PRODUCT SPECIFICATION

Product Name: Low Voltage Energy Storage BMS

Product Model: TB-P16S(100-120-150-200A)

Version: V1.8

Compiler: Sherry	Reviewer: Ethan	Ratify: Gary
2025-3-16	2025-3-16	2025-3-16

Revision History			
Date	Revision version	Revision Notes	Reviser
2024-3-2	V1.0	New formulation	Bin
2024-4-25	V1.1	Updated dimension	Bin
2024-5-15	V1.2	Update light board, short circuit, power consumption	Sherry
2024-7-31	V1.3	A4 version	Sherry
2024-9-16	V1.4	Update fault parameters	Sherry
2024-11-06	V1.5	Update parameters	Sherry
2024-11-22	V1.6	Update port definition	Sherry
2024-12-16	V1.7	Update LCD parameters and others	Sherry
2025-3-16	V1.8	Optimize the terminal block	Sherry

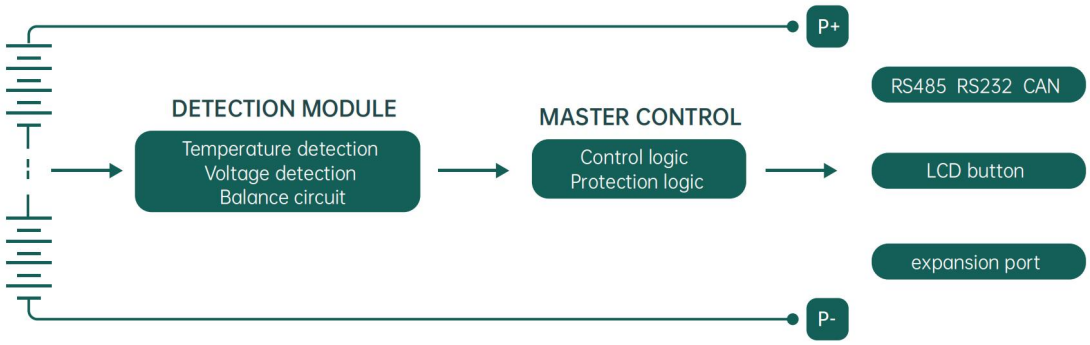
Catalog

1. Overview of the solution

1.1.Introduction

TB-P16SxxxA is suitable for low voltage energy storage system, supporting up to 16 cells in series, a total of 16-channel voltage detection, 7-channel temperature detection (5-channel cell detection, 1-channel environment detection, 1- channel MOS detection); It can realize a variety of fault alarms and protections, such as over-charging, over-discharging, over-current, over-temperature, under-temperature, short-circuit, etc., The product can be connected in parallel through the RS485 to realize multi-groups and the maximum number of parallel groups is 16. It can use the host computer to set parameters, troubleshooting, remote monitoring through WIFI to achieve remote management.

1.2.Solution topology diagram

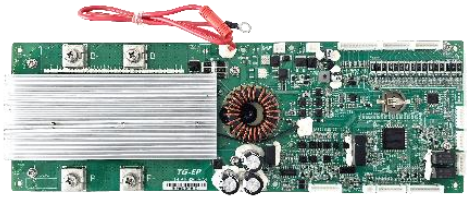


1.3.Application environment

Index item	Parameter&Description
Use ambient temperature range	-20℃ ~ 70℃
Storage environment temperature range	-40℃ ~ 85℃
Use ambient humidity range	5 ~ 95(45℃±2℃)%RH
Storage environment humidity range	≤95(45℃±2℃)%RH
Atmospheric pressure	76 ~ 106 Kpa
Altitude	≤2000M
Heat dissipation mode	Natural heat dissipation
IP rating	IP20

2. Overview of product

2.1.Product Details List

Name		Quantity	Unit	Actual picture
BMS main board		1	pc	
LCD display（optional）		1	pc	
Communication board		1	pc	
Wire harness	Voltage Sampling Wire	1	set	
	NTC Temperature Sensor	1	set	
	Communication Board Connection Wire	1	set	
	Display Screen Communication Wire	1	pc	
	Switch Wire	1	pc	

2.2.Main features

Parameter item	Parameter&Description
Main board external size	300*100mm
Communication board external size	160*45mm

Parameter item	Parameter&Description
LCD display (optional) external size	106*71mm
Working mode	Normal working mode/Sleep mode
Rated voltage	51.2VDC
Rated current	100A\120A\150A\200A
Maximum continuous charging current	100A\120A\150A\200A
Maximum continuous discharge current	100A\120A\150A\200A
Power consumption	Normal operation power consumption ≤8W; sleep power consumption ≤2W
Charge Current Limit	Max: 10A
Battery side static sleep current	≤0.2mA
Number of single voltage detection channels	16 channels
Individual voltage detection	2 ~ 4.5VDC, ≤±10mV, -10℃ ~ +55℃
Busbar current detection	>50A, ±2%; ≤50A, error within 1A
Temperature detection number	7-channel temperature acquisition channel (5-channel cell detection, 1-channel environment detection, 1-channel MOS detection) Cell and environment temperature detection:≤±2℃ @0℃ ~ +50℃ MOS temperature detection:≤±3℃ @-40℃ ~ +85℃
Battery total voltage detection accuracy	0 ~ 60V DC, ≤±0.1V
SOC accuracy	≤±5%
Single battery balancing method	Passive discharge balancing, 100mA±20%
Dry node output	2-channel(48V DC/1A)
Heating control	1-channel(48V DC/2A)
Fan control	1-channel(12V DC/0.5A)
LED	9
DIP switch	Four digits (hardware manual dialing)
Communication mode	CAN, RS485, RS232, WIFI (expansion)
Data storage	≥1000 historical data records
Pre-charging function	Support
Current Limiting	Support
Reverse connection protection	Support

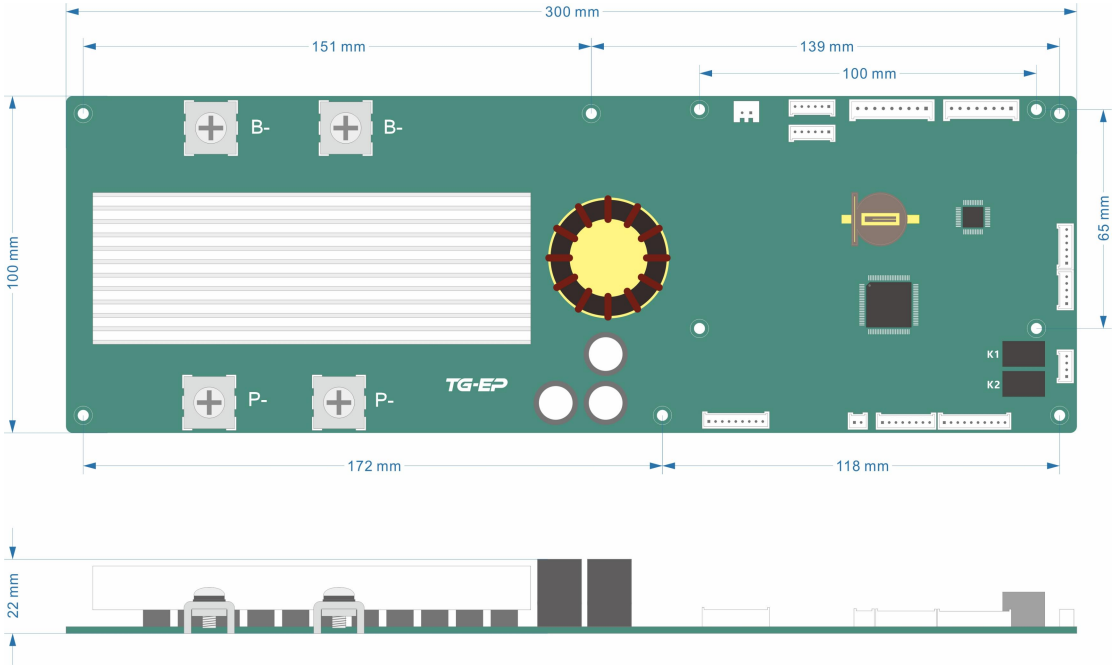
Parameter item	Parameter&Description
One-button power on	Support
Upper computer	Support
Program upgrade	Support
Display screen	Separately equipped

2.3.Communication protocol list

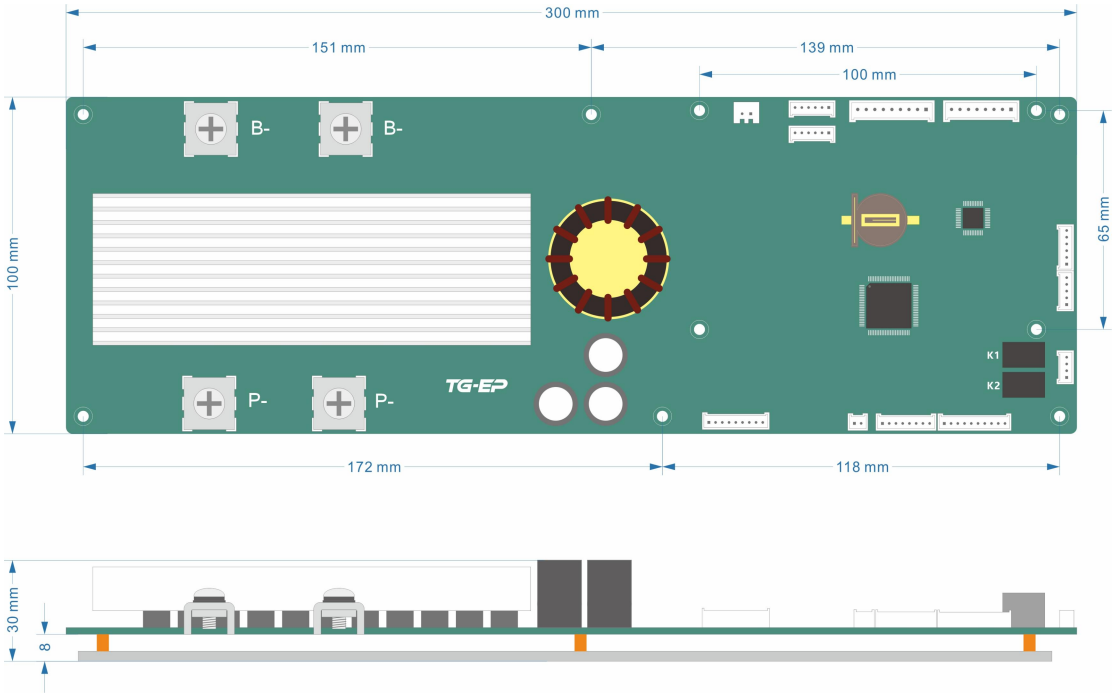
Sequence number	Host computer	RS485 communication protocol	Host computer	CAN communication protocol
1	0x00-DEYE	DEYE	0x00-Megarevo	Megarevo
2	0x01-Voltronic	Voltronic	0x01-Sofar	Sofar
3	0x02-Growatt	Growatt	0x02-Growatt	Growatt
4	0x03-Pylon	Pylon	0x03-Victron	Victron
5	0x04-SRNE	SRNE	0x04-LXP	LXP
6	0x05-INVT	INVT	0x05-SMA	SMA
7	0x66-TG-EP	TG-EP	0x06-SRNE	SRNE
8			0x07-Pylon	Pylon
9			0x08-DEYE	DEYE

2.4.Main board size

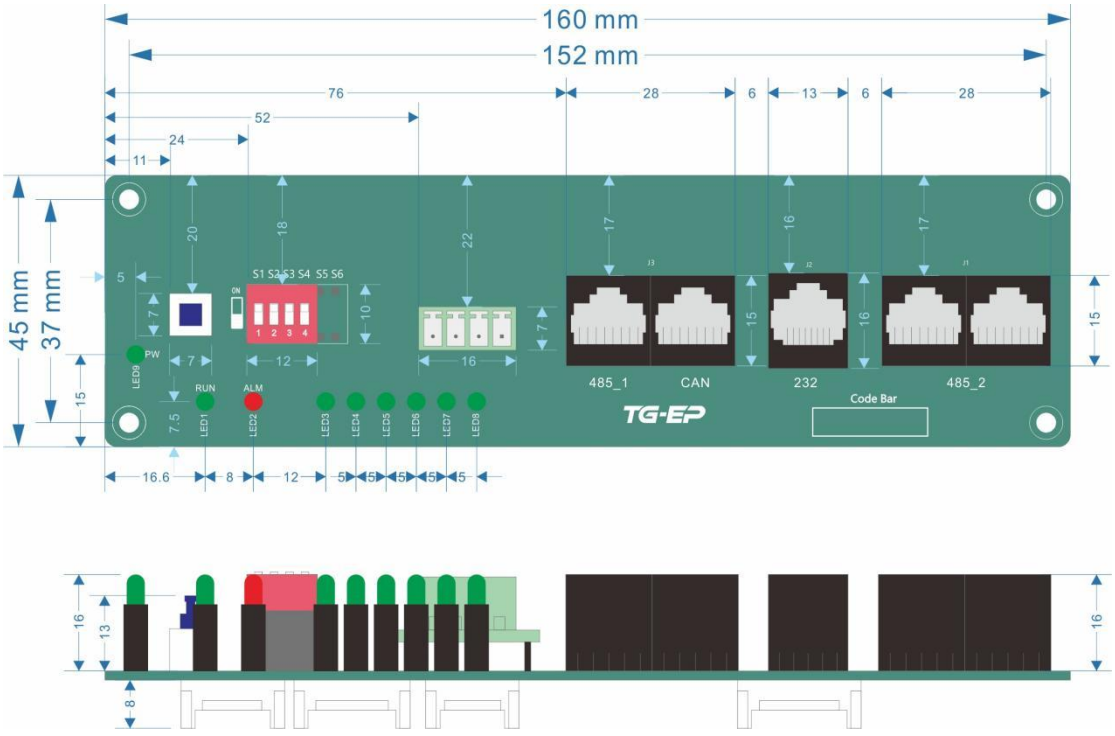
TB-P16S100A/120A:



TB-P16S150A/200A:

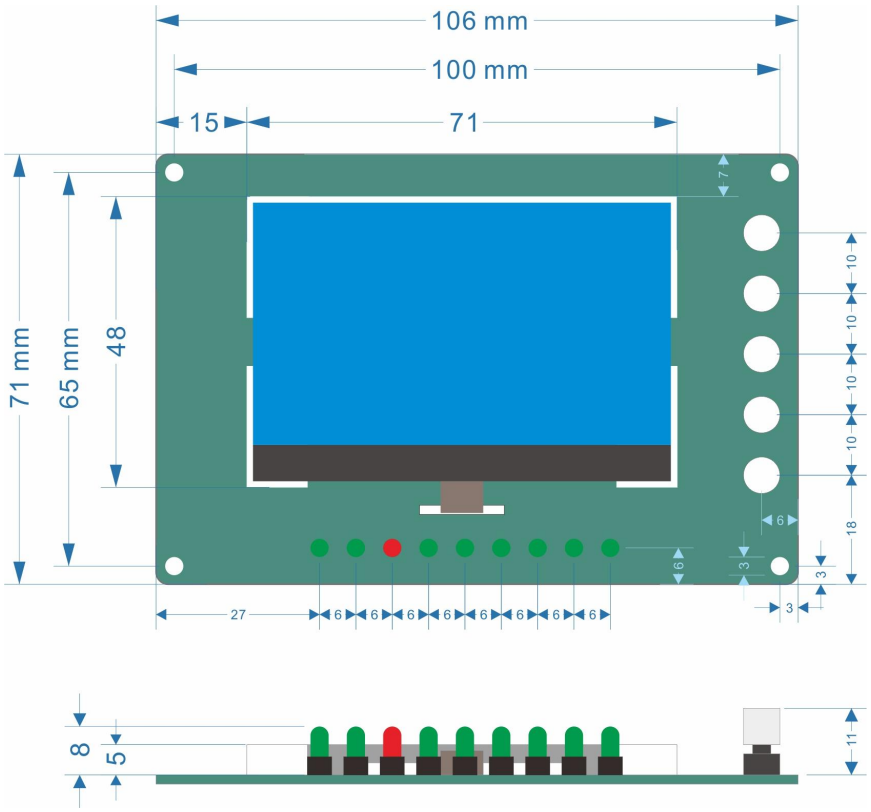


2.5.Communication board dimensions



Note: The location of the LED indicator is optional and when selected on the communication board, the dimensions are as shown above.

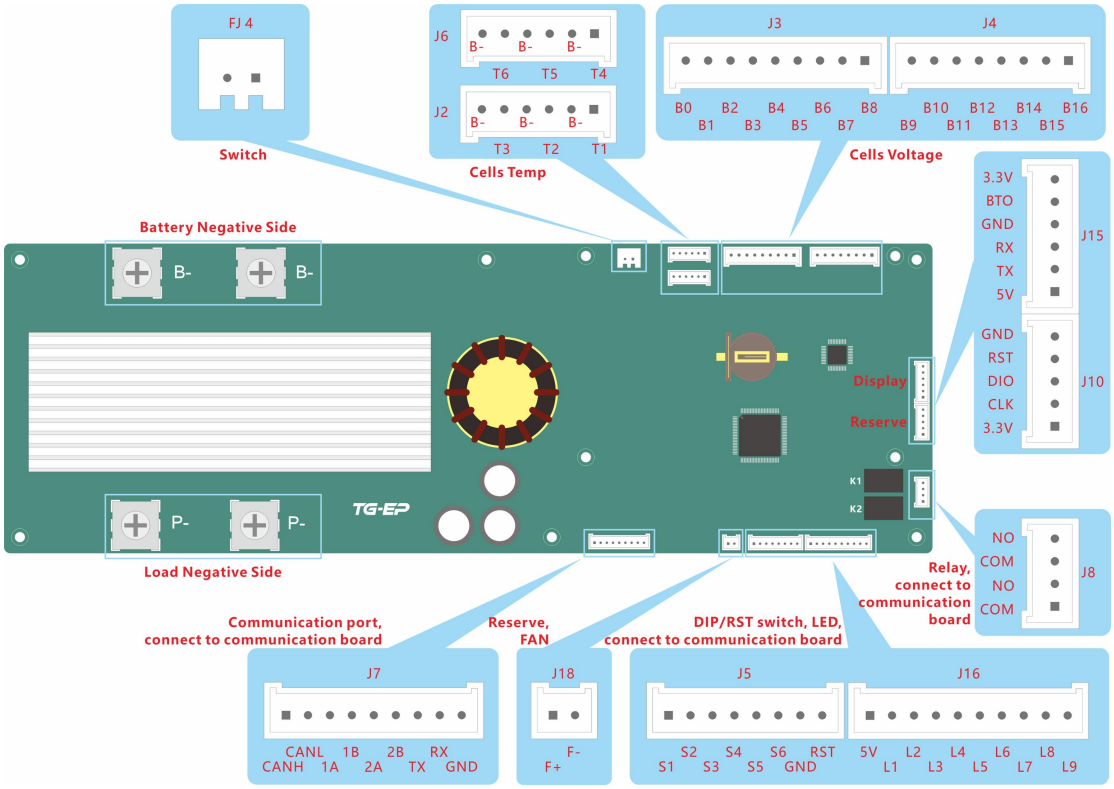
2.6.LCD display (optional) dimensions



Note: The position of the LED indicator is optional and when selected on the LCD, the dimensions are as shown above.

3. Port function

3.1.Main board port function diagram



3.2.Main board port definition table

Mark	Functional Description	Load	Remark
FJ4（Upper and lower power switches）			
2.54-2P	Control switch interface	/	/
J6（Temperature sampling）			
TEMP6	Temperature detection+	/	Ambient temperature
GND	Temperature detection-	/	
TEMP5	Temperature detection+	/	Cell temperature 5
GND	Temperature detection-	/	
TEMP4	Temperature detection+	/	Cell temperature 4
GND	Temperature detection-	/	
J2（Temperature sampling）			
TEMP3	Temperature detection+	/	Cell temperature 3
GND	Temperature detection-	/	

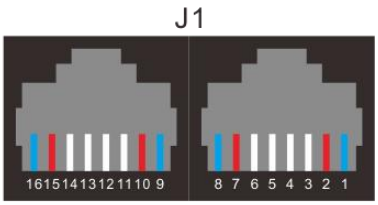
Mark	Functional Description	Load	Remark
TEMP2	Temperature detection+	/	Cell temperature 2
GND	Temperature detection-	/	
TEMP1	Temperature detection+	/	Cell temperature 1
GND	Temperature detection-	/	
J3（Cell voltage sampling）			
B0	GND	/	
B1	1#Cell voltage detection	5V,5mA	
B2	2#Cell voltage detection	5V,5mA	
B3	3#Cell voltage detection	5V,5mA	
B4	4#Cell voltage detection	5V,5mA	
B5	5#Cell voltage detection	5V,5mA	
B6	6#Cell voltage detection	5V,5mA	
B7	7#Cell voltage detection	5V,5mA	
B8	8#Cell voltage detection	5V,5mA	
J4（Cell Voltage Sampling）			
B9	9#Cell voltage detection	5V,5mA	
B10	10#Cell voltage detection	5V,5mA	
B11	11#Cell voltage detection	5V,5mA	
B12	12#Cell voltage detection	5V,5mA	
B13	13#Cell voltage detection	5V,5mA	
B14	14#Cell voltage detection	5V,5mA	
B15	15#Cell voltage detection	5V,5mA	
B16	16#Cell voltage detection	5V,5mA	
J15（LCD display）			
5V	Power supply	/	
TX	Communication	/	
RX	Communication	/	
GND	GND	/	
RS1	/	/	

Mark	Functional Description	Load	Remark
RS2	/	/	
J10（Debugging port）			
3.3V	St-link	/	
CLK	St-link	/	
DIO	St-link	/	
RST	St-link	/	
GND	St-link	/	
J8（Dry contact）			
COM_K2	Public side	48VDC-2A	
NO_K2	Contacts	48VDC-2A	
NC_K2	Contacts	48VDC-2A	
COM_K1	Public side	48VDC-2A	
NO_K1	Contacts	48VDC-2A	
NC_K1	Contacts	48VDC-2A	
J16（Light panel）			
5V	Power supply	/	
LED_RUN	Indicator light	/	System status
LED_ALM	Indicator light	/	Alarm
LED3	Indicator light	/	SOC
LED4	Indicator light	/	SOC
LED5	Indicator light	/	SOC
LED6	Indicator light	/	SOC
LED7	Indicator light	/	SOC
LED8	Indicator light	/	SOC
LED_PW	Indicator light	/	Power
J5（DIP, reset switches）			
S1	External switch signal	3.3V,1mA	
S2	External switch signal	3.3V,1mA	
S3	External switch signal	3.3V,1mA	

Mark	Functional Description	Load	Remark
S4	External switch signal	3.3V,1mA	
S5	External switch signal	3.3V,1mA	
S6	External switch signal	3.3V,1mA	
B-	Power ground	GND	
RST_EX	Reset switches	3.3V,1mA	
J18（DC12V output）			
F+	DC12V+	12V，0.5A	Controllable heat dissipation fan
F-	DC12V-	12V，0.5A	
J7（Communication）			
CANH	CAN Communication	/	
CANL		/	
RS485_1A	485 Communication 1	/	
RS485_1B		/	
RS485_2A	485 Communication 2	/	
RS485_2B		/	
RS232_TX	232 Communication	/	
RS232_RX		/	
GND	Communication power Isolation ground	/	

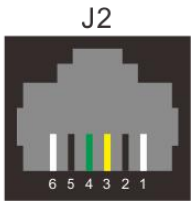
3.3.Communication board port description

3.3.1. Parallel communication port J1



Position No.	16	15	14	13	12	11	10	9
Definition	RS485_2B	RS485_2A	/	/	/	/	RS485_2A	RS485_2B
Position No.	8	7	6	5	4	3	2	1
Definition	RS485_2B	RS485_2A	/	/	/	/	RS485_2A	RS485_2B

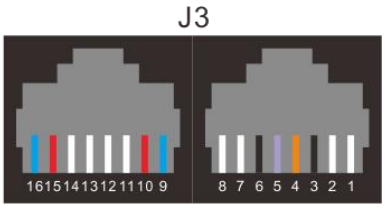
3.3.2. Host computer communication port J2



232

Position No.	6	5	4	3	2	1
Definition	/	GND	RS232_RX	RS232_TX	GND	/

3.3.3. Inverter communication port J3



485_1 CAN

RS485_1 Position No.	16	15	14	13	12	11	10	9
Definition	RS485_1B	RS485_1A	GND	/	/	GND	RS485_1A	RS485_1B
CAN Position No.	8	7	6	5	4	3	2	1
Definition	/	/	GND	CAN_L	CAN_H	GND	/	/

3.4.LED indicator instruction

LED light working status indication:

Status	Normal/Alert/ Protection	PW (L9)	RUN (L1)	ALM (L2)	L8	L7	L6	L5	L4	L3	Indication
Sleep	Sleep	off	off	off	off	off	off	off	off	off	All off
Standby	Normal	always on	off	off	Based on the power display						Standby
	Alert	always on	off	blink							
Charge	Normal	always on	always on	off	Based on the power display						
	Alert	always on	always on	blink							
	OC protection	always on	always on	always on	always on	always on	always on	always on	always on	always on	If no charging, the indicator turn to standby

	Charge OCP	always on	always on	always on	Based on the power display						Current-limited charging
	Temperature and voltage protection	always on	off	always on	Based on the power display						Stop charging
Discharge	Normal	always on	blink	blink	Based on the power display						
	Alert	always on	blink	blink							
	UV protection	always on	blink	always on	off	off	off	off	off	off	Stop discharging
	Temperature ,OC and failure protection	always on	off	always on	Based on the power display						Stop discharging
Emergency fault	MOS Failure, short-circuit and OC lockout,AFE Failure	always on	off	always on	off	off	off	off	off	off	Stop charging and discharging

LED light power indication:

Battery Level Indicator		L8	L7	L6	L5	L4	L3
SOC	0-17%	always on	off	off	off	off	off
	18-33%	always on	always on	off	off	off	off
	34-50%	always on	always on	always on	off	off	off
	51-66%	always on	always on	always on	always on	off	off
	67-83%	always on	always on	always on	always on	always on	off
	84-100%	always on	always on	always on	always on	always on	always on

3.5.LCD display button instruction

4. BMS installation instructions

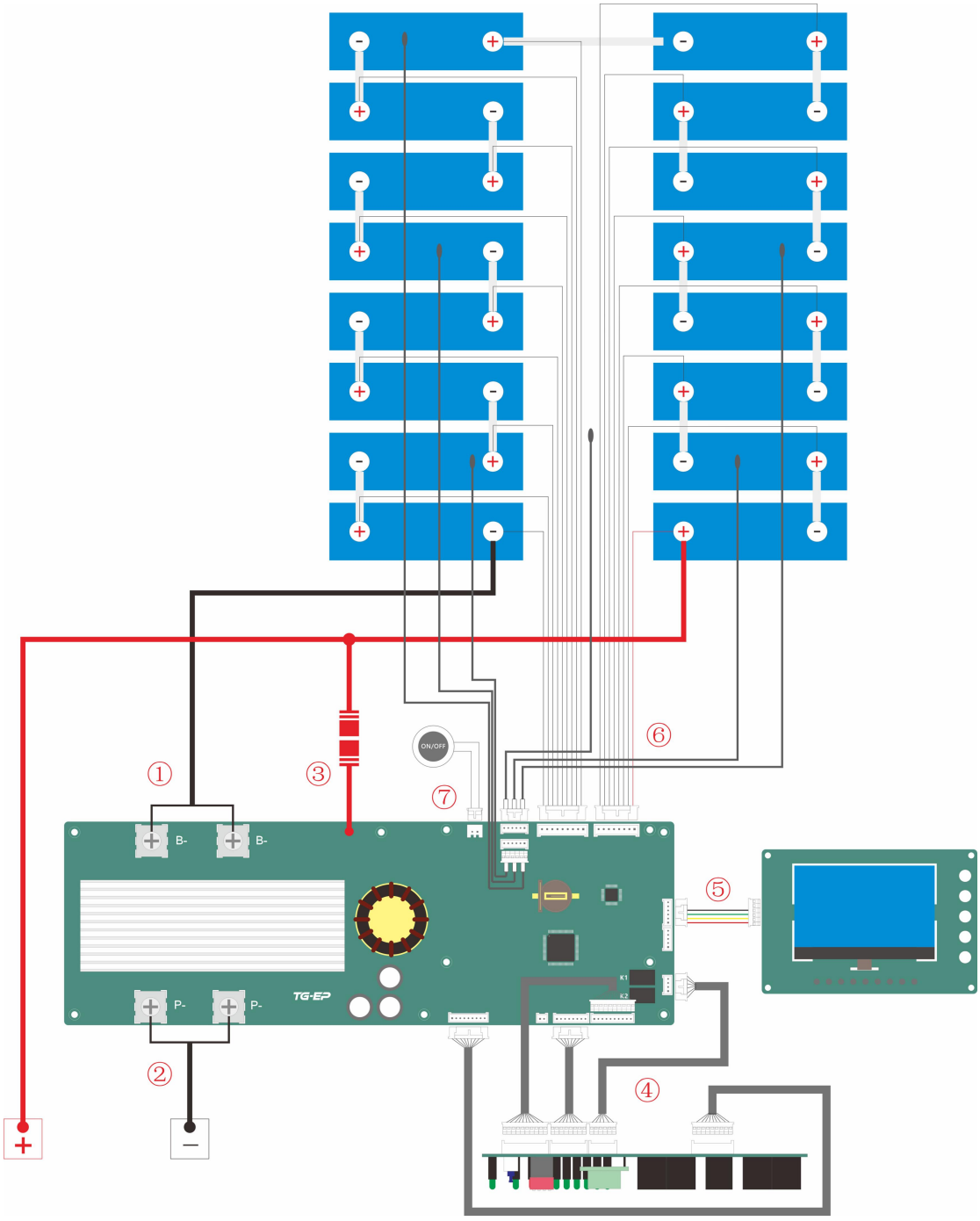
4.1.Safety regulations requirements

Before starting installation or operation, please read the operating instructions and precautions carefully to avoid accidents. When installing or operating our company's equipment, you must comply with the safety regulations and engineering design specifications of the relevant industry, and strictly follow the relevant equipment precautions and special safety instructions provided by our company.

- The accessories connected to the main board must be standard accessories listed in the "Product Details List". It is strictly forbidden to connect other devices. If necessary, please confirm with the technical support. Otherwise, the manufacturer will not be responsible for any damage to the circuit board.
- When assembling, the components should not directly contact the surface of the battery cell to avoid damaging the battery cell. The assembly should be firm and reliable.
- In use, pay attention to the lead, soldering iron, solder, etc. Do not touch the components on the circuit board, otherwise it may damage the circuit board.
- The use of the process should pay attention to anti-static, moisture-proof, waterproof, etc.
- Please follow the design parameters and usage conditions during use, otherwise the protection board may be damaged.
- When connecting and disconnecting the power, it must be operated in the order of up and down power.
- When connecting the battery pack, do not connect it incorrectly or even inversely.
- After assembling the battery pack and circuit board, if you find that there is no voltage output or charging for the first time, please check whether the wiring is correct.
- The final explanation right belongs to TG-EP.

4.2.BMS installation steps

Installation Diagram:



Installation Steps:

① Fix the board according to the structural dimensions, and Connect the B-terminal to the negative terminal of the battery as shown;

② Connect the P-terminal to the P- of the battery pack as shown;

③ connect the mainboard B+ to the positive pole of the battery as shown in the figure;

④ Connect the communication board. As shown in the figure, connect J7, J5, J16, and J8 on the BMS board to J8, J9, J11, and J10 on the communication board;

⑤ Connect LCD (optional). As shown in the figure, connect J15 on the BMS board to J2 on the LCD board;

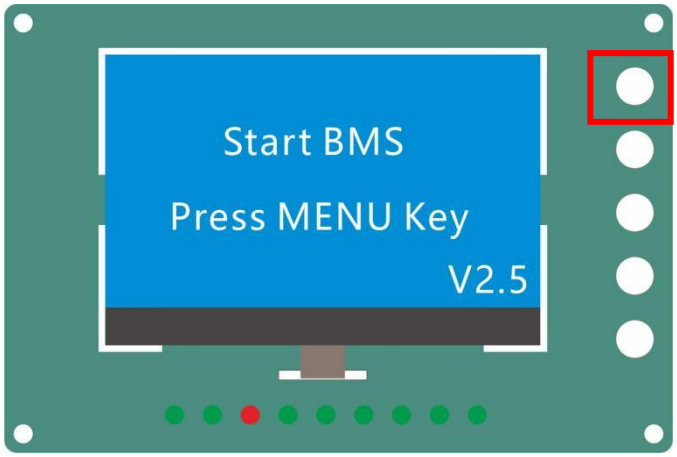
⑥ As shown in the figure, connect the NTC sensor to the J2 and J6 port, connect the battery cell voltage detection line of battery 1~ 8 strings to the J3 port, and connect the battery cell voltage detection line of battery 9 to 16 strings to the J4 port;

⑦ Finally, connect the switch to FJ4. After ensuring the above wiring is correct, turn on the FJ4 switch to power BMS.

⑧ Check the communication board. If the green power indicator LED9 (PW) is on, it means the communication board is installed normally;

PW light is on

⑨ Press the MENU button on the LCD panel to wake up the screen and view the parameters and fault status through the LCD.



MENU button

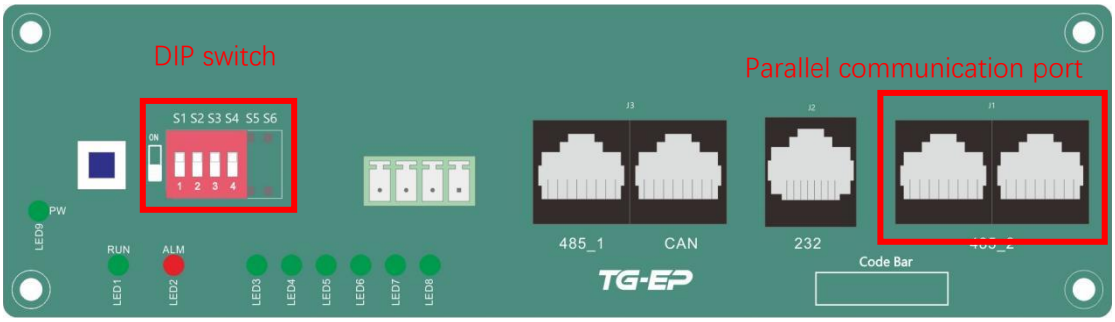
Special Notes:

1) Make sure the switch (FJ4) is turned off before wiring or disconnecting;

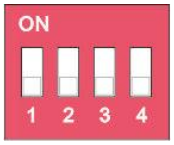
2) When removing the wires, remove the other wires first, then remove the B- and B+ wires.

4.3.BMS parallel instructions

4.3.1. Key components



4.3.2. DIP switch description



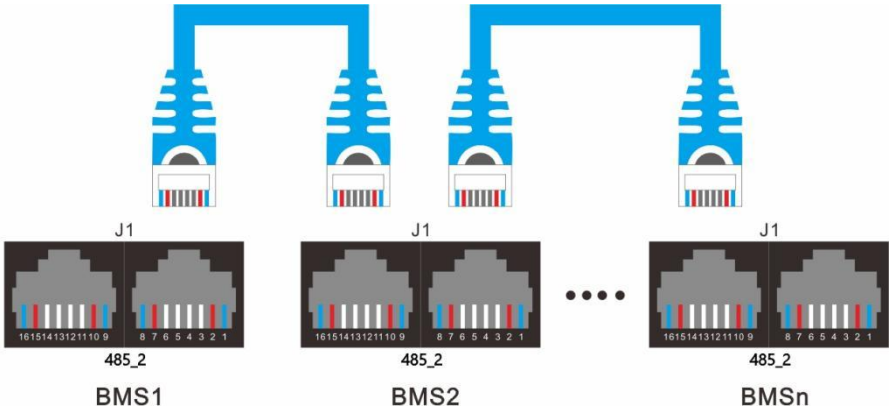
Address	DIP setting			
	1#	2#	3#	4#
0	OFF	OFF	OFF	OFF
1	ON	OFF	OFF	OFF
2	OFF	ON	OFF	OFF
3	ON	ON	OFF	OFF
4	OFF	OFF	ON	OFF
5	ON	OFF	ON	OFF
6	OFF	ON	ON	OFF
7	ON	ON	ON	OFF
8	OFF	OFF	OFF	ON
9	ON	OFF	OFF	ON
10	OFF	ON	OFF	ON
11	ON	ON	OFF	ON
12	OFF	OFF	ON	ON
13	ON	OFF	ON	ON
14	OFF	ON	ON	ON
15	ON	ON	ON	ON

Note: The address bit is 0, the default is the master, and the slave address dial code cannot be repeated, otherwise the communication will be abnormal.

4.3.3. Parallel communication port instruction

① Install the BMS for each battery PACK according to the BMS installation instructions, and keep the BMS turned off;

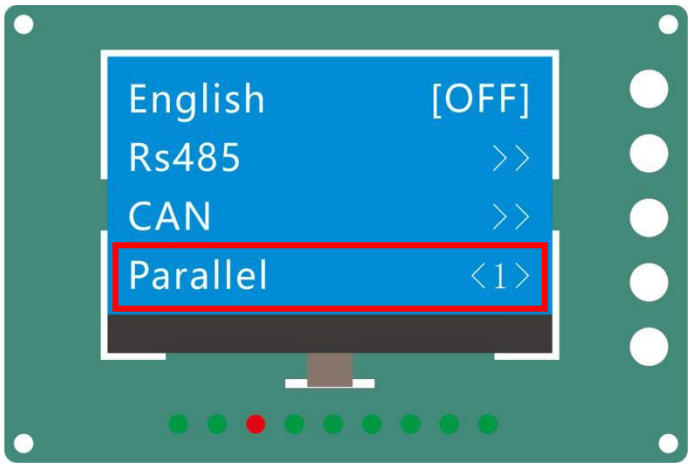
② Connect the 485_2 parallel communication port of each BMS with a communication cable as shown in the figure;

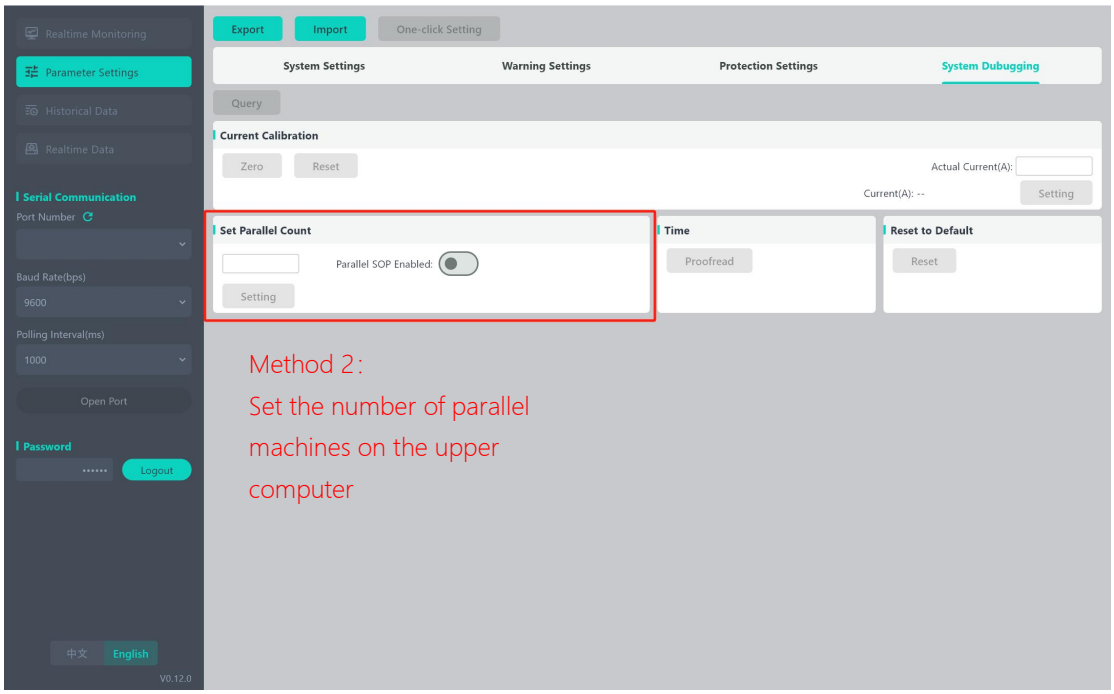


③ Set the dip switch. For details, see 4.3.2 Dip switch description. ID: 0 corresponds to the host. The maximum setting ID is 15;

④ Power on each BMS in turn, and set the [parallel quantity] through the display screen of the host or by connecting the host to the upper computer;

Method 1:
Set the number of parallel devices on the display screen





Method 2:
Set the number of parallel machines on the upper computer

⑤ If there is no "internal communication alarm", it means that the parallel setting is successful. If there is an "internal communication alarm", the status parameters of the master and slave machines can be queried through the host computer. If there are no parameters or the parameters are no longer refreshed, it means that the slave machines is not communicating.

5. Parameters list

Function Name	Trigger Default	Restore Default Values/Conditions	Delay Default
Single overvoltage alarm	⩾3600mV	< 3400mV	3000mS
Single undervoltage alarm	⩽2700mV	> 2900mV	3000mS
Single overvoltage protection	⩾3750mV	1. Maximum cell voltage is lower than the recovery voltage release(3450mV) 2. Discharge current ⩾3A release Any of the above conditions are met, the system will resume	3000mS
Single undervoltage protection	⩽2300mV	> 3000mV 1. Minimum cell voltage is higher than the recovery voltage release 2. Charge current ⩾1A Release Any of the above conditions are met, the system will resume	3000mS
Total battery Overvoltage alarm	⩾56.0V	< 54.0V	3000mS
Total battery Undervoltage alarm	⩽46.5V	> 48.0V	3000mS
Total overvoltage protection	⩾58.4V	< 54.4V 1. Voltage lower than the recovery voltage release 2. Discharge current ⩾3A release Any of the above conditions are met, the system will resume	3000mS
Total voltage undervoltage protection	⩽44.8V	> 49.0V 1. Voltage higher than the recovery voltage release	3000mS

Function Name		Trigger Default	Restore Default Values/Conditions	Delay Default
			2. Charge current ⩾1A Release Any of the above conditions are met, the system will resume	
Cell tempe -rature alarm	Charging high temperature alarm	⩾55℃	< 50℃	100ms
	Charging low temperature alarm	⩽5℃	> 10℃	100ms
	Discharge high temperature alarm	⩾55℃	< 50℃	100ms
	Discharge low temperature alarm	⩽-15℃	> -10℃	100ms
Cell temperature prohibition charging	Charging high temperature protection	⩾65℃	< 50℃	1000mS
	Charging low temperature protection	⩽0℃	> 5℃	1000mS
Cell temperature prohibition discharging	Discharge high temperature protection	⩾65℃	< 50℃	1000mS
	Discharge low temperature protection	⩽-20℃	> -15℃	1000mS
Ambient temperature protection	Ambient high temperature alarm	⩾60℃	< 50℃	100mS
	Ambient low temperature alarm	⩽-15.0℃	> -10.0℃	100mS
	Ambient over-temperature protection	⩾65℃	< 60℃	1000mS
	Ambient low temperature protection	⩽-20.0℃	> -15.0℃	1000mS
MOS high temperature	MOS high temperature alarm	⩾95℃	< 80℃	100mS
	MOS high temperature protection	⩾105℃	< 85℃	1000mS
Charging overcurrent alarm	TB-P16S100A	105A	/	2000mS
	TB-P16S120A	126A		
	TB-P16S150A	157.5A		
	TB-P16S200A	210A		

Function Name		Trigger Default	Restore Default Values/Conditions	Delay Default
Charge overcurrent protection 1	TB-P16S100A	110A	1. Timed release, 600S 2. Release when discharge current ⩾1A Note: Locked 3 times, need to restart to release	2000mS
	TB-P16S120A	132A		
	TB-P16S150A	165A		
	TB-P16S200A	220A		
Charge overcurrent protection 2	TB-P16S100A	115A	1. Timed release, 600S 2. Release when discharge current ⩾1A Note: Locked 3 times, need to restart to release	
	TB-P16S120A	138A		
	TB-P16S150A	172.5A		
	TB-P16S200A	230A		
Discharge overcurrent alarm	TB-P16S100A	105A	/	2000mS
	TB-P16S120A	126A		
	TB-P16S150A	157.5A		
	TB-P16S200A	210A		
Discharge overcurrent protection 1	TB-P16S100A	110A	1. Timed release, 300S 2. Release when charging current ⩾1A Note: Locked 3 times, need to restart to release	2000mS
	TB-P16S120A	132A		
	TB-P16S150A	165A		
	TB-P16S200A	220A		
Discharge overcurrent protection 2	TB-P16S100A	115A	1. Timed release, 300S 2. Release when charging current > 1A 3. Locked 3 times, need to restart to release	200mS
	TB-P16S120A	138A		
	TB-P16S150A	172.5A		
	TB-P16S200A	230A		
Output short-circuit protection	TB-P16S100A	400A	Automatically recover after 1 minute delay, locked after 3 consecutive attempts	220us
	TB-P16S120A	480A		
	TB-P16S150A	600A		
	TB-P16S200A	800A		
Cell balance function	Balance opening voltage	3400 mV		
	Balance opening pressure difference	30 mV		
	Balanced mode	Balanced charging and standby status		
Battery capacity	Battery rated capacity	According to the actual capacity	/	/
	Low battery alarm	< 10%	> 15% recover	1s
Max charge current	TB-P16S100A	100A	/	/
	TB-P16S120A	120A		

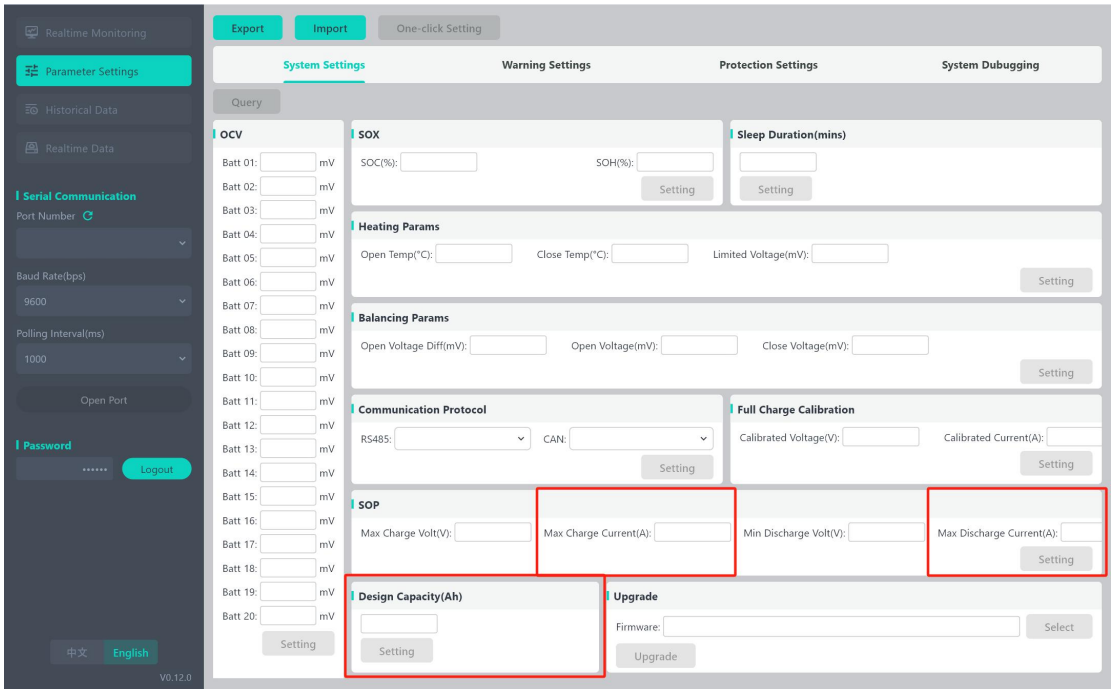
Function Name		Trigger Default	Restore Default Values/Conditions	Delay Default
Max discharge current	TB-P16S150A	150A	/	/
	TB-P16S200A	200A		
	TB-P16S100A	100A		
	TB-P16S120A	120A		
	TB-P16S150A	150A		
	TB-P16S200A	200A		
Max charge voltage		58.4V	/	/
Manual key function	Power on	> 2s open	/	/
	Shut down	> 2s down	/	/
Monitor power consumption management	Sleep time	1440 min	No communication, no charge and discharge current Button and 485 activation	
Pre-charge function	Precharge time	open	/	2000ms
Heating parameters		open	The maximum cell temperature is ≤0℃, and the minimum cell voltage is >3.0V	/
		stop	The maximum cell temperature is ≥10°C, and the minimum cell voltage is ≤3.0V.	
large voltage difference	Large voltage difference alarm	Differential pressure >600mV	Voltage difference < 500mV	/
	Large voltage difference protection	Differential pressure > 800mV	Voltage difference < 500mV	/
Full charge calibration	Full charge calibration voltage Full charge voltage>56.8V, full charge calibration current<1.5A			
	Single cell voltage ≤ 2300mV (settable), or overall voltage ≤ 44.8V (settable). When either condition is met, the SOC is calibrated to 0%.			
SOH parameters	Cycle coefficient	80%		
	Cyclic attenuation coefficient	200 times/1%		

6. Configure parameters and protocols

Configuration parameters: During the first installation and debugging, the following parameters

need to be verified or configured through the upper computer:

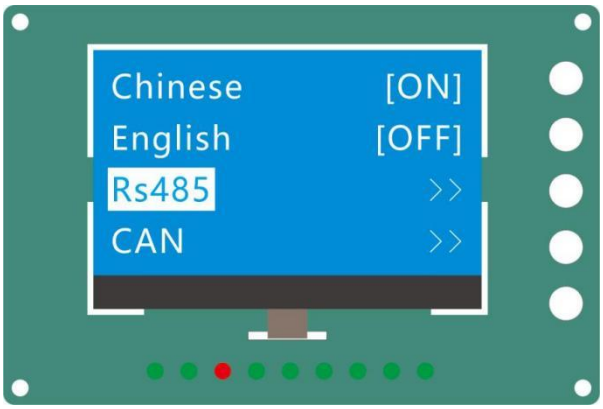
Parameters	Setting criteria
Rated capacity	based on the actual capacity
Max discharge current	based on the actual capacity
Max discharge current	based on the actual capacity



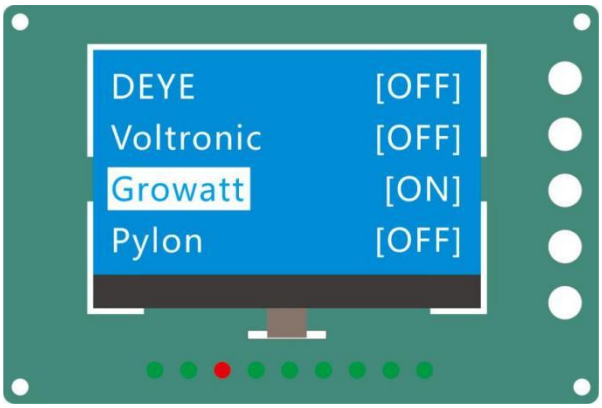
Configuration Protocol: The configuration protocol can be configured through the display screen or upper computer.

Display screen configuration protocol steps:

① Select "Settings" by flipping through "UP" and "DOWN", and press "ENTER" to enter the settings page, as shown below:



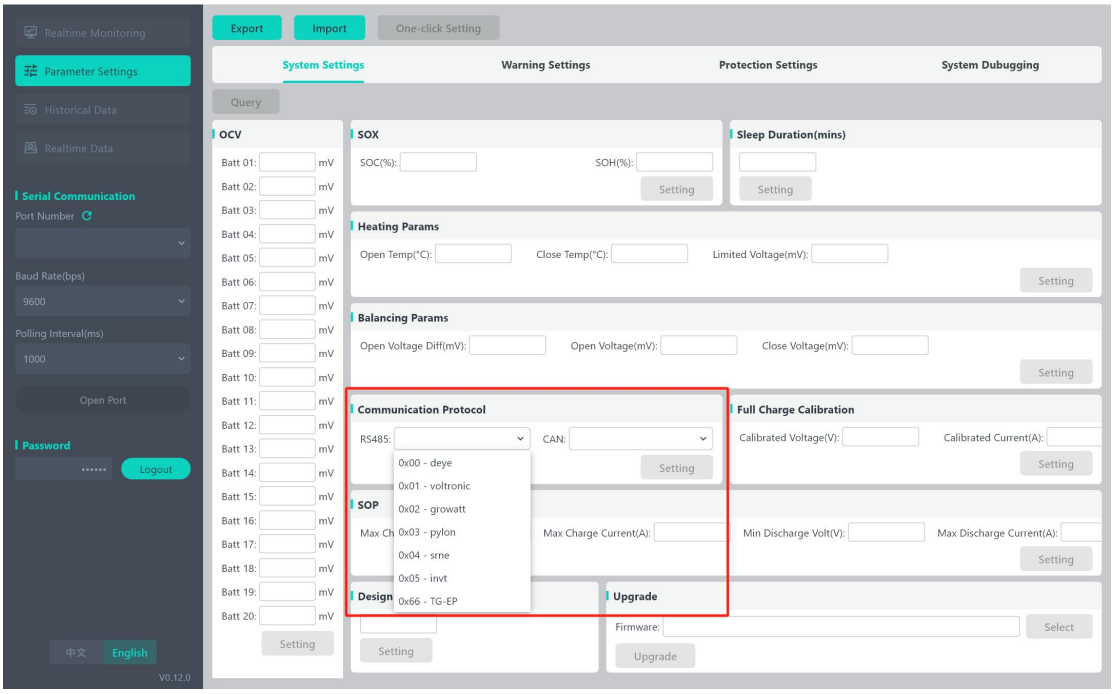
② Select the protocol type you want to set, such as "RS485", and press "ENTER" to enter the RS485 protocol selection page. As shown in the figure below, select the desired protocol name and press "ENTER" to switch "ON/OFF". Select "ON" to successfully set.



Upper computer Configuration Protocol:

On the upper computer "Parameter Settings" > "System Settings" page, find the "Communication Protocol" window, select the required protocol, and click "Set".

Please note that if either the "RS485" or "CAN" input box is empty, the setting cannot be successful. In this case, you can wait for the data to be read before clicking Set, or select a value in the input box that does not need to be set and then click Set.



7. Main function description

7.1.Voltage detection and protection

The single board supports 16-channel battery cell detection ports, with single cell voltage detection, total voltage detection, over-voltage, under-voltage alarm and protection functions, high detection accuracy, fast protection response, and different parameters can be set according to the characteristics of the battery cells used.

Single unit over-charge protection and recovery

When any section of the battery cell is higher than the set value of monomer overcharging protection, BMS enters into overcharging protection state, and the charging equipment can not charge the battery; after monomer over-voltage protection, the overcharging protection state will be lifted when the highest monomer voltage drops below the recovery value of monomer overcharging.

Total voltage over-charge protection and recovery

When the battery voltage is higher than the total voltage overcharge protection setting value, the BMS enters into the overcharge protection state, and the charging equipment can not charge the battery; the overcharge protection state is lifted when the total voltage drops below the total voltage overcharge recovery value.

Single over-discharge protection and recovery

When any battery cell is lower than the set value of single over-discharge protection, BMS enters into over-discharge protection state, and the load can't discharge the battery; after over-discharge protection occurs, charging the battery pack to reach the restoration value can

release the over-discharge protection state, or restart BMS through reset to re-test whether the battery pack voltage reaches the restoration value.

Total voltage over-discharge protection and recovery

When the battery voltage is lower than the total voltage over-discharge protection setting value, BMS enters into the over-discharge protection state, and the load can't discharge the battery; after the over-discharge protection occurs, charging the battery pack to reach the restoration value can release the over-discharge protection state, or re-testing whether the voltage of the battery pack reaches the restoration value after restarting the BMS through reset.

7.2.Current detection and protection

Support charging and discharging over-current alarm and protection, current alarm protection, current protection level differentiation, to realize different response time and protection logic under different current sizes, current detection accuracy ≤ ± 2%, current error within 50A not more than 1A, parameters can be set to adjust.

Charging over-current protection and recovery

When the charging current exceeds the charging over-current protection setting value and reaches the delay time BMS enters the charging over-current protection, the battery can not continue to charge; after the charging over-current protection, BMS automatically delays the recovery of the charging over-current protection, and re-detects the external charger current after the fault is lifted.

Discharge over-current protection and recovery

When the discharge current exceeds the setting value of discharge over-current protection and reaches the delay time, BMS enters into discharge over-current protection and the battery can not continue to be discharged; after the occurrence of discharge over-current protection, BMS automatically delays the recovery of discharge over-current protection, and re-tests the current of the external charger after the fault is lifted.

7.3.Temperature detection and protection

Support 5-channel core temperature detection, 1-channel Mos temperature detection, 1-channel ambient temperature detection, with charging and discharging high-temperature, low-temperature detection, alarm and protection, detection accuracy of not more than ± 3 ℃, parameters can be set to adjust.

Charging and discharging high temperature protection and recovery

When the temperature of any cell is higher than the set value of high temperature protection during charging and discharging, the BMS enters into high temperature protection and stops charging or discharging; when the temperature of all cells is lower than the high temperature recovery value, the BMS resumes charging or discharging.

Charging and discharging low temperature protection and recovery

When the temperature of the highest battery cell is lower than the low temperature protection setting value under charge/discharge state, BMS enters into low temperature protection and stops charging or discharging; when the temperature of all battery cells is higher than the low temperature recovery value, BMS resumes charging or discharging.

Ambient temperature protection, power temperature protection

When the detected ambient temperature is higher than the ambient high temperature setting value, the BMS enters the ambient high temperature protection and the BMS stops charging and discharging; when the detected power temperature is higher than the power protection setting value, the BMS enters the power high temperature protection and the BMS stops charging and discharging.

7.4.Equalization function

In standby and charging state, when the cell voltage difference exceeds the equalization start voltage difference, and the highest cell voltage is higher than the equalization start voltage, the equalization function is turned on, and the passive equalization current will be 100mA, which will keep the consistency of the voltage of the battery cell and improve the efficiency of the use of the battery and the cycle life; the equalization will be stopped when the difference of the voltage of the battery cell is less than the set value.

7.5.Pre-charging function

Built-in pre-charging circuit, the pre-charging function is activated at the moment of power-on, avoiding the large current generated at the moment of discharging, resulting in output over-current protection.

7.6.Communication function

Support RS485, RS232, CAN, and can be extended according to the needs of the use of WIFI, communication for parallel connection of multiple machines, as well as connecting with the host computer.

7.7.SOC calculation and calibration

SOC detection accuracy $\leqslant \pm 5\%$, support online SOC calibration and local SOC calibration, when SOC deviation reduces cycle efficiency, the system automatically calibrates to ensure that SOC accuracy meets the requirements and improve the use of efficiency.

7.8.Dry contact control

Dry contact 1 (K1): Normally open, closed when the system has a low SOC alarm;
Dry contact 2 (K2): Normally open, closed when the system has a fault protection.

8. 8.Version comparison table

Specification	Hardware	Mainboard program	Display program	Host computer
V1.4	A4	V1.1.5	V2.9	V0.12.0
V1.7	A6	V2.2.8	V2.9	V0.12.3
V1.8	A7	V2.9.3	V2.9	V0.12.3

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