天邦达 TIAN POWER Shenzhen Tian-power technology co., ltd

Shenzhen Tian-Power New Energy Technology Co., Ltd.

Product specification

Product name: Low Voltage BMS Plus

Product No. (Internal): TP-BMSP48100B2-15S

Product model (external):＿＿＿＿＿＿

Version：V1.0

Production	Review Nucleus	Batch Quasi
Fu Zhipeng	Ma Jun	Hu Longwen

Recipient	
Customer confirmation	

Company Address: Building 26, No.6 Industrial Zone, Yulu Community, Gongming Street, Guangming New District, Shenzhen

9/F, Block A, Hi-Tech Innovation Center, Intersection of Guangqiao Road and Kelian Road, Guangming District, Shenzhen

E-mail：info@tian-power.com

Net Address: www.tian-power.com

Revision record

Date	Revised version	Revision notes	Reviser	Auditor	Approving person
2022-10-11	V1.0	First release	Fu Zhi peng	Ma Jun	Hu Long wen

Directory

1 Overview

1.1 Applications

This product is suitable for lithium iron phosphate battery communication backup power supply, which can provide overcharge, overdischarge, overcurrent, overtemperature, undertemperature, short circuit and reverse connection protection functions for battery pack, and can also provide voltage balance function during charging process; Through CAN bus or RS485, multi-group parallel connection CAN be realized reliably, and communication CAN be carried out with the host computer. The maximum number of parallel connection groups is 32 groups. Parameter configuration, data monitoring and software upgrade are carried out on the upper computer software. Intelligent lithium battery BMS is compatible with 15-string and 16-string lithium battery packs.

Intelligent lithium battery BMS is divided into two parts: BMU and BDC. BMU (Battery Management Unit) realizes the functions of single cell voltage and temperature monitoring, SOC calculation, operation logic strategy control, parameter setting, external communication and so on. BDC
(Bidirectional Direct Current Converter) is a bi-directional DC conversion circuit between the battery pack and the main circuit of the communication backup power supply, which is used to perform the functions of constant current and constant voltage charging and discharging of the battery, standby and protection, etc.
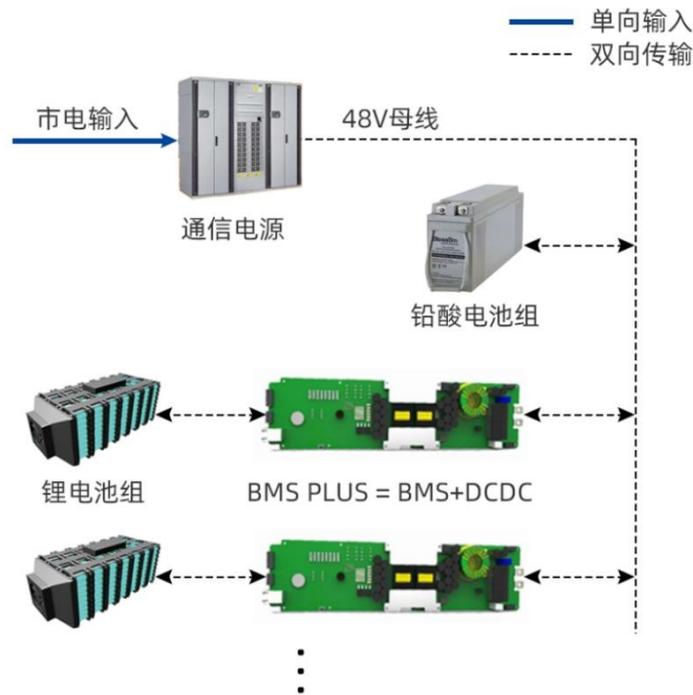
System working schematic diagram

1.2 Functional characteristics of products

- Condition monitoring: It supports the detection of voltage and temperature of the battery cell and the whole group of voltage and current, and has SOC and SOH detection calculation, which is easy to maintain and use, and maximizes the safety, reliability and service life of the battery.

- Integrate BMS and bidirectional DCDC: support the mix and match of different batteries, and realize the full-function intelligent management of lithium batteries.
- Parallel power expansion characteristics: Maximum 32 groups of batteries are supported in parallel, and maximum power $P \leq 24kW$ is supported.
- Alarm management: Support abnormal alarms such as overvoltage, undervoltage, overcurrent, high and low temperature.
- Abnormal protection: Support over-voltage, under-voltage, over-current, short circuit, high and low temperature, battery fault, hardware fault and other abnormal protection.
- It has intelligent software anti-theft function, sound and light alarm function.
- Balance function: Support the real-time balance function of battery core.
- Information reporting: provide northbound CAN/RS485 interface, and upload alarm and status data through CAN/RS485 interface.
- Intelligent design: It has extended functional interfaces such as Bluetooth APP, wireless 4G communication and gyroscope.
- Easy to maintain and use: support multiple activation and forced power-down functions, and have maintenance mode.
- Maintenance-free: The battery module can be maintained-free during use, saving customers' battery operation and maintenance inspection costs and reducing the frequency of replacement at the station.
- Long life: The life of battery module is 2 ~ 3 times that of ordinary lead-acid battery. At the same time, it can realize real-time online monitoring of battery health and storage capacity at the station, and improve the reliability of standby power at the station.

1.3 Definition of internal product model of Tianbangda
TP-BMSP48/100B2-00

	Explanation	Value		Remarks

A	Brand	TP= Tian Power	
B	Product type (large)	BMSP = BMS PLUS Series	
C	Nominal voltage	48, 24, 280…	
D	Rated capacity	20,50,100…	
E	Platform version	A,B,C…	
F	Hardware model suffix	1,2,3…	
G	Product version	00,01,02…10,11…	

1.4 System block diagram
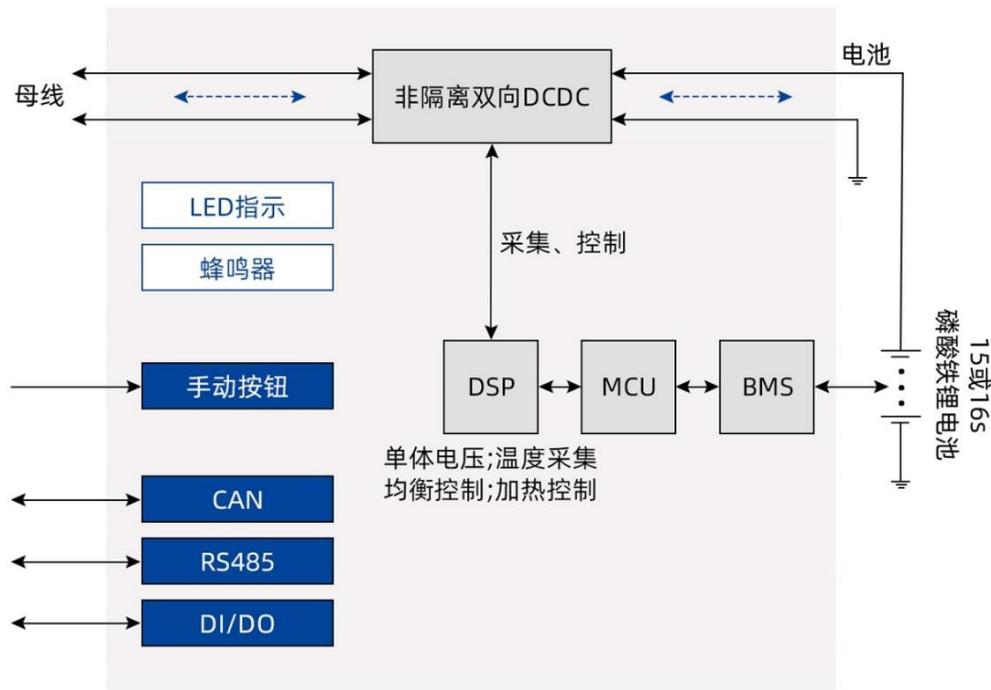
Internal principle block diagram of battery module

2 Environmental conditions

Serial number	Project	Technical index	Unit	Remarks
1	Working ambient temperature	-20 ℃ ~ + 60 ℃	℃	For use above 55 ℃, it is required Meet the power derating requirements
2	Storage temperature	-40 ℃ ~ + 70 ℃	℃	
3	Relative humidity	5~95	%	No condensation
4	Altitude	0-4000	m	1800m ~ 4000m drop Er: 1 ℃ every 220m
5	Atmospheric pressure	76 ~ 106	Kpa	
6	Shock and vibration	The peak acceleration is 150m/s2 and the duration is 11ms. Sine wave vibration with frequency of (10 ~ 55) Hz and amplitude of 0.35 mm.		
7	Heat dissipation mode	Natural heat dissipation		
8	Protection level	IP20		

3 Functional characteristics

3.1 Voltage detection and protection function

It has the functions of single voltage and overall voltage detection, overvoltage and undervoltage alarm and protection. The accuracy error of monomer voltage detection is less than 10mV under normal temperature and static conditions. The overall voltage is detected by BDC, the error of detection accuracy is less than 0.1 V, and the alarm and protection parameters can be set by the upper computer.

3.2 Current detection and protection function

It has the functions of charging and discharging current detection, alarm and protection. The charging current is displayed as positive current and the discharging current is displayed as negative current. The accuracy error of current sampling at normal temperature is ≤ 2%. The alarm and protection parameters can be set by the upper computer.

3.3 Temperature detection and protection function

It has the function of detecting battery core and ambient temperature, and can give alarm and protection when charging and discharging at high and low temperatures. In the working temperature range, the error of temperature sampling accuracy is less than 2 ℃. It includes 8 cell temperature sensors, 1 ambient temperature sensor and 2 MOS transistor temperatures. The alarm and protection parameters can be set by the upper computer. The default specification of temperature probe is 10k Ω/3950.

3.4 Short circuit protection function

BDC has the function of detecting and protecting the output short circuit.

3.5 Battery pack capacity calculation function

The SOC of the battery pack can be calculated, and the accuracy error of SOC estimation is ≤ 5% (test method: according to the relevant test method in YD/T2344.1-2011 lithium iron phosphate battery pack for communication).

3.6 Equalization function

It can balance the cells in the battery pack: when the battery pack is charged, when the single cell voltage reaches the starting balance voltage and the maximum pressure difference is greater than the balance pressure difference, the single cell that meets the conditions starts the balance function. Up to 6 channels are supported for simultaneous equalization, and the equalization current is 100mA @ 3.6 V. It can be set by the upper computer to balance the opening voltage and balance the pressure difference.

3.7 LED indication function

It has 8 LED indicator lights, 4 green lights are used to indicate the current battery pack SOC, 1 red light is used to indicate the fault during alarm and protection, 1 green light is used to indicate the operation and 2 green lights are used to indicate the standby and charging of the battery pack Electricity, discharge state.

3.8 Sleep and wake-up function

Numbering	Dormancy condition	Awakening condition	Remarks
1	The minimum unit voltage is lower than the unit overdischarge protection value (can Set) or the total pressure is lower than the overall overdischarge protection value (can be set), after 5 minutes, enter sleep	Charging, soft switching	
2	It can be forced to enter sleep through the upper computer	Charging, soft switching	
3	It can be forced to shut down by pressing the key soft switch	Soft switching	It can only be turned on through soft switch

State power consumption description: normal working power consumption ≤ 8 W;; Sleep power consumption ≤ 10 mW;; Shutdown power consumption ≤ 5mW.

3.9 Communication function

It can communicate with host computer or moving loop through RS485, and upload and save the collected information.

It CAN communicate with other modules in parallel through CAN bus, each module actively sends out the relevant data of its own module, receives the data of other modules, calculates the capacity of added or cut-out modules, realizes independent current or SOC balance through logic strategy, and realizes the functions of self-adaptation and self-management.

3.10 Control function of upper computer

It has a friendly upper computer interface, and can conveniently set protection parameters such as over-voltage, under-voltage, over-current, over-temperature and under-temperature, as well as functional parameters such as balance, sleep, capacity and various alarm parameters through the upper computer. When necessary, the upper level controller CAN be set up in parallel for charging and discharging control, and the controller CAN increase the collection of load current and other module currents without CAN communication, so as to make the control management more reliable.

3.11 Upgrade function

 Software upgrade CAN be carried out through CAN bus or RS485 interface.

3.12 Communication protocol

Customer protocol is supported, with RS485 baud rate of 9600bps and CAN baud rate of 125kbps.

3.13 Charge and discharge current limiting function

It can realize the charging and discharging current limiting function, and the current limiting value can be set, with the maximum current limiting value of 100A. Usually, charging works in current limiting mode. When over current protection occurs in charging and discharging, it is generally not cut off, but switched to current limiting mode.

3.14 Anti-reverse connection function

It has anti-reverse connection circuit. After the system is powered on, the protection board can be avoided from burning due to the reverse connection of battery wiring during parallel installation. Note: It only supports startup protection after reverse connection, but does not support online reverse connection.

3.15 Parallel communication function

The parallel communication function of 32 modules CAN be realized through CAN bus or RS485 interface. No dialing switch is set, the factory default address is 1, and the address setting can be changed by the upper computer or adaptively for parallel communication. After parallel connection, the battery pack data can be monitored circularly by the upper computer.

3.16 Current sharing control function

Through CAN communication interface, each BMSP CAN receive the data information of other battery packs, and realize the discharge current sharing control through adaptive current sharing strategy operation, or realize the best capacity matching charge and discharge through adaptive capacity balancing strategy operation.

3.17 Multiple working modes

According to the operation mode setting, it can realize charging and discharging current limiting operation mode, charging and discharging straight-through mode, discharging constant voltage operation mode, etc.

3.18 Data storage function

Support about 100,000 battery status data storage functions.

3.19 Dry contact function

Support 2 dry contact outputs. Under normal working condition, two dry contacts are in open state, and after abnormal alarm, the corresponding dry contacts are closed. (Software configurable)

Dry contact 1: Battery failure (battery voltage 1V is too low and pressure difference 800mV is too large).
Dry contact 2: BMS failure (charge MOS damage, discharge MOS damage, NTC disconnection).

3.20 Reservation function

There is still room on the circuit board, which can reserve 1 way of heating function, 1 way of buzzer function and 1 way of gyroscope anti-theft function. In the standard version, the buzzer function is enabled by default in case of failure, and the gyroscope anti-theft function is not enabled.

3.21 Key technical parameter table

Technical parameters	Rated specification	Accuracy/error	Remarks
Product size	420*104*45mm (length * width * thickness) for 19-inch wide rack mounting		
Heat dissipation mode	Natural heat dissipation		
Working mode	Support normal-pass mode, charging current-limiting mode, discharging current-limiting mode, discharging boosting mode and maintenance mode		
Operating voltage	36V ~ 60VDC		
Rated output power	4800W	≤ ± 2%	Bidirectional, and the parameters can be set
Boost output setpoint	54VDC	≤ ± 0.5%	Parameters can be set
Operating power consumption	≤ 8W	/	
Static sleep current at battery terminal	≤ 0.2 mA	/	
Number of single voltage detection channels	Route 15	/	
Monomer voltage detection	2 ~ 4.5 VDC	≤ ± 10mV	-20 ℃ ~ + 60 ℃
Battery/bus current detection	-180A~+180A	≤ ± 2%	Error below ± 50A ≤ 1A
Number of temperature detection channels	8-way battery temperature 2-way MOS temperature, 1-way ambient temperature	≤ 2 ℃ @ 0 ℃ ~ + 50 ℃ ≤ 3 ℃ @-40 ℃ ~ + 85 ℃	NTC Specification 10k Ω/3950
Accuracy of Acquisition of Total Battery Voltage	0 ~ 60V DC	≤ ± 0.2 V	
Accuracy of bus voltage acquisition	0 ~ 60V DC	≤ ± 0.2 V	
Equalization mode of single cell	Passive discharge equalization	100mA ± 20%	Vcell=3.6V
Dry contact input	48V DC/1A	/	1 channel (active high)
Dry contact output	48V DC/1A	/	2-way (normally open)
Heating control	48V DC/2A	Start heating when the average temperature of battery is lower than the set value, stop heating when it is greater than the stop heating value, and no The charger is not heated	
LED	4-way SOC 4-way status indication		Operation, alarm, charging, Discharge
SOC precision	/	≤ 5%	According to YD/T2344.1- 2011

Isolation withstand voltage level	707V DC or 500V AC	/	Communication interface and low voltage
Data storage	≥ 100,000 historical data records	/	
Parallel use	It supports 32 groups of batteries to be used in parallel, and can realize current sharing between charging and discharging		

Isolation withstand voltage level	707V DC or 500V AC	/	Communication interface and low voltage
Data storage	≥ 100,000 historical data records	/	

4 Electrical characteristics

4.1 Basic parameters of battery management

4.1.1 Basic parameter setting (ambient temperature: 25 ℃)

Project	Whether it can be set	Details	Setting value	Remarks
Dormancy voltage	Settable	Sleep voltage setting value	3.30V	Eligible scope: 3.3 ± 0.02 V
Consumption current	Can't be set	Standby power consumption (normal standby pass-through)	≤ 8W	8W/50V=160mA
	Can't be set	Internal consumption during hibernation	≤ 300uA	
Full charge setting	Settable	Constant pressure value	52.5 ± 0.3 V	When charging at constant voltage, when the total voltage is greater than the constant voltage value and the current is less than the constant current value, BMS will consider that the battery capacity has been fully charged. The charging MOSFET will be cut off.
	Settable	Constant current value	2 ± 0.5 A	
Charge equalization	Settable	Equalization opening voltage	3.5V	
	Settable	Balanced opening pressure difference	20mV	
	Can't be set	Equalization current	40-100mA	
Standby time	Settable	Forced recovery charging opening voltage after overcharge	5Day	
Capacity setting	Settable	Full capacity setting	100AH	
	Settable	Residual capacity setting	50AH	

4.1.2 Protection parameter setting

Project	Default Status	Whether or not Settable	Details	Setting value	Remarks (qualified range)
Monomer overcharge protection	Open	Settable	Monomer overcharge detection voltage	3.65V	3.65 V ± 0.05 V
	Open	Settable	Monomer overcharge detection delay time	1000 ms	500~3000 ms
	Open	Settable	Monomer overcharge release voltage	3.35V	Qualified range: 3.35 ± 0.05 V When the maximum voltage is lower than the recovery point and the maximum voltage is less than 3.5 V, Delay 1H and turn on the charging mos
Monomer over-discharge protection	Open	Settable	Monomer overdischarge detection voltage	2.5V	2.5 ± 0.05 V
	Open	Settable	Monomer overdischarge detection delay time	1000 ms	500~3000ms

	Open	Settable	Monomer overdischarge release	2.9 V or	2.9 ± 0.05 V

				Charge recovery	
Overall overcharge protection	Open	Settable	Total overcharge detection voltage	54 V	54 ± 0.5 V
	Open	Settable	Total overcharge detection delay time	1000 ms	500~3000ms
	Open	Settable	Total overcharge release voltage	50.25 V	50.25 ± 0.5 V After the total overcharge recovery voltage < 50.25 V, the charging MOS transistor can be turned on with a delay of 1S.
Overall overdischarge protection	Open	Settable	Overall overdischarge detection voltage	43.2V	43.2 ± 0.5 V
	Open	Settable	Overall overdischarge detection delay time	1000 ms	500~3000ms
	Open	Settable	Overall overdischarge release	48.00V	48 ± 0.5 V
Overcurrent protection	Open	Settable	Average charge current	25 A	25 ± 3A
	Open	Settable	Discharge overcurrent protection	Discharge 125A/ 15 seconds	125 ± 3A
Short circuit protection	Open	Time is impossible Set	Short circuit protection	Have	
	Open	_	Protective conditions	Load short circuit or overload	After three consecutive short circuit protection actions, enter the secondary protection, and no longer automatically restart the normal output function, it should be able to restart manually or automatically when the voltage of the lithium battery output port recovers to above 43.2 V Resumption of work
Temperature protection	Open	Settable	Charging high temperature protection	60 ℃	60 ± 2 ℃
	Open	Settable	Delay time of charging high temperature protection	4000ms	3500~4500ms
	Open	Settable	Charging high temperature recovery	50 ℃	50 ± 2 ℃
	Open	Settable	Discharge high temperature protection	65 ℃	65 ± 2 ℃
	Open	Settable	Delay time of discharge high temperature protection	4000ms	3500~4500ms
	Open	Settable	High temperature recovery of discharge	55 ℃	55 ± 2 ℃
	Open	Settable	Charging low temperature protection	0 ℃	0 ± 2 ℃
	Open	Settable	Charging cryogenic protection delay time	4000ms	3500~4500ms
	Open	Settable	Charging low temperature recovery	3 ℃	3 ± 2 ℃
	Open	Settable	Discharge low temperature protection	-20 ℃	-20 ± 2 ℃
	Open	Settable	Delay time of discharge cryogenic protection	4000ms	3500~4500ms
	Open	Settable	Low temperature recovery of discharge	-15 ℃	-15 ± 2 ℃
	Open	Settable	Environmental temperature and high temperature protection	90 ℃	90 ± 2 ℃
	Open	Settable	Ambient temperature high temperature protection delay time	4000ms	3500~4500ms
	Open	Settable	High temperature recovery of ambient temperature	85 ℃	85 ± 2 ℃

	Open	Settable	Environmental temperature and low temperature protection	-25 ℃	-25 ± 2 ℃
	Open	Settable	Ambient temperature low temperature protection delay time	4000ms	3500~4500ms

	Open	Settable	Low temperature recovery of ambient temperature	-15 ℃	-15 ± 2 ℃
	Open	Settable	High temperature protection of mos tube	128 ℃	128 ± 2 ℃
	Open	Settable	High temperature protection delay time of mos tube	4000ms	3500~4500ms
	Open	Settable	High temperature recovery of mos tube	105 ℃	105 ± 2 ℃

4.1.3 Alarm parameter setting

Project	Default status	Whether or not Set	Details	Setting value	Remarks (qualified range)
Monomer overcharge alarm	Open	Settable	Monomer overcharge detection voltage	3.80 V	3.80 ± 0.05 V
	Open	Settable	Monomer overcharge detection delay time	3000ms	2000~4000ms
	Open	Settable	Monomer overcharge recovery voltage	3.60V	3.60 ± 0.05 V
Single overrelease alarm	Open	Settable	Monomer overdischarge detection voltage	2.70V	2.70 ± 0.05 V
	Open	Settable	Monomer overdischarge detection delay time	3000ms	2000~4000ms
	Open	Settable	Monomer overdischarge recovery	2.90 V	2.90 ± 0.05 V
Overall overcharge alarm	Open	Settable	Total overcharge detection voltage	56V	56 ± 0.5 V
	Open	Settable	Total overcharge detection delay time	3000ms	1000~4000ms
	Open	Settable	Overall overcharge recovery voltage	50.25V	50.25 ± 0.5 V
Overall overrelease alarm	Open	Settable	Overall overdischarge detection voltage	41.5V	41.5 ± 0.5 V
	Open	Settable	Overall overdischarge detection delay time	3000ms	2000~4000ms
	Open	Settable	Overall overdischarge recovery	45V	45 ± 0.5 V
Temperature alarm	Open	Settable	Charge high temperature alarm	55 ℃	55 ± 2 ℃
	Open	Settable	Charging high temperature alarm delay	3000ms	2500~3500ms
	Open	Settable	High temperature recovery	50 ℃	50 ± 2 ℃
	Open	Settable	Put on a high temperature alarm	60 ℃	60 ± 2 ℃
	Open	Settable	High temperature alarm delay	3000ms	2500~3500ms
	Open	Settable	Recovery at high temperature	55 ℃	55 ± 2 ℃
	Open	Settable	Charge low temperature alarm	5 ℃	5 ± 2 ℃
	Open	Settable	Charge low temperature alarm delay	3000ms	2500~3500ms
	Open	Settable	Filling and low temperature recovery	8 ℃	8 ± 2 ℃
	Open	Settable	Low temperature alarm	-15 ℃	-15 ± 2 ℃
	Open	Settable	Low temperature alarm delay	3000ms	2500~3500ms
	Open	Settable	Low temperature recovery	-12 ℃	-12 ± 2 ℃
	Open	Settable	MOS High Temperature Alarm	125 ℃	125 ℃ 2 ℃
	Open	Settable	MOS High Temperature Alarm Delay	3000ms	2500~3500ms
	Open	Settable	MOS high temperature recovery	101 ℃	101 ℃ 2 ℃

	Open	Settable	Ambient high temperature alarm	85 ℃	85 ± 2 ℃

	Open	Settable	Ambient high temperature alarm delay	3000ms	2500~3500ms
	Open	Settable	Environmental high temperature recovery	80 ℃	80 ± 2 ℃
	Open	Settable	Ambient low temperature alarm	-20 ℃	-20 ± 2 ℃
	Open	Settable	Ambient low temperature alarm delay	3000ms	2500~3500ms
	Open	Settable	Environmental low temperature recovery	-10 ℃	-10 ± 2 ℃
Capacity alarm	Open	Settable	Low capacity alarm	0%	–
	Open	Settable	Low capacity recovery	0%	–
Differential pressure alarm	Open	Settable	Excessive pressure difference alarm	1000mV	1000 ± 20m V

BMS Parameter Setting Summary Table				
Serial number	Testing items		Set scope	Default value
1.	Equalization function	Equilibrium condition	Under charging and standing, the pressure difference is > 20mV, V>3.5V	Open
2.	Communication anti-theft		Enable, time can be set	Shut down
3.	Heating function		Enabled, the temperature can be set	Shut down
4.	Low pressure dormancy	Dormancy condition	2.0 ~ 2.5 V, Single or overall undervoltage protection goes to sleep after 5 minutes delay	2.7V，5min
		Recovery condition	Button, incoming call	
5.	Working mode		Self-management, constant voltage, battery characteristics	Battery characteristics
6.	Discharge BUS voltage	Setting value	43 ~ 57V	53.00V
7.	Discharge BUS current	Setting value	0 ~ 125%	120%
8.	Discharge BUS power	Setting value	0-100%	100%
9.	Charging BAT voltage	Setting value	40 ~ 60V	54.00V
10.	Average charge current	Setting value	2-100%	15%
11.	Charging BAT power	Setting value	4-130%	100%
12.	Discharge depth DOD	Setting value	0-100%	90%
13.	Discharge BUS step voltage	Setting value	40 ~ 58V	46.00V
14.	Number of cell voltages	Setting value	15-16	15

15.	Quantity of temperature detection	Setting value	0 ~ 8	4

BMS Parameter Setting Summary Table			
Serial number	Testing items	Set scope	Default value
16.	Start address offset	Not configurable	214

4.2 Fault handling strategy

Refer to tables in annexes I and II

4.3 Bidirectional DC/DC electrical parameters

BUCK current limiting charging working state

Project	Unit	Minimum value	Typical value	Maximum value	Remarks
Input (charge) voltage range	VDC	42	54.0	60	
Output (battery) voltage range	VDC	36	49	56	
Output limited power	W	0	/	4800	
Current limiting current	A	10	100	120	Battery current
Current limiting accuracy	%	/	/	± 2.5%	Battery current
Ripple noise	mV	/	/	200	
Battery side current ripple	%	/	/	1%	
Efficiency	%	98%	/	/	Rated power
Source effect (battery current)	%	/	/	± 0.5%	Battery current change ratio
Switch overshoot (battery current)	%	/	/	5%	Full voltage range, various load strips Piece
Input voltage jump (battery power Stream)	%	/	/	10%	43 ~ 54V jump, 100% load
Input impulse current	%	/	/	150%	Maximum steady state under rated input conditions Lose 150% of the peak value of incoming current
Charge input overvoltage protection	V	/	/	60	If the charging voltage is higher than the threshold, it should

					be cut off

					Open charging circuit
Charging impulse current protection	A			330	BUCK charging state, the charging voltage drops instantly and then recovers, charging impulse current will be generated Quickly disconnect charging circuit protection
Output undervoltage protection	V	32			Output voltage less than threshold, delay 10s

BUCK current limiting discharge working state

Project	Unit	Minimum value	Typical value	Maximum value	Remarks
Input voltage range	VDC	42	49	57	
Output (load) voltage range	VDC	36	49	56	
Output limited power	W	/	4800	5500	
Current limiting current	A	10	100	120	Battery current
Current limiting accuracy	%	/	/	± 2.5%	Battery current
Load side current ripple	%	/	/	1%	
Load side voltage ripple	mV	/	/	200mV	
Current overshoot				150A	
Charge-discharge switching time	ms			10ms	
Current limiting adjustment time	ms			5ms	Start to current limiting steady state
Efficiency	%	98%	/	/	
Input (battery) undervoltage protection	V	40	/	/	Input Voltage Persistently Less Than Valve Detected Value, close the discharge circuit
Charging impulse current protection	A			300A	When BUCK is discharged, charging voltage is applied instantaneously, which will produce impulse charging current, so it should be disconnected quickly Charging circuit protection
Output undervoltage protection	V	32			Output Voltage Continuously Less Threshold 10s, close the discharge circuit

Straight-through working state

Project	Unit	Minimum value	Typical value	Maximum value	Remarks
Battery voltage range	VDC	42	50	57	

Continuous working current	A		100		

				300	
Charging impulse curr ent protection	A			300	
Discharge overcurrent protection	A			120	Turn current limiting
Charging overcurrent protection	A			120	Turn current limiting

BOOST Current Limiting Discharge Operating State

Project	Unit	Minimum value	Typical value	Maximum value	Remarks
Input voltage range	VDC	42	50.0	56	
Output (load) voltage range	V	48	57	58	Settable
Output voltage stabilizati on accuracy	%	/	/	± 1%	
Charge-discharge switching time	ms			10ms	
Unbalance of current sharing of parallel machine	%			10%	No current sharing bus, natural sag
Output power	W	/	4800	5200	
Current limiting current	A	1	/	100	Settable
Current limiting accuracy	%	/	/	± 2.5%	
Output voltage ripple	mV	/	/	200mV	
Load effect	%			± 0.5%	
Source effect	%			± 0.1%	
Efficiency	%	98%			
Startup overshoot	%	/	/	5%	Input full voltage range and output various loads
Dynamic voltage overshoot	%	/	/	5%	25%-50-25%, or 50%-75%-50% load change
Voltage dynamic response recovery time	us	/	/	500	
Load catastrophe characteristics	%			10%	Load from 0-100% or 100%-0
Charging impulse current protection	A			330A	
Discharge overcurrent protection	A			120A	
Input undervoltage protection	V	40			

Note: The above current parameters are all current parameters on the battery side.

4.4 Power derating curve

4.4.1 Input voltage and power derating curve

<mark>To be updated</mark>

4.4.2 Ambient temperature and p ower derating curve <mark>to be updated</mark>

4.5 LED Indicator Definition

LED arrangement sequence: 4 green capacity indicators (one row or one column); One red alarm indic ator, one green running indicator, one green charging indicator and one green discharge indicator (one row or one column).

LED lamp indication status table:

Status	Normal/alarm/prot ection	RUN ●	ALM ●	CHG ●	DCH ●	Electricity indicat or LED ● ● ● ●				Description
Shut dow n	Dormancy	Exting uish	Exting uish	Exting uish	Exting uish	Ext ing uis h	Extin guish	Ext ing uish	Extin guish	Total extinction
Standby	Normal	Chan g Lia ng	Exting uish	Exting uish	Exting uish					Standby state
	Alarm	Flash 1	Exting uish	Exting uish	Exting uish					Temperature alarm ALM flash 3
Maintena nce mode	Maintenance and in stallation	Flash 2	Flash 2	Flash 2	Flash 2					
Chargin g	Normal	Chan g Lia ng	Exting uish	Chan g Lia ng	Exting uish	According to the e lectricity quantity indication				
	Alarm (excluding te mperature)	Flash 2	Exting uish	Chan g Lia ng	Exting uish					Temperature alarm ALM flash 3
	Overcharge protecti on	Flash 1	Exting uish	Exting uish	Exting uish					
	Over-temperature, u nder-temperature, o ver-current Protection	Flash 1	Flash 2	Flash 1	Exting uish					CHG lamp goes out when cut off
Discharg e	Normal	Chan g Lia ng	Exting uish	Exting uish	Chan g Lia ng					
	Alarm	Chan g Lia ng	Flash 3	Exting uish	Chan g Lia ng					Discharge overcurren t alarm ALM does not flash
	Overdischarge prote ction	Flash 1	Exting uish	Exting uish	Exting uish					
	Over-temperature, under-temperature, over-temperature Current and short circuit protection	Flash 1	Flash 2	Exting uish	Flash 1					DCH lamp goes out when cut off

Charging/ discharging	Malfunction	Exting uish	Chan g Lia ng	Exting uish	Exting uish	Ext ing uis h	Extin guish	Ext ing uis h	Extin guish	Refers to BMS volta ge sampling

| Power/standby | | | | | | | | | | Device, charging MOS Hardware failures such as damage and disconnection of temperature sensor |

Explanation of LED flashing state

Flicker state	Bright	Extinguish
Flash 1	0.25S	3.75S
Flash 2	0.5S	0.5S
Flash 3	0.5S	1.5S

Correspondence between SOC lamp display and capacity

Capacity state	Electricity indicator LED			
	●	●	●	●
	LED1	LED2	LED3	LED4
[0, 25%)	Bright	Extinguish	Extinguish	Extinguish
[25%,50%)	Bright	Bright	Extinguish	Extinguish
[50%,75%)	Bright	Bright	Bright	Extinguish
[75%,100%]	Bright	Bright	Bright	Bright
Lighting condition: If the single unit voltage is higher than the sleep voltage or the charging and discharging time capacity when standing The quantity indicator light is always on according to the capacity ratio.				

Differentiation of charging and discharging modes and states

Status	Working mode	CHG	DCH
Charging	Straight-through charging	Chang Liang	Extinguish
	BUCK current limiting charging	Flash 2	Extinguish
Discharge	Straight-through discharge	Extinguish	Chang Liang

	BOOST discharge of BOOST	Extinguish	Flash 2
	BUCK current limiting discharge	Extinguish	Flash 3

5 Safety characteristic requirements

Serial number	Proje ct		Test requirements	Remarks
1	Elec trica l stre ngth	DC pair co mmunicatio n	500Vac or 707Vdc/30mA/1min	No arc, no breakd own
		DC pair hou sing	500Vac or 707Vdc/30mA/1min	No arc, no breakd own
		Communica tion pair she ll	500Vac or 707Vdc/30mA/1min	No arc, no breakd own
2	Insul ation resi stan ce	DC pair co mmunicatio n	$\geq$ 10 M Ω @ 500Vdc	Under normal atmospheric pressure, the relative humi dity is 90% and the test DC voltage is 500V
		DC pair hou sing	$\geq$ 10 M Ω @ 500Vdc	
		Communica tion pair she ll	$\geq$ 10 M Ω @ 500Vdc	

6 EMC and Lightning Protection Test Requirements

Serial number	Project		Test requirements	Remarks
1	Surge	Surge protection level of power interface	Power port line-to-line shall meet the requirements of GB/T 17626.5-2019 Grade 4 (open circuit test voltage 2kV), and line-to-ground shall meet GB/T 17626.5-2019 Grade 4 (open circuit test) Check voltage 4kV).	
		Surge protection level of communication interface	Communication port line-to-line shall meet the requirements of GB/T 17626.5-2019 Grade 2 (open circuit test voltage 0.5 kV), and line-to-ground shall meet GB/T 17626.5-2019 Grade 2 (open circuit) Test voltage 1kV)	
2	Electromagnetic compatibility	CE	CLASS A	EN55032/CISPR32
		RE	CLASS B	EN55032/CISPR32
		ESD	Contact discharge: 8KV, criterion B Air discharge: 15KV, criterion B	GB/T 17626.2-2006
		EFT	DC Port: 0.5 kV, Criterion B Signal Port: 0.25 kV, Criterion B	GB/T17626.4

7 Reliability requirements

Reliability test item

Proje ct	Spec ificat ion
High temperature storage	After being placed at 85 ± 2 °C for 48 hours, and then restored to normal temperature, BMS was tested It should work normally and meet the parameter requirements shown in Chapter 4 of this paper.
Low temperature storage	BMS was placed at-40 $\pm$ 2 °C for 16 hours, and then returned to normal temperature after testing, BMS It should work normally and meet the parameter requirements shown in Chapter 4 of this paper.
High temperature and high humidity work	The BMS module must be able to operate continuously for 24 hours at 70 ± 2 °C and 80-85% humidity (No-load), then return to normal temperature and let stand for 2 hours after testing, BMS should work normally and meet the parameter requirements shown in Chapter 4 of this paper.
Working at high t emperature	The BMS module must be able to operate continuously at 55 ± 2 °C for 2 hours, and then return to normal temperature. After testing, the BMS should work normally and meet the parameters shown in Chapter 4 of this paper Begging.
ₒlkjk	The BMS module must be able to operate continuously at-20 $\pm$ 2 °C for 2 hours, and then return to normal After testing in warm condition, BMS should work normally and meet the parameter requirements shown in Chapter 4 of this paper.
Vibration	The vibration tests of BMS system in X, Y and Z directions were carried out. From 10Hz to 55Hz, the frequency sweep rate is 1oct/min, and the displacement amplitude (single amplitude) is 0.8 mm. After the test, the BMS should work normally and meet the requirements shown in Chapter 4 of this paper The parameter requirements of the.

8 Working mode

8.1 Classification of normal working modes

This product is a lithium battery management system, in addition to the conventional lithium battery charging and discharging and protection functions, its outstanding features charging and discharging with bidirectional DC/DC power conversion function;

In the application scenarios such as multi-group parallel connection and mixed use of old and new, each battery pack obtains the state data of all modules through CAN communication, monitors the external bus voltage, and adaptively adjusts its own charging and discharging state through strategy calculation to meet the reliability requirements and maximize the overall standby capacity.

This product discharge can provide three output modes:

（1） <u>Mode 1 Self-managed constant voltage discharge mode:</u> Lithium battery module can follow the bus voltage of the system power supply (to detect the bus voltage of-0. 3V

Is the discharge setting value), intelligent self-management constant voltage discharge output.

（2） Self-managed mode has temperature compensation mode: the following bus voltage is 48v-52V

（3） Self-managed mode without temperature compensation mode: the following bus voltage is 48v-54V

The intelligent lithium battery module works in this mode. When it is connected in parallel with lead-acid battery and lithium iron phosphate battery (including cascade battery), the intelligent lithium battery enters a constant voltage discharge state according to the change of bus voltage of the power supply system, which can realize the priority discharge of the main use of the intelligent lithium battery. When the mains power is cut off, the main use of intelligent lithium battery will give priority to discharge, and the discharge depth of intelligent lithium battery can be set (the default DOD is 90%). After the intelligent lithium battery discharges to the preset discharge depth, the output constant voltage value will be lowered to lead-acid battery discharge. When the lead-acid battery discharges to the lower constant voltage voltage of intelligent lithium battery pack, the intelligent lithium battery will be mainly discharged again until the intelligent lithium is protected by low voltage, and the intelligent lithium will no longer discharge, but the lead-acid battery will continue to discharge.

Note: The uniform charging, floating charging, temperature replenishment and down voltage management of lead-acid batteries comply with the characteristics of lead-acid batteries or the setting values of the original power supply system, and the original management strategy of lead-acid batteries will not be changed when smart lithium and lead-acid batteries are mixed.

（2） <u>Mode 2 Power Management Constant Voltage Discharge Mode:</u> The intelligent lithium battery module communicates with the switching power supply system, and the intelligent lithium battery module can be set to the constant voltage discharge mode through the switching power supply. The constant voltage discharge can be set in the range of 48V ~ 57V, and the conversion discharge keeps the output at the setting value of the power supply at constant voltage; This mode can improve the remote power supply capacity of the station, and it is not recommended to mix with other types of batteries.

（3） <u>Mode 3 Battery Characteristic Discharge Mode:</u> The lithium battery module is output according to the characteristic discharge curve of the battery, that is, the output voltage of intelligent lithium battery is equal to the battery voltage. This mode is similar to ordinary lithium battery BMS, but charging and discharging overcurrent will start DCDC for current limiting instead of direct overcurrent protection. This mode can be connected with lead-acid battery in parallel to support synchronous discharge.

8.2 Hibernation and shutdown pattern classification

Non-working modes can be divided into two types:

➢   Hibernation mode:

In this mode, the main power circuit is closed, the communication and acquisition circuit is dormant, and the external communication and interface circuit is dormant. When the MCU is powered down, it can be awakened by charging and pressing the soft switch for 2 ~ 10s.
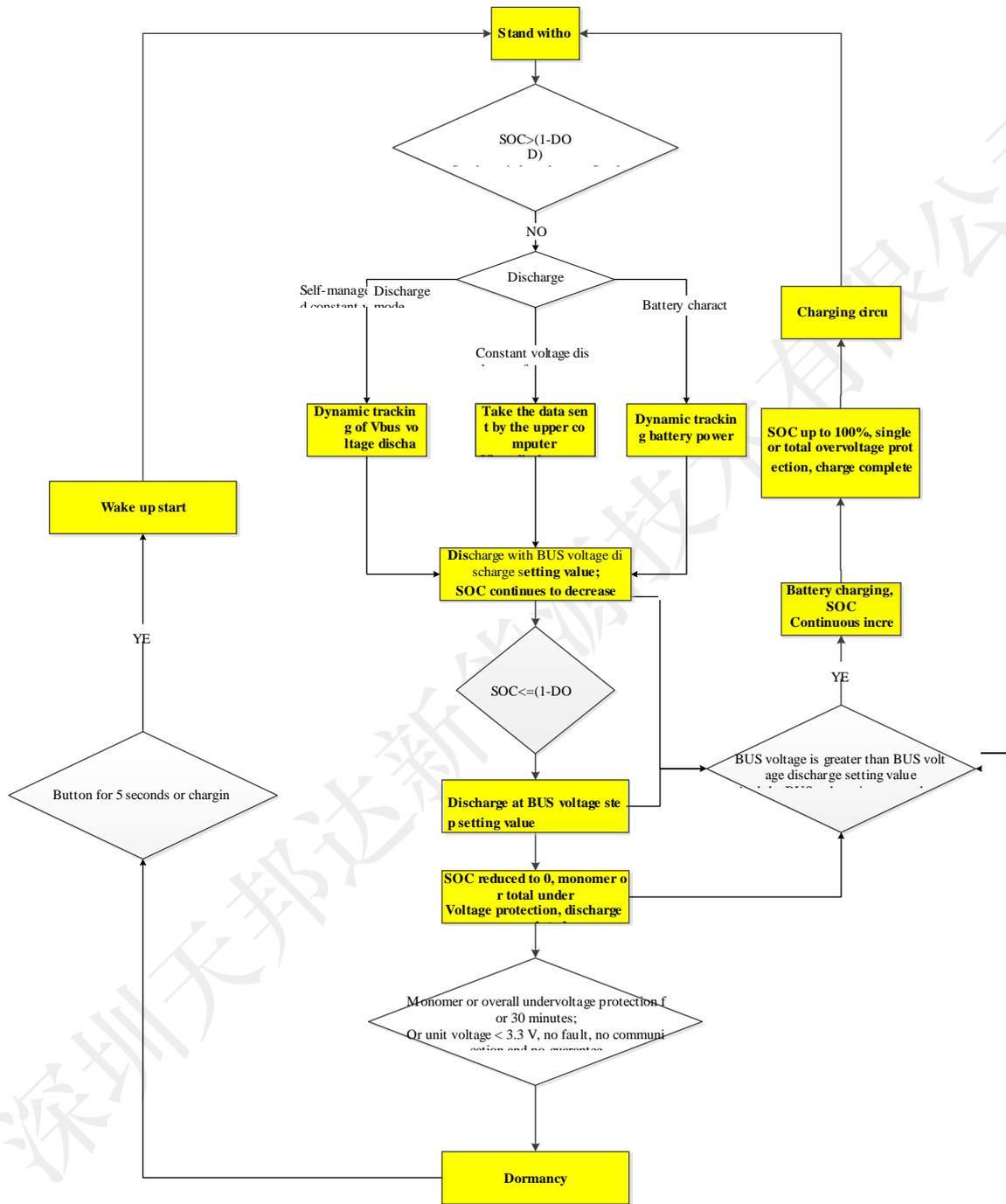
The lowest unit voltage is lower than the unit overdischarge protection value (optional) or the total voltage is lower than the overall overdischarge protection value (optional). After 5 minutes, enter the sleep mode;

BMS can be forced into sleep mode by issuing instructions from the upper computer;

➢   Shutdown:

Shut down by pressing soft switch for 4 ~ 10s, and start-up can be triggered by pressing soft switch for 2 ~ 10s again (start-up cannot be done by other ways)

8.3 State machine description

Stand witho

SOC>(1-DO D)

NO

Discharge

Self-managed constant v mode   Discharge

Battery charact

Constant voltage dis

Charging circu

Dynamic tracking of Vbus voltage discha

Take the data sent by the upper computer

Dynamic tracking battery power

SOC up to 100%, single or total overvoltage protection, charge complete

Wake up start

Discharge with BUS voltage discharge setting value; SOC continues to decrease

Battery charging, SOC Continuous incre

YE

SOC<=(1-DO

Discharge at BUS voltage step setting value

BUS voltage is greater than BUS voltage discharge setting value

YE

Button for 5 seconds or chargin

SOC reduced to 0, monomer or total under Voltage protection, discharge

Monomer or overall undervoltage protection for 30 minutes; Or unit voltage < 3.3 V, no fault, no communication and no guarantee

Dormancy

Master logic state diagram

8.4 Maintenance mode

Used for battery module replacement. Press the soft switch button for more than 15 seconds to enter the maintenance mode. In this mode, four status indicators are flashing at the same time (except SOC indicator), and BMS is active, but it will cut off the internal power main circuit and will not charge or discharge.

This mode can ensure safe and reliable battery module replacement operation. Press the soft switch button again for more than 15 seconds to exit the mode and enter the normal working mode

By entering the maintenance mode function, it can meet the situation that the battery in the existing network is not powered down, and expand the system online, so as to ensure that the battery will not be down due to power failure in the expansion process.

Remarks:

1. Soft switch activation button belongs to contact button, and the interval between two buttons should be greater than 0.5 s, otherwise the operation is invalid.

2. If the battery is in charge/discharge/offline mode, the BMS can be activated again only by pressing the activation button for 5 ~ 10s after the battery is forced to be powered down through the soft switch button.

9 Parallel use

This product supports parallel application, and increases standby time or standby power synchronously: the standby power of a single battery module is 4.8 KW, and the maximum power supported by N groups in parallel is P=min (4.8kW*N* supports the maximum power/KW, 24kW), 2 ≤ N ≤ 32.
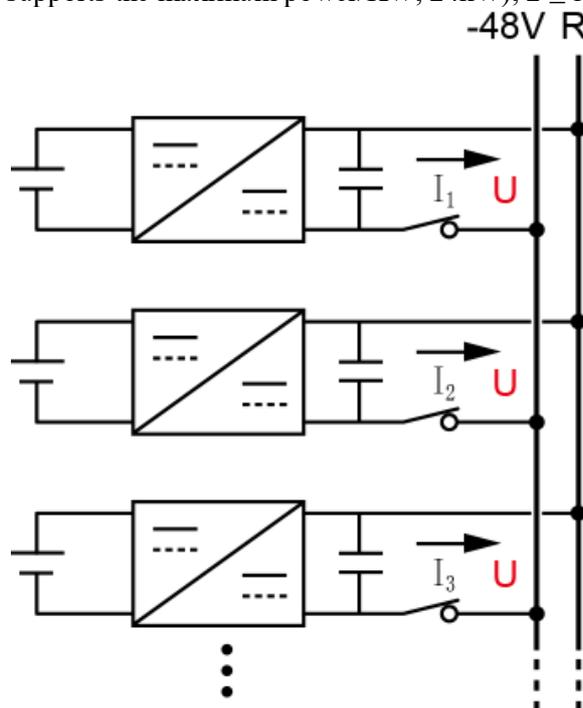
Schematic diagram of parallel machine

Under constant voltage discharge mode, the current sharing imbalance between battery modules is less than or equal to 10%.

10 Communications

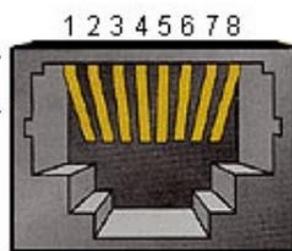## 10.1   RS485 & CAN Communication Interface

Data communication CAN be carried out with the upper computer through CAN/RS485, and the communication method is as follows:

8.1. 1 Communication wiring

The communication interface adopts 8P8C straight PCB welded RJ45 network cable socket (round pin),

and the corresponding pins are connected in parallel. The pins are defined as follows: interface definition:

 Pin1 and 3: RS485_A; Pin2 and 4: RS485_B;

          Pin7: CANH; Pin8: CANL;

CAN/RS485

8.2 Parallel communication

BMS CAN communicate in parallel through CAN. When connecting, there are two communication interfaces on th
e board, and the corresponding signal lines are connected to adjacent modules one in and one out. Address of parallel co
mmunication is allocated adaptively in sequence by module coding.

In parallel communication, the status of different systems can be monitored through multiple groups of displays on the mon
itoring page of the upper computer.

8.3 This product supports BMS communication protocol-Tianbangda intelligent lithium battery RS485 monito
ring communication protocol (total electricity + non-total electricity) customer version

V1.2, baud rate 9600

10.2   Reserved interface

This product reserves GPS and gyroscope module interface, and can realize gyroscope/GPS anti-theft function t
hrough expansion board.

10.3   Dry contact output interface

Support 2 dry contact outputs. Under normal working condition, two dry contacts are in disconnected state; After abnormal
alarm occurs, the corresponding dry contact is closed.

(Software configurable)

Dry contact 1: Battery failure (battery voltage 1V is too low and pressure difference 800mV is too large).

Dry contact 2: BMS failure (charge MOS damage, discharge MOS damage, NTC disconnection).

10.4   Dry contact input interface (reserved)

Support 1-way dry contact input, reserved configuration.

11 upper computer system

The monitoring platform can directly communicate with the power supply/BMS through RS485 interface, and can obtain real-time information and historical data such as power supply/battery voltage, current, temperature, state, SOC and DCDC. You can import and export configuration parameters. You can save monitoring related data to reports and so on.

For specific operation, please refer to the Instruction Manual of Upper Computer

12 interface description

12.1 External interface definition

Serial number	Name	Screen printing	Functional description
1	Protective earthing	GND	M6 screw
2	Dry contact output	DO1 DO2	Alarm dry contact, configurable
3	Dry contact input	DI	Dry contact input for boost mode control, wake up
4	Reserved extension interface	RESERVED	Reserved extended serial port
5	Communication interface	COM_IN	1. Used to report information and communication cascades. 2. Double-layer RJ45 terminals are adopted.
6	Communication interface	COM_OUT	
7	Running indicator light	RUN	
	Alarm indicator lamp	ALM	
	Charging indicator	CHG	Refer to 4.5 for detailed functions and functions
	Discharge indicator lamp	DCHG	
	Capacity status indicator	SOC	
8	Manual power up and down button	MANUAL ON/OFF	Manual power up and down, maintenance button, belongs to contact button, specific functions refer to 8 activation and boot.
9	Positive terminal	+	The positive and negative interfaces of the battery module. M6 screws are used for fixing, and appropriate OT terminals should be selected. The torque requirement is 4 N · m, and the wire diameter size is recommended to be 25mm2. When the temperature condition is less than 45 ℃, the wire diameter requirement can be appropriately relaxed, but it should not be less than 16mm2.
	Negative terminal	-	
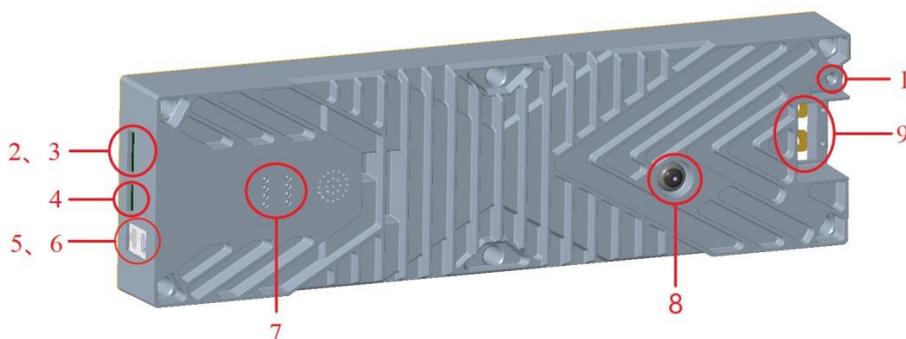
12.2   External connector wiring definition

1. Definition of dry contact input and output pins (Connector brand: Connector; Model: PLTBH1.5-06-S-3. 81)
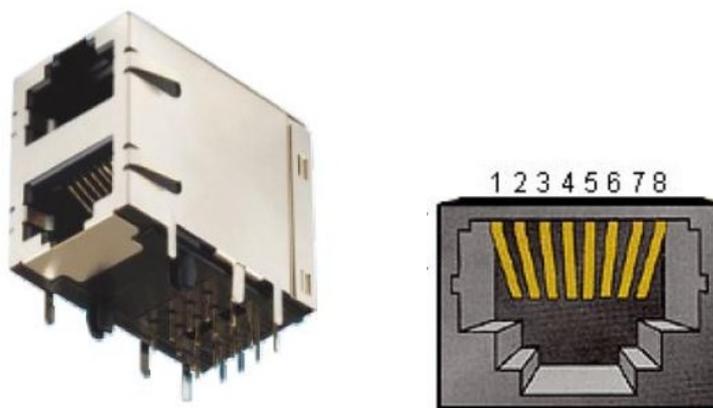

PIN1

Serial number	Signal name	Function	Signal description	Electrical characteristics	Remarks
1	DO1_NO	Output	DO1 output constant start	Low voltage, low current	
2	DO1_M	Output	DO1 output common terminal	Low voltage, low current	
3	DO2_NO	Output	DO2 output constant start	Low voltage, low current	
4	DO2_M	Output	DO2 output common terminal	Low voltage, low current	
5	DI1+	Input	-48V positive (dry contact input power supply)	Low voltage, low current	
6	DI1-	Input	DI1-Signal input terminal (short-circuited with DI1 + Effective, disconnected as invalid)	Low voltage, low current	

2. J9 reserved extension interface definition (connector brand: Connett; Model: PLTBH1.5-04-S-3. 81)

PIN1

Serial number	Signal name	Function	Signal description	Electrical characteristics	Remarks
1	+12V	Input	Expansion module power supply 12V	Low voltage, low current	
2	GSM_RX	Output	The expansion module receives signals	Low voltage, low current	
3	GSM_TX	Input	The expansion module sends a signal	Low voltage, low current	
4	HALL_GND	Input	GND	Low voltage, low current	

3. Definition of communication RJ45 interface (brand: Xinrong; Model: 8801-8P-002)

Serial number	Signal name	Function	Signal description	Electrical characteristics	Remarks
1	RS485_A	RS485	RS485 Signal A	Low voltage, low current	
2	RS485_B	RS485	RS485 Signal B	Low voltage, low current	
3	RS485_A	RS485	RS485 Signal A	Low voltage, low current	
4	RS485_B	RS485	RS485 Signal B	Low voltage, low current	
5	NC			Low voltage, low current	
6	NC			Low voltage, low current	
7	CANH	CAN	CAN high	Low voltage, low current	
8	CANL	CAN	Low CAN	Low voltage, low current	

Note: Double-layer RJ45, the signal definition of both sockets is the same.

4. Definition of positive and negative pins of battery (120A copper bar, M6 crimping terminal)

Serial number	Signal name	Function	Signal description	Electrical characteristics	Remarks
1	P+	Output	Output positive electrode of battery module	Low voltage, high current	
2	P-	Output	Output negative electrode of battery module	Low voltage, high current	

5. Definition of grounding terminal (M6 crimping terminal/120A/, crimping to front panel)

Serial number	Signal name	Function	Signal description	Electrical characteristics	Remarks
1	PGND	GND	Safe ground point	Low voltage, high current	

12.3 Internal interface definition

Serial number	Terminal code	PIN number	Terminal type	Function
1	J5/J6	1	M6 PCB Crimp Terminal/120A/ACTB021	Battery power terminal
2	J1	17	1XHB-17A; 17PIN; Foot distance 2.54 mm;; Straight needle with buckle white	Monomer collection
3	J8	16	16PIN socket; DIP; The spacing is 2.00 mm;;	Temperature acquisition
4	J12	2	2PIN socket; The foot distance is 3.96 mm;; Beige; Straight insertion	Heating control
5	J13	2	2PIN socket; Foot distance 2.54 mm;; Straight needle; True color	Push button switch

12.4 Internal connector wiring definition

1. Definition of positive and negative pins of battery (M6 PCB crimping terminal/120A/ACTB021/)

Serial number	Signal name	Function	Signal description	Electrical characteristics	Remarks
1	B+	Output	Output positive electrode of battery module	Low voltage, high current	
2	B-	Output	Output negative electrode of battery module	Low voltage, high current	

1. J1 pin definition (1XHB-17A; 17PIN; foot distance 2.54 mm; straight pin with snap white)

From left to right, 1-17

Serial number	Signal name	Function	Signal description	Electrical characteristics	Remarks
1	B1-	Input	Battery pack section 1 negative electrode	Low voltage, low current	J1-1
2	B1+	Input	Battery pack section 1 positive electrode	Low voltage, low current	J1-2
3	B2+	Input	Battery pack section 2 positive electrode	Low voltage, low current	J1-3
4	B3+	Input	Battery pack section 3 positive electrode	Low voltage, low current	J1-4
5	B4+	Input	Battery pack section 4 positive electrode	Low voltage, low current	J1-5
6	B5+	Input	Battery pack section 5 positive electrode	Low voltage, low current	J1-6
7	B6+	Input	Battery pack section 6 positive electrode	Low voltage, l	J1-7

				ow current	
8	B7+	Input	Battery pack section 7 positive electrode	Low voltage, low current	J1-8
9	B8+	Input	Battery pack section 8 positive electrode	Low voltage, high current	J1-9
10	B9+	Input	Battery pack section 9 positive electrode	Low voltage, low current	J1-10

11	B10+	Input	Battery pack section 10 positive electrode	Low voltage, low current	J1-11
12	B11+	Input	Battery pack section 11 positive electrode	Low voltage, low current	J1-12
13	B12+	Input	Battery pack section 12 positive electrode	Low voltage, low current	J1-13
14	B13+	Input	Battery pack section 13 positive electrode	Low voltage, low current	J1-14
15	B14+	Input	Battery pack section 14 positive electrode	Low voltage, low current	J1-15
16	B15+	Input	Battery pack section 15 positive electrode	Low voltage, low current	J1-16
17	B16+	Input	Battery pack section 16 positive electrode	Low voltage, low current	J1-17

3. J8 pin definition (brand: Xinrong; Model: BTW20007-16A0PRS-000)
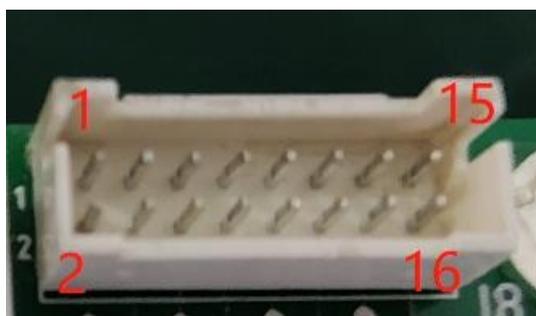
Serial number	Signal name	Function	Signal description	Electrical characteristics	Remarks
1	T_GND	Input	Temperature acquisition site	Low voltage, low current	J8-1
2	TEMP1+	Input	Temperature acquisition signal 1	Low voltage, low current	J8-2
3	T_GND	Input	Temperature acquisition site	Low voltage, low current	J8-3
4	TEMP2+	Input	Temperature acquisition signal 2	Low voltage, low current	J8-4
5	T_GND	Input	Temperature acquisition site	Low voltage, low current	J8-5
6	TEMP3+	Input	Temperature acquisition signal 3	Low voltage, low current	J8-6
7	T_GND	Input	Temperature acquisition site	Low voltage, low current	J8-7
8	TEMP4+	Input	Temperature acquisition signal 4	Low voltage, low current	J8-8
9	T_GND	Input	Temperature acquisition site	Low voltage, low current	J8-9
10	TEMP5+	Input	Temperature acquisition signal 5	Low voltage, low current	J8-10
11	T_GND	Input	Temperature acquisition site	Low voltage, low current	J8-11
12	TEMP6+	Input	Temperature acquisition signal 6	Low voltage, low current	J8-12
13	T_GND	Input	Temperature acquisition site	Low voltage, low current	J8-13
14	TEMP7+	Input	Temperature acquisition signal 7	Low voltage, low current	J8-14
15	T_GND	Input	Temperature acquisition site	Low voltage, low current	J8-15

| 16 | TEMP8+ | Input | Temperature acquisition signal 8 | Low voltage, l ow current | J8-16 |

4. J12 pin definition (brand: Xinrong; Model: BTW39601-02A0PRS-G00)

Seria l nu mbe r	Signal na me	Functio n	Signal de scription	Electrical cha racteristics	Remark s
1	HEAT-	Output	Heating control output negative electrod e	Low voltage, hi gh current	J12-1
2	HEAT+	Output	Heating control output positive electrod e	Low voltage, hi gh current	J12-2

5. J13 pin definition (brand: Xinrong; Model: BTW25004-02A0PRS-G00)

Serial number	Signal name	Function	Signal description	Electrical characteristics	Remarks
1	BUTTON1	Input	Manual soft switch button trigger signal positive pole	Low voltage, low current	J13-1
2	BUTTON2	Input	Manual soft switch button trigger signal positive pole	Low voltage, low current	J13-2

Note: Refer to User Manual for specific wiring method

13 Structural dimensions

11.1 Battery structure requirements: (to be updated by customers)

| Parameter	Indicators
Weight of the whole machine (excluding accessories)	/
Size of whole machine (width * depth * height)	(Standard 19 inches wide)
Protection level	IP20
Surface coating color	Black

Outlook drawing of the whole machine (to be updated)

11.2 PCBA structure requirements:

PCBA Dimension Requirements	PCB Maximum Space: 420.0*104.0*38.0 mm (Length * Width * Thickness)
PCB weight	1kg ± 10%
Plate	FR-4 Green Oil Tin Spray
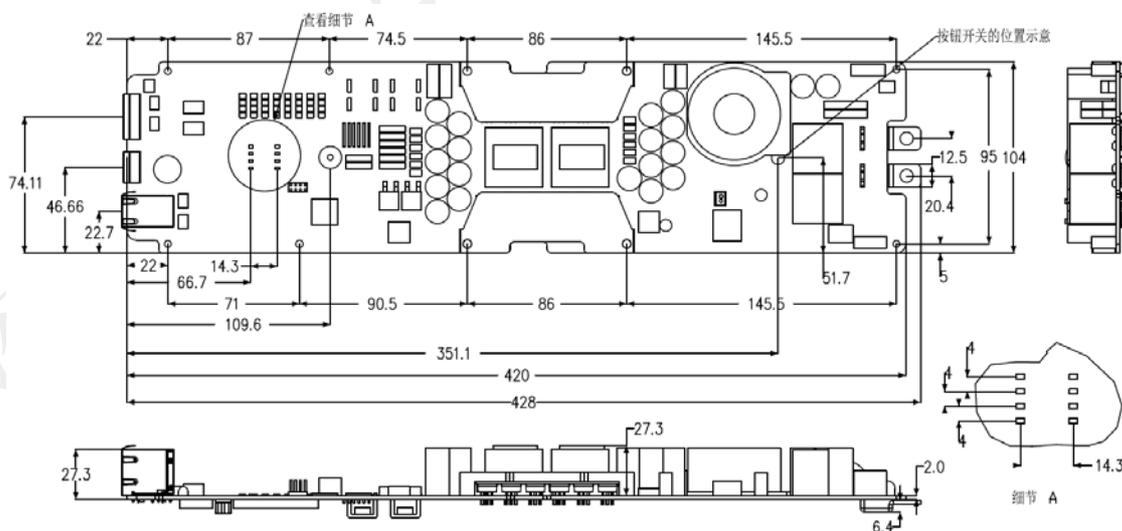
Front view and side view of PCB
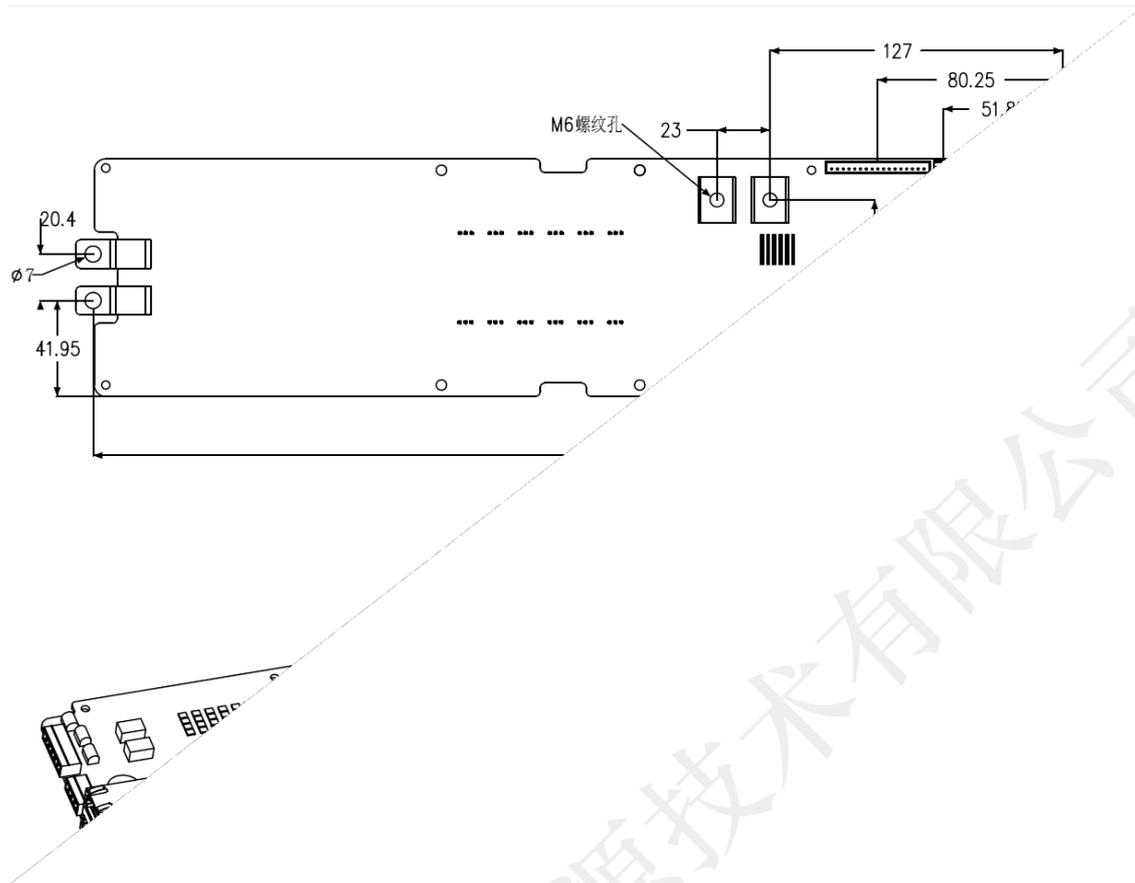
PCB Bottom Drawing

14 Production related requirements

14.1   Production and delivery mode

Production and delivery method: ODM

The customer provides the front panel kit to Tianbangda for assembly and aging test;
Tianbangda is responsible for the production, processing and testing of PCBA, assembly with the fr
ont panel, aging test, and then sending it to the client for assembly into the battery pack.

14.2   Shipment list

The product delivery list is as follows:

Seque ence No.	Configurati on type	Material name	Material name	Singl e Bit	Nu mbe r Qua ntity	Remarks
1	Power supply products	PCBA finished p roduct	Intelligent lithium battery BMS	PCS	1	Main prod uct
2	Screw	Screw	M6 Wiring Screw	PCS	2	
3	Connector ter minal	Terminal	4pin, 3.81 mm connector terminal	PCS	1	
4	Connector ter minal	Terminal	6pin, 3.81 mm connector terminal	PCS	1	
5						
6						

14.3   Product bar code

The bar code of the whole machine is divided into three forms, and the two-dimen
sional code is added with clear code, which are respectively pasted on PCBA, batt
ery chassis and packing box. xxx customers require PCB barcode rules as follows:
TBD
Bar code rules of the whole machine: to be confirmed by customers, the number of digits is less than 20 ch
aracters.

15 Packaging, Transportation and Storage

15.1 Packaging

There are product name, model, manufacturer's logo, inspection certificate of manufacturer's quality department, manufacturing date, etc. on the packing box; There is a list of accessories in the packing box.

15.2 Transport

Products should be packed in firm boxes when transported. The outside of the box should comply with the relevant national standards and should be "handled with care" and "moisture-proof"
Signs. Packing boxes containing products are allowed to be transported by any means of transport. Direct rain and snow and mechanical impact should be avoided during transportation.

15.3 Storage

When products are not in use, they should be stored in packing boxes. The ambient temperature of the warehouse is 0-40 ℃ and the relative humidity is not more than 80%. Harmful gases, flammable and explosive products and corrosive chemicals are not allowed in the warehouse, and there is no strong mechanical vibration, impact and strong magnetic field. The packing boxes should be at least 20cm high from the ground and at least 50cm away from walls, heat sources, windows or air inlets. The storage period under the specified conditions is generally 2 years, and re-inspection should be carried out after more than 2 years.

16 Safety Precautions

Before starting installation or operation, please read the operation guide and precautions carefully to avoid accidents. Matters such as "precautions, warnings and dangers" in products and product user manuals do not represent all safety matters to be observed, but only serve as supplements to safety precautions in various installation and use operations. Therefore, the personnel responsible for product installation and operation must undergo professional training, master the correct operation methods of the system and various safety precautions before carrying out various installation or operation of equipment. When installing or operating the equipment of our company, we must abide by the safety specifications and engineering design specifications of relevant industries, and strictly abide by the relevant equipment precautions and special safety instructions provided by our company.

1) When receiving and discharging electricity, it must be operated in the order of discharging and discharging electricity.

2) When connecting the battery pack, do not connect it incorrectly or even reversely, or the upper computer cannot be connected, or the main chips on the circuit board have obvious heating. Please power it down quickly. At this time, the circuit board may be defective and need to be replaced and repaired. When assembling, it is strictly forbidden to touch the circuit board components such as thread ends and solder, in case of touching, it may damage the circuit components and cause defects.

3) Strictly follow the design parameters required by the specifications, otherwise the circuit board may be damaged.

4) Pay attention to moisture-proof, waterproof and anti-static in use.

5) Once the safety protection of the equipment is damaged, the equipment must stop working and refer to the relevant maintenance regulations.

6) When the power supply equipment changes from cold environment to warm environment, condensation may cause leakage danger, so grounding requirements must be strictly implemented;

7) It must be operated by qualified personnel to connect the equipment to the power supply.

8) To cut off the power supply, the machine must be shut down for five minutes, so that the capacitor has sufficient discharge time before the equipment can be maintained.

9) Pay attention to safety: Avoid touching with hands where there are safety warning signs, high pressure and high energy signs, so as not to cause electric shock and scald.

17 Citing Standards and Specifications

The terms in the following documents become the terms of this standard by reference in this document. All subsequent amendments (excluding corrigendum content) or revisions of dated reference documents are not applicable to this standard. However, the parties to an agreement under this standard are encouraged to study whether the latest versions of these documents can be used. For undated reference documents, the latest version is applicable to this standard.

GB/T 4798.1-3 Environmental Conditions for the Application of Electrical and Electronic Products

GB/T 2423 Environmental Test for Electrical and Electronic Products (Series Standards)

48V Rectifier for YD/T 731-2018 Communication

YD/T 2344.1-2011 Lithium iron phosphate battery packs for communications-Part 1: Integrated battery packs

QZTT2241-2020 Intelligent Lithium Iron Phosphate Battery Technical Requirements and Testing Specifications