermittent discharge	1、Open: After low voltage protect,need to charge the battery,when the voltage charged to the recovery point, the batteries continue discharging. 2、Close: After low voltage protect , voltage rebound to Recovery points above in10s,Automatic recovery discharge.
Manual key setting	Boot/activate		The BMS is in a dormant state. After the button is pressed for 3 seconds, the BMS will be activated, and the LED indicator will be lit successively, and then the BMS will return to the normal working state.
	Shutdown/sleep		The BMS is in standby or working state. After pressing the button for 3 seconds, the BMS will be put to sleep, and the LED indicator will be lit successively and then the BMS will be put to sleep;
	reset		BMS is in standby or working state. After pressing the button for 6S, the BMS is reset.
BMS power dissipation management	Maximum standby time		24 h(Alternating current is absent and there is no effective discharge current)

■ States indication

● Capacity Indicator

State		Charging				Discharge			
Capacity indicator		L4●	L3●	L2●	L1●	L4●	L3●	L2●	L1●
	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
RUN indicator●		ON				Flash			

● Flashing instructions

Flash mode	ON	OFF
Flash1	0.25s	3.75s
Flash2	0.5s	0.5s
Flash3	0.5s	1.5s

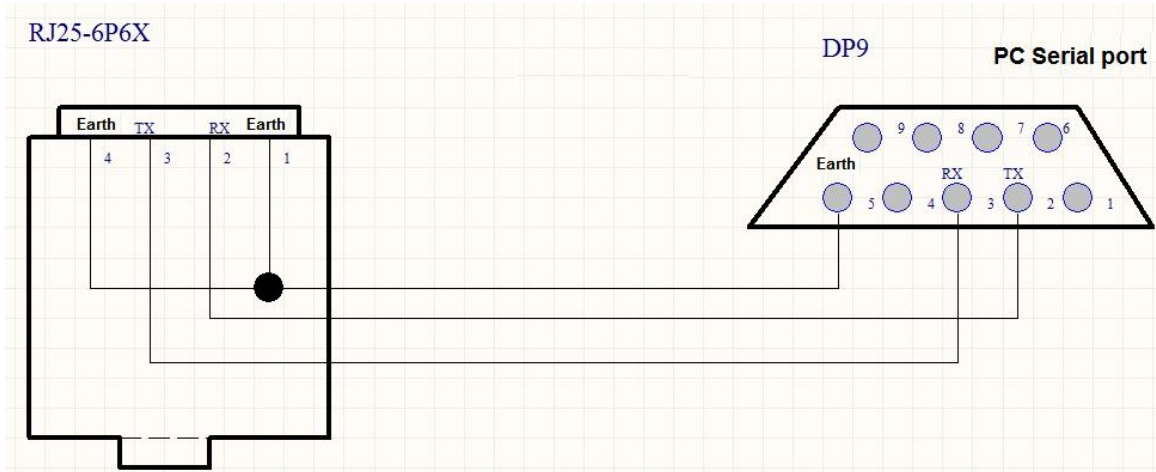
● Status indication

State of the system	State of running	RUN	ALM	SOC				Instruction
		●	●	●	●	●	●	
Shutdown	Sleep	OFF	OFF	OFF	OFF	OFF	OFF	All OFF
Stand by	Normal	Flash1	OFF	OFF	OFF	OFF	OFF	Stand by
	Alarm	Flash3	Flash3	OFF	OFF	OFF	OFF	ALM and RUN Lamp Synchronized Flash 3
Charge	Normal	ON	OFF	Indicate according to capacitance				The highest LED flash 2
	Overvoltage alarm	ON	OFF	Indicate according to capacitance				The highest LED flash 2
	Overflow warning	ON	Flash3	Indicate according to capacitance				The highest LED flash 2
	Overvoltage protection	ON	OFF	ON	ON	ON	ON	Note: under the condition that only the power supply exists, the indicator light is always on. If there is no power supply, the indicator light should be restored to the standby state.

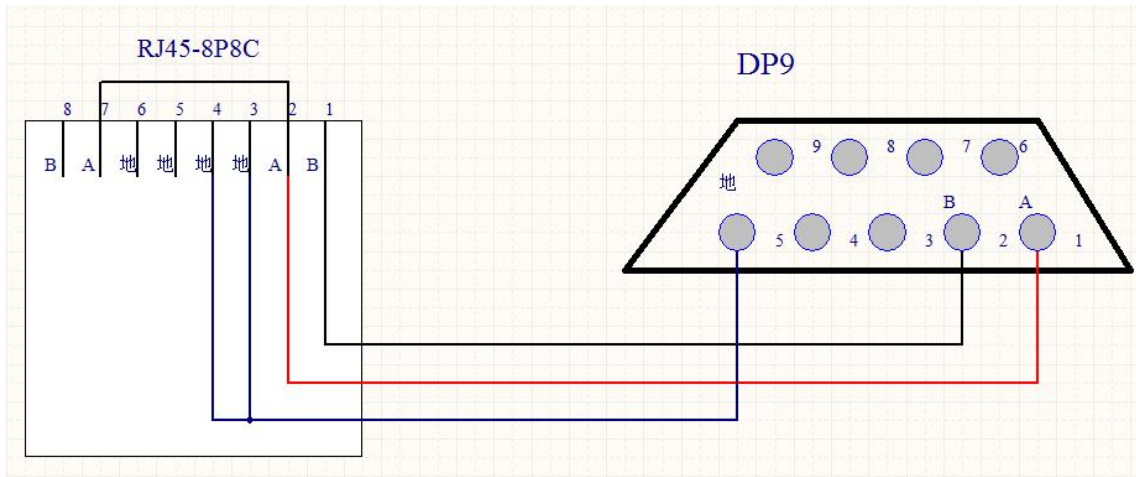
	Overcurrent protection (without current limiting function)	OFF	ON	OFF	OFF	OFF	OFF	Stop charging, do not detect power 24 hours later, no operation, forced dormancy
	Current-limiting charging	ON	OFF	Indicate according to capacitance				The highest LED flash 2
Discharge	normal	Flash3	OFF	Indicate according to capacitance				According to Capacity ON
	alarm	Flash3	Flash3					ALM and RUN Lamp Synchronized Flash 3
	Overcurrent, Short Circuit and Reverse Connection Protection	OFF	ON	OFF	OFF	OFF	OFF	Stop discharging, after 24 hours offline, no action, forced dormancy
	Undervoltage protection	OFF	OFF	OFF	OFF	OFF	OFF	Stop discharge
temperature	Normal	Normal indication according to status						---
	Charging alarm	ON	Flash3	Indicate according to capacitance				The highest LED flash 2
	Discharge alarm	Flash3	Flash3	Indicate according to capacitance				According to the constant power indication, ALM and RUN lights flash synchronously 3
	Protection	OFF	ON	OFF	OFF	OFF	OFF	Stop charging and discharging, after off-line, sleep after 24 hours without action
	Failure alarm	Flash2	Flash2	Flash 2	Flash 2	Flash 2	Flash 2	Core failure, MOS tube failure, NTC failure, FAE failure

■ Communication

● RS232 interface



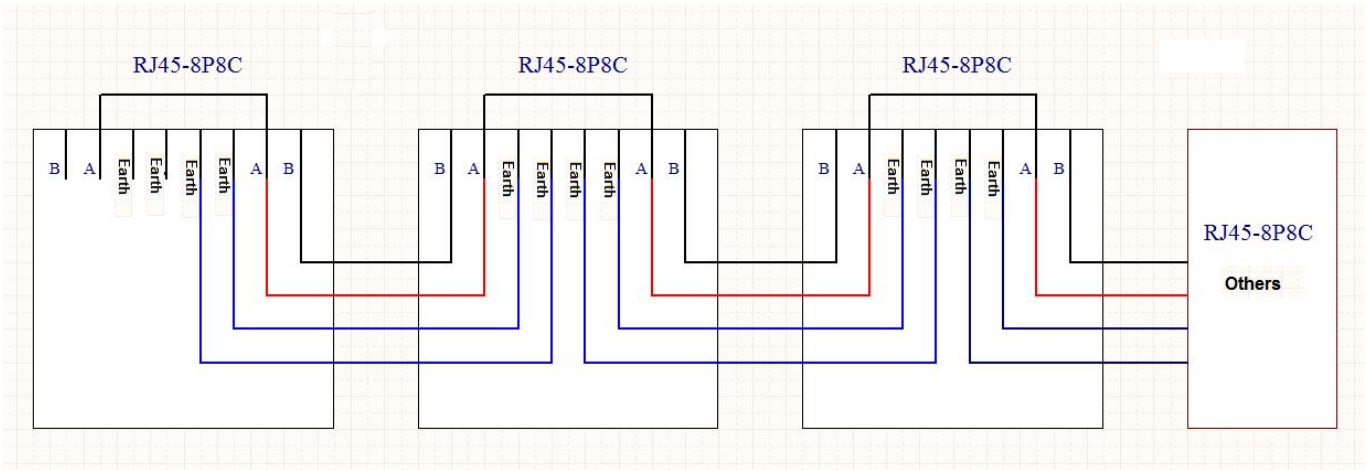
● RS485 interface



● Series-parallel interface

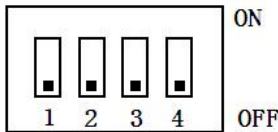
RS485 interface acts as parallel communication interface while RS232 interface acts as up-link communication interface. PC or intelligent terminal device can read battery data of any parallel PACK through RS232 interface.

RS485 Port connector as below:



- **Address dial the code**

- **Parallel Dial Switch Definition:** In multi-computer communication when batteries are connected in parallel, different Pack addresses can be distinguished by using Dial Switch. Hardware addresses can be set by Dial Switch on board. The definition of Dial Switch refers to the table below.



address	Dial Switch Position				instructions
	#1	#2	#3	#4	
0	OFF	OFF	OFF	OFF	Pack0
1	ON	OFF	OFF	OFF	Pack1
2	OFF	ON	OFF	OFF	Pack2
3	ON	ON	OFF	OFF	Pack3
4	OFF	OFF	ON	OFF	Pack4
5	ON	OFF	ON	OFF	Pack5
6	OFF	ON	ON	OFF	Pack6
7	ON	ON	ON	OFF	Pack7
8	OFF	OFF	OFF	ON	Pack8
9	ON	OFF	OFF	ON	Pack9
10	OFF	ON	OFF	ON	Pack10
11	ON	ON	OFF	ON	Pack11
12	OFF	OFF	ON	ON	Pack12
13	ON	OFF	ON	ON	Pack13
14	OFF	ON	ON	ON	Pack14
15	ON	ON	ON	ON	Pack15

BMS can automatically identify the corresponding dialing address after dialing the address (if the address can not be read after dialing, please reset in the standby state of BMS). When the dialing address is 0, BMS is configured to work in a single machine mode; when the dialing address is 1, BMS is configured to work in a host mode and connected with the host computer through RS232; From address 2 to 8, BMS is configured to work in slave mode and connect to external devices via RS485.

■ Working state of the whole machine

- **Charging mode:** When BMS in the detection of to AC power connection and external charging voltage is greater than the internal battery voltage 0.1V, Open the MOSFET charging. When the charging current achieve the effective charging current, it enters charging mode. In charge mode, both charge and discharge MOSFETs are closed.
- **Full mode:** When BMS detects AC connection and BMS has implemented overvoltage protection, it enters full mode.
- **Floating charging mode:** When BMS detects AC connection, it enters the floating charging mode because the charging current, charging temperature and other abnormal protection can not be normal charging or the external charging voltage can not be close to the internal battery voltage to generate effective charging current. In floating mode, the charging MOSFET is disconnected.

This BMS has a unique design for floating charge state detection in standby mode. Even if there is no effective charging and discharging current in standby mode for a variety of reasons until the standby time is up to 10 hours, BMS will not enter shutdown mode as long as the interface voltage is not less than 30V.
- **Discharge mode:** BMS enters the discharge mode when the load connection is detected and the discharge current reaches the effective discharge current.
- **Standby mode:** When the above four modes are not satisfied, enter standby mode. In standby mode, the discharge MOSFET is closed and the charging MOSFET is disconnected.
- **Shutdown mode:** normal standby for 24 hours, battery triggered under-voltage protection, execution of button shutdown or upper computer execution of shutdown command, BMS into shutdown mode ((BMS must be in standby status)

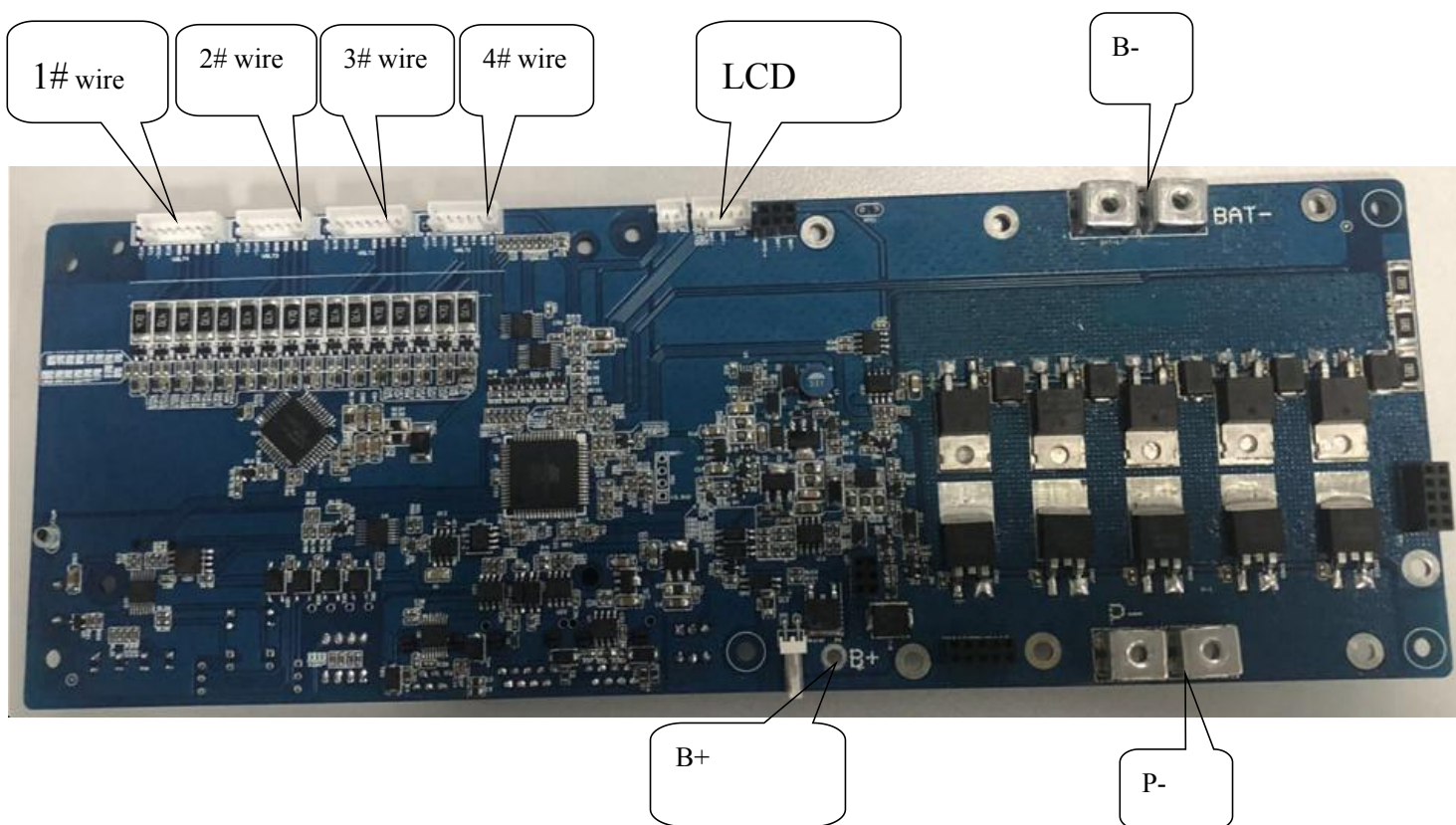
Wake-up conditions of shutdown mode: 1. Charging activation; 2. Keyboard boot. 3

Communication wake up

Note: BMS will automatically switch on the discharge circuit every 4 hours after the undervoltage shutdown to check whether the DC current is restored. The discharge circuit is opened and maintained for 10S, and the discharge circuit is locked up for up to 10 times.

■ Connection Definition

●BMS Down-lead



●The definition of the wiring harness

1#wire 7PIN	T T B1- B1+ B2+ B3+ B4+
2#wire 6PIN	T T B5+ B6+ B7+ B8+
3#wire 7PIN	T T B9- B9+ B10+ B11+ B12+
4#wire 6PIN	T T B13+ B14+ B15+ B16+

Item		Description
1# wire	T T black line (connect by two NTC)	Connect sensor
	B1- white line	connect the cathode of first battery
	B1+ yellow line	connect the anode of first battery
	B2+ red line	connect the anode of second battery
	B3+ brown line	connect the anode of third battery
2#wire	B4+ blue line	connect the anode of fourth battery
	T T black line (connect by two NTC)	Connect sensor
	B5+ white line	connect the anode of fifth battery
	B6+ yellow line	connect the anode of sixth battery
3#wire	B7+ red line	connect the anode of seventh battery
	B8+ brown line	connect the anode of eighth battery
	TT-black line (two connected by NTC)	Connect the sensor
	B9- white	Connect the negative of 9th battery
	B9+ yellow	Connect the positive of 9th battery
4#wire	B10+ red	Connect the positive of 10th battery
	B11+ brown	Connect the positive of 11th battery
	B12+ blue line	Connect the positive of 12th battery
	TT BLACK (The two are connected together by NTC)	Connect sensor
4#wire	B13+ white	Connect the positive of 13th battery
	B14+ yellow	Connect the positive of 14th battery
	B15+ red	Connect the positive of 15th battery
	B16+ brown	Connect the positive of 16th battery (when 15 cells is applied , Connect the positive of 15th battery)
B-		Connect the total negative of battery pack
B+		Connect the total positive of battery pack
P-		Charging/discharging negative port

The assembly sequence (Empty load)

B- →1#wiring harness → 2#wiring harness→3#wiring harness→ 4#wiring harness→B+

The dismantle sequence (Empty load)

B+→4#wiring harness→3#wiring harness→2#wiring harness→1#wiring harness→B-

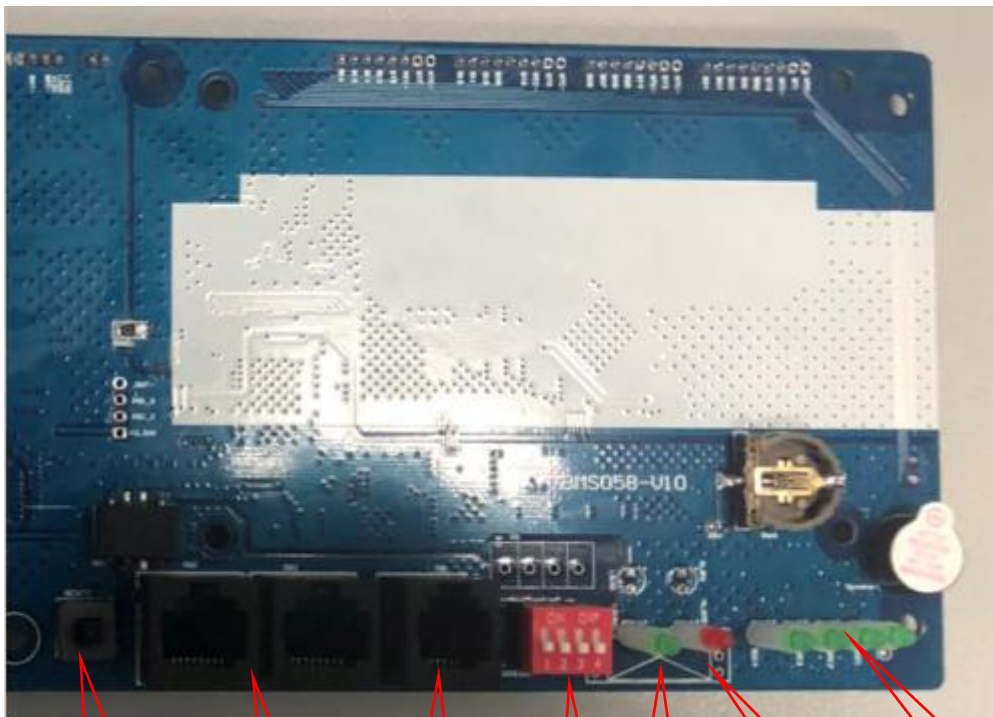
Remark: Connection and remove the protective plate please strictly in accordance

●Input and output

When charging: The positive of charger connects to the positive of the total battery pack, the negative of charger connected to the protection plate "P-".

When discharging: The positive of load connects to the positive of the total battery pack, The negative of load connects to the protection plate "P-".

● Input Interface



On Off,
Reset

RS485

RS232

Add
switch

Run
indicator

Alarm
indicator

Capacity
indicator

■ Attention

When welding the battery leads, there must be no wrong or reverse connection. If the connection is indeed wrong, the BMS may be damaged, and it can only be used after re-testing.

Do not directly touch the surface of the cell when assembling the BMS, so as not to damage the cell. Assembly should be firm and reliable.

Pay attention to the use of the lead, soldering iron, soldering tin do not touch the components on the circuit BMS, otherwise it may damage the BMS.

The use of the process should pay attention to anti-static, moisture-proof, waterproof, etc.

Please follow the design parameters and use conditions during use, and do not exceed the values in this specification, otherwise it may damage the BMS.

After assembling the battery pack and BMS, please check whether the wiring is correct if no voltage output or no charging is found in the initial power on.

When charging, confirm whether this model has the reverse connection function. If there is no reverse connection function, the charging device cannot be wrongly connected, otherwise the BMS will be damaged.

The company reserves the right of final interpretation.

■ history version

version	Changing Record	Date	Engineer
V1.0	Initial design	2020.3.17	Wang Jianrong