HV Energy Storage

BMS Solution Specification

(16S Each Pack)

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2025-4-25	2025-4-25	2025-4-25

Revision History			
Date	Revised Version	Revision Note	Reviser
2025-2-22	V1.0	Newly formulate	Bin
2025-4-25	V1.1	Communication terminal optimization	Bin

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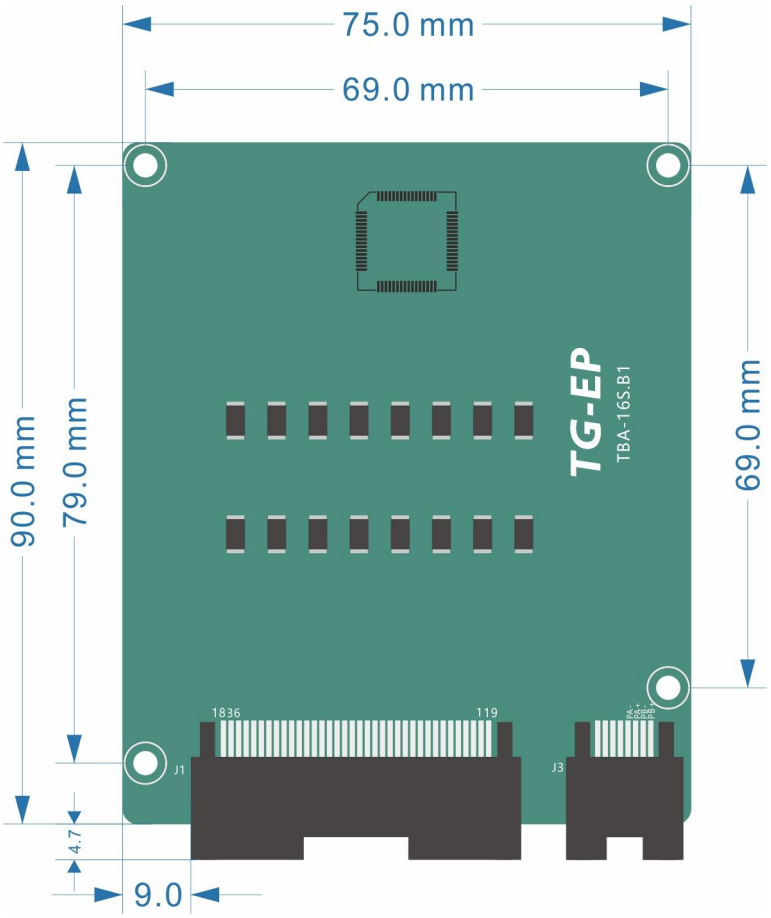
1. Overview of the solution

This BMS solution is suitable for the 2 levels control of high voltage energy storage system, which manages the battery cluster. Configure the battery PACKs through Daisy chain communication to provide different capacity options. It can realize a variety of fault alarm and protection, and can use the upper computer for parameter setting and fault diagnosis.

2. TBA-M16S Hardware description

2.1. Main board dimension drawing



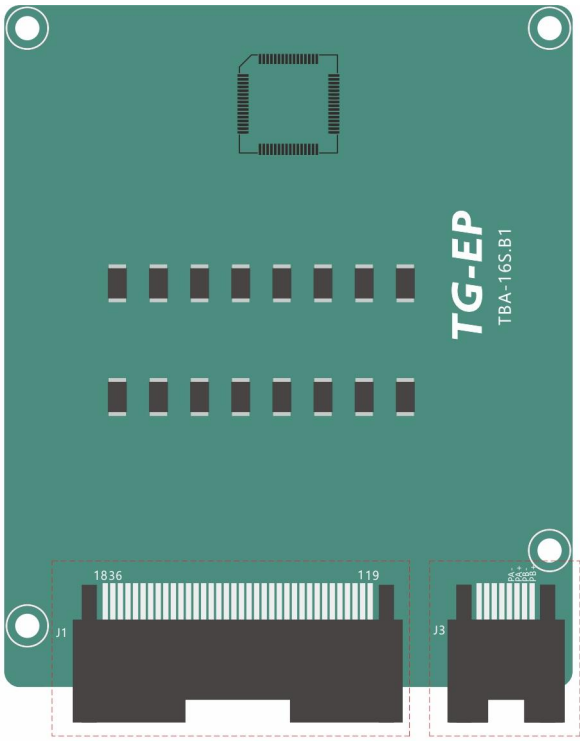
2.2. Hardware parameter list

Index item	Parameter
Overall dimensions of main board	75*90mm

Operating voltage	36V ~ 60V （AFE）
Working power consumption	Normal working power consumption ≤ 10ma; Sleep power consumption ≤300uA
Number of single cell voltage detection channels	16 road
Monomer voltage detection	0 ~ 5VDC，≤±10mV
Number of temperature detection channels	7 channels of battery cell temperature detection, ≤ 2℃,-40℃ ~ 125℃
Single cell equalization mode	Passive discharge equalization, 100 ma 20%
Correspondence	Daisy chain
Working power consumption	Normal working power consumption ≤ 10ma; Sleep power consumption ≤300uA

2.3.Main board port function

2.3.1. Port function diagram



J1:Sampling port　　J3:Daisy chain communication port

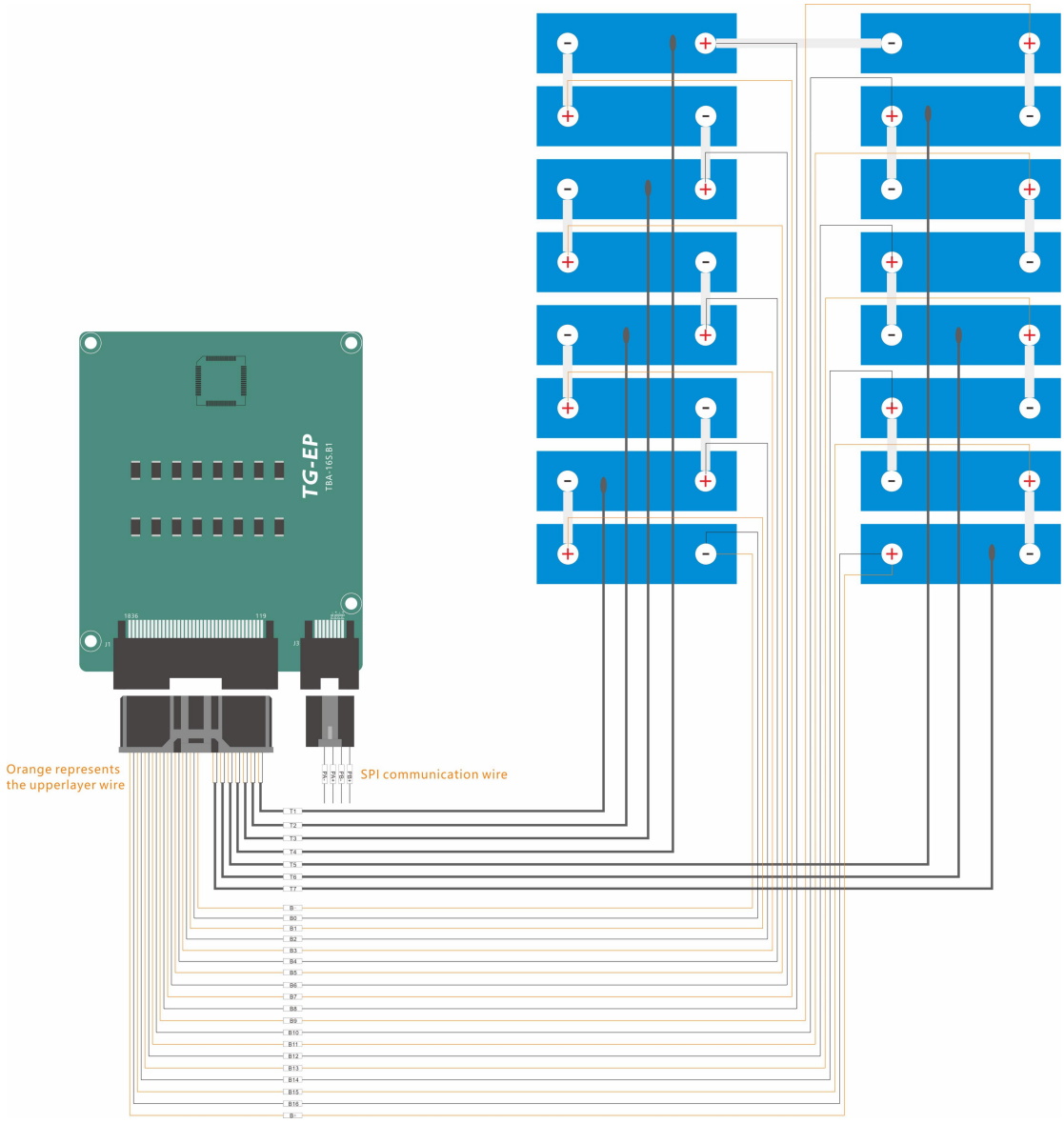
2.3.2. Port definition table

Port	Functional description	Remarks
J1: Sampling port		

Port		Functional description	Remarks
J1-1	RT1	Temp-1 detection	
J1-2	RT2	Temp-1 detection	
J1-3	RT3	Temp-3 detection	
J1-4	RT4	Temp-4 detection	
J1-5	RT5	Temp-5 detection	
J1-6	RT6	Temp-6 detection	
J1-7	RT7	Temp-7 detection	
J1-8	GND	GND	
J1-9	B-	AFE power supply negative	
J1-10	B1	1# cell positive pole	
J1-11	B3	3# cell positive pole	
J1-12	B5	5# cell positive pole	
J1-13	B7	7# cell positive pole	
J1-14	B9	9# cell positive pole	
J1-15	B11	11# cell positive pole	
J1-16	B13	13# cell positive pole	
J1-17	B15	15# cell positive pole	
J1-18	B+	AFE power supply positive	
J1-19	GND	GND	
J1-20	GND		
J1-22	GND		
J1-22	GND		
J1-23	GND		
J1-24	GND		
J1-25	GND		
J1-26	GND		
J1-27	GND		
J1-28	B0	Battery negative	

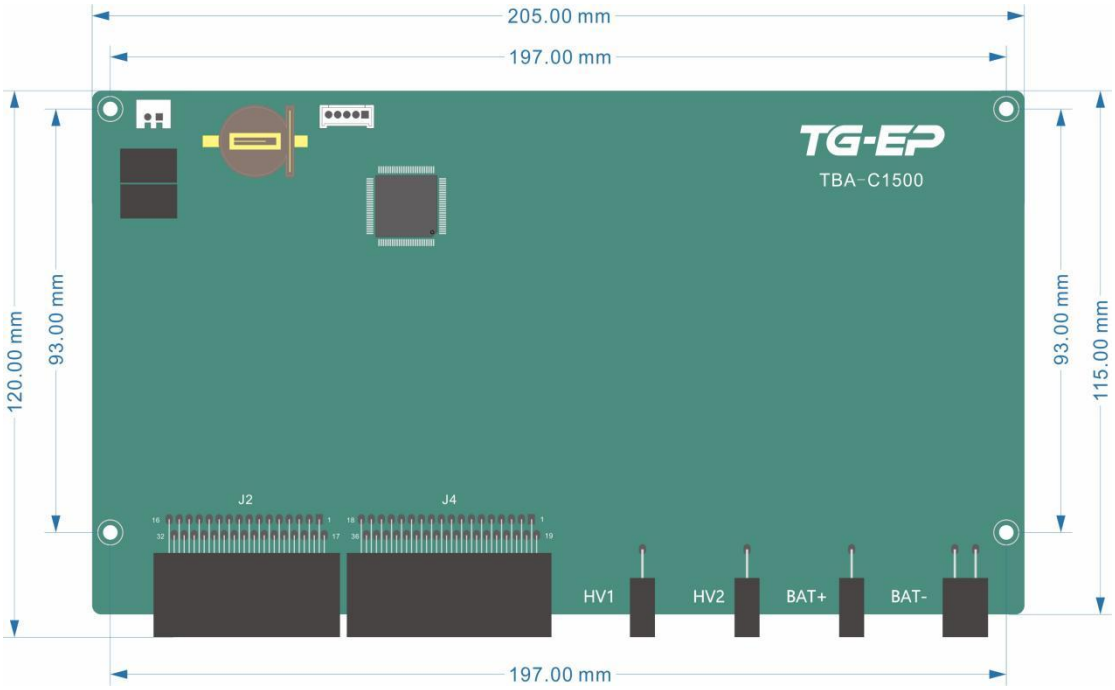
Port		Functional description	Remarks
J1-29	B2	2# cell positive pole	
J1-30	B4	4# cell positive pole	
J1-31	B6	6# cell positive pole	
J1-32	B8	8# cell positive pole	
J1-33	B10	10# cell positive pole	
J1-34	B12	12# cell positive pole	
J1-35	B14	14# cell positive pole	
J1-36	B16	16# cell positive pole	
J3 Communication Port			
J3-1	PA-	Daisy chain output negative	
J3-2	PA+	Daisy chain output positive	
J3-3	PB-	Daisy chain input negative	
J3-4	PB+	Daisy chain input positive	

2.4. Sampling Wiring Diagram



3. TBA-C1500 Hardware description

3.1.Main board dimension drawing

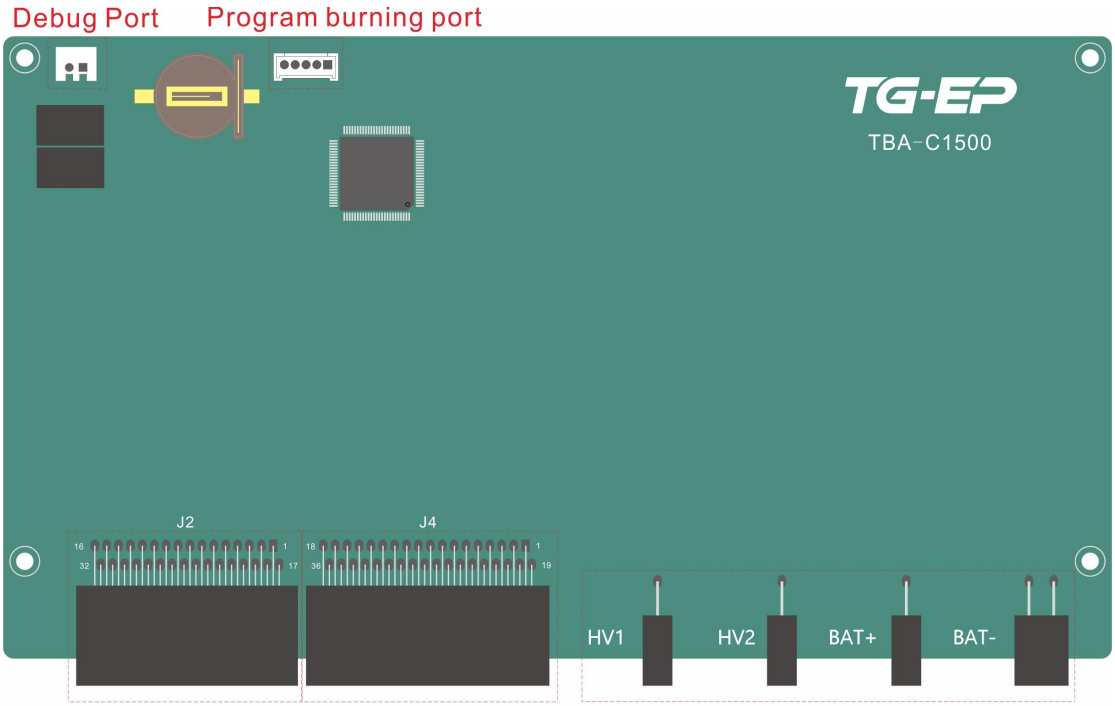


3.2. Hardware parameter list

Index item	Parameter
Overall dimensions of main board	205*115mm
Operating voltage	9 ~ 30 VDC (matching the working power supply range of hardware)
SOC accuracy	≤ 5%, according to YD/T2344.1-2011.
Data storage	≥ 10,000 historical data records
Pre-charging function	Have
Charging current limiting	Have
Upper computer	Have
Program upgrade	Have
Communication methods	CAN, RS485, WIFI (extended), 4G (extended)

3.3.Main board port function

3.3.1. Port function diagram

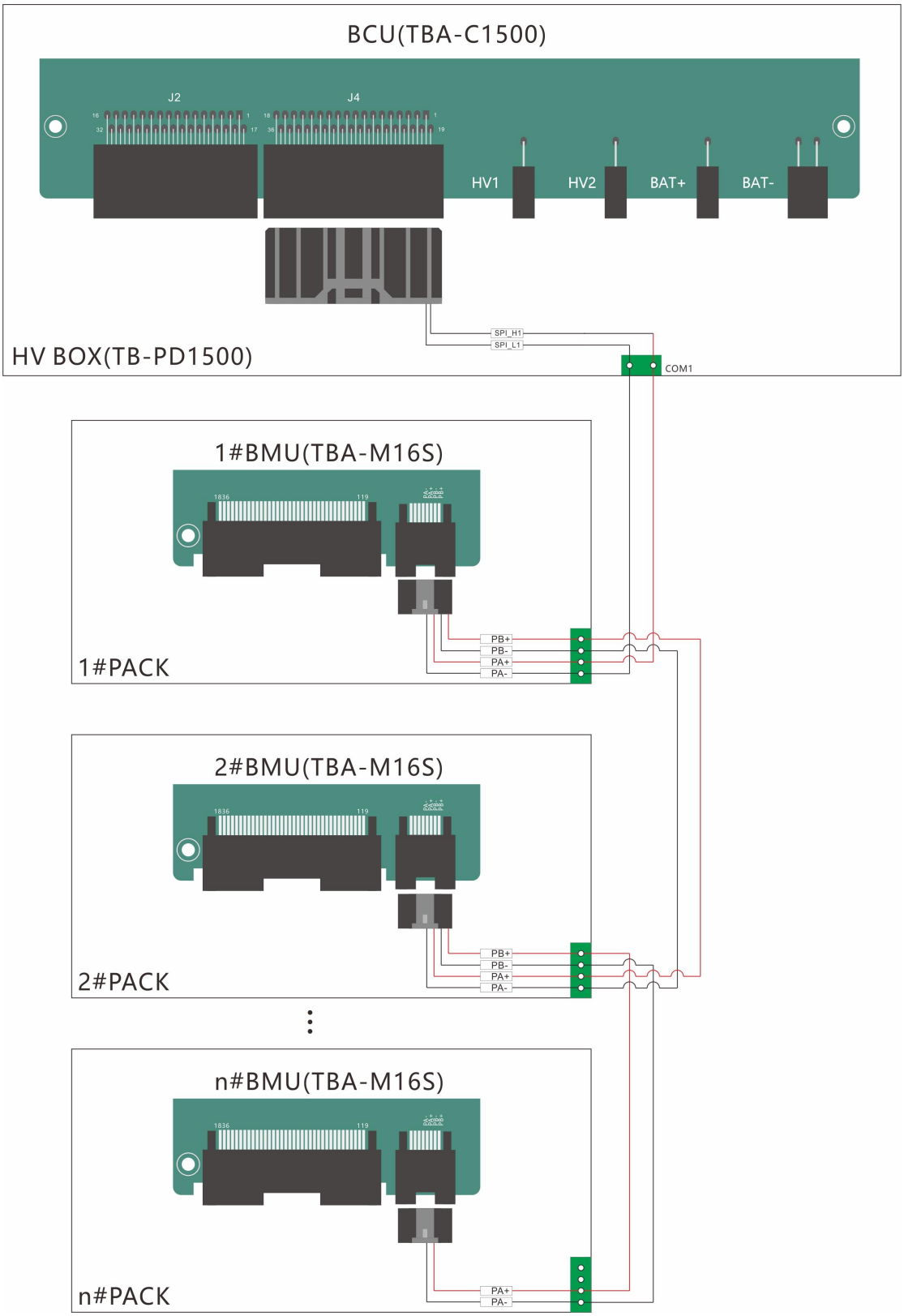


3.3.2. Port definition table

Post	Bit number	Definition	Bit number	Definition
J2	1	/	17	PE
	2	HALL_I2	18	HALL_I1
	3	HALL_5V+	19	HALL_5V-
	4	DIH1	20	GND
	5	DIH2	21	SW1_OUTA
	6	DIH3	22	SW1_OUTB
	7	WKUP	23	SW2_OUTA
	8	DOL1	24	SW2_OUTB
	9	DOL2	25	SW3_OPA
	10	DOL3	26	SW3_OPB
	11	DOH1	27	GND
	12	DOH2	28	GND

	13	DOH3	29	GND
	14	DOH4	30	GND
	15	PW+	31	PW+
	16	PW-	32	PW-
J4	1	SPI_L1	19	SPI_H1
	2	SPI_L2	20	SPI_H2
	3	CAN1H	21	CAN1R
	4	GND_CAN1	22	CAN1L
	5	CAN2H	23	CAN2R
	6	GND_CAN2	24	CAN2L
	7	CAN0L	25	CAN0H
	8	485A1	26	GND_CAN0
	9	GND_4851	27	485B1
	10	485B2	28	485A2
	11	DIL1	29	GND_4852
	12	DIL3	30	DIL2
	13	GND	31	DO_ADR
	14	SW1_IN-	32	SW1_IN+
	15	SW2_IN-	33	SW2_IN+
	16	TEMP2	34	TEMP1
	17	TEMP4	35	TEMP3
	18	TGND	36	TGND
HV1	1	High voltage sampling 1	2	/
HV2	1	High voltage sampling 2	2	/
BAT+	1	High voltage sampling positive	2	/
NE	1	Shunt input negative (IS-)	2	High voltage sampling negative (BAT-)
	3	Shunt input positive (IS+)	4	/

3.4. Master-slave Communication Wiring Diagram



4. Display Installation Instructions

4.1. Display Appearance (7 inch)

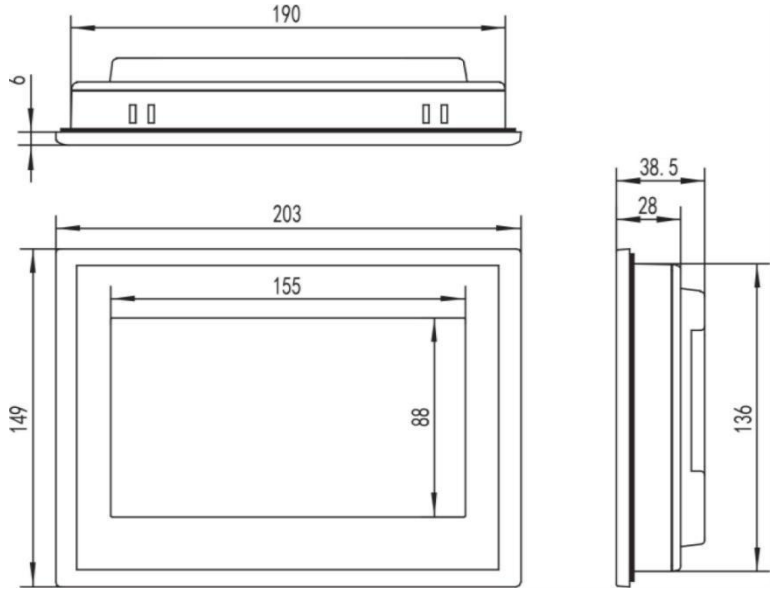
4.1.1. Product Specifications

Category	Details	Parameter

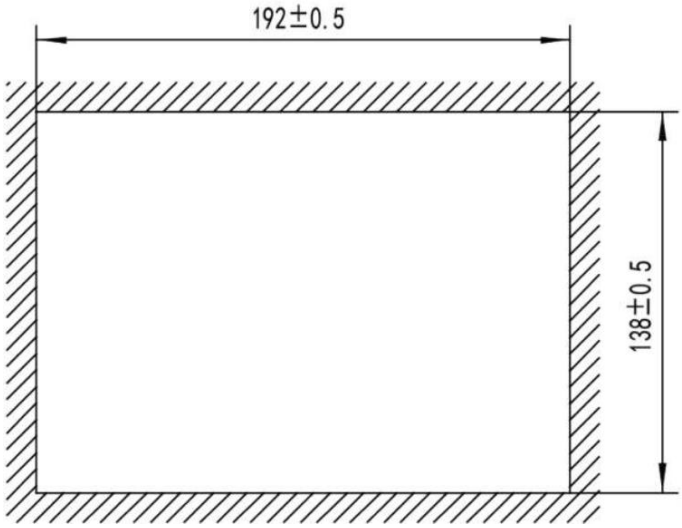
Product feature	LCD Screen	7"TFT
	Backlight Type	LED
	Resolution	800 x480
	Display Brightness	250cd/m
	Touch screen	4-Wire Resistive
	Input Voltage	24±20%VDC
	Rated Power	5W
	Processor	ARM 600MHz
	Memory	64MB
	System Storage	128MB
	Storage Space	8M
	Hardware Clock	Built-in
Environmental Conditions	Operating Temperature	0℃~45℃
	Operating Humidity	5%~90%(Non-condensing)
	Storage Temperature	-10℃~60℃
	Storage Humidity	5%~90%Non-condensing)
Product Specifications	Enclosure Color	Black
	External Dimensions	203*149mm
	Cutout Dimensions	192*138mm
	Display Dimensions	155*88mm

4.1.2. Product Dimensions

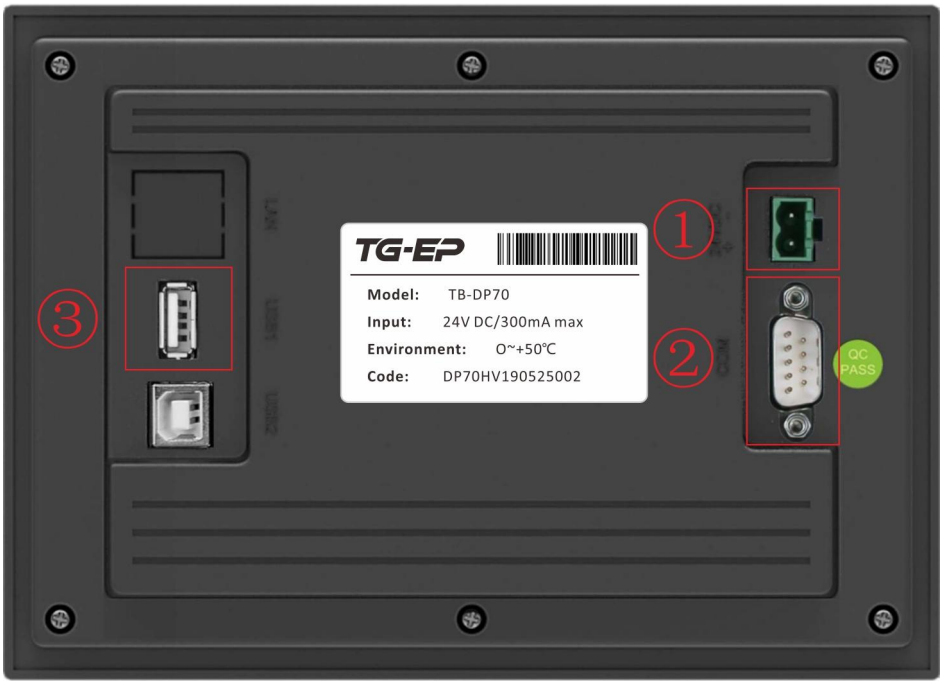
External Dimensions:



Cutout Dimensions:

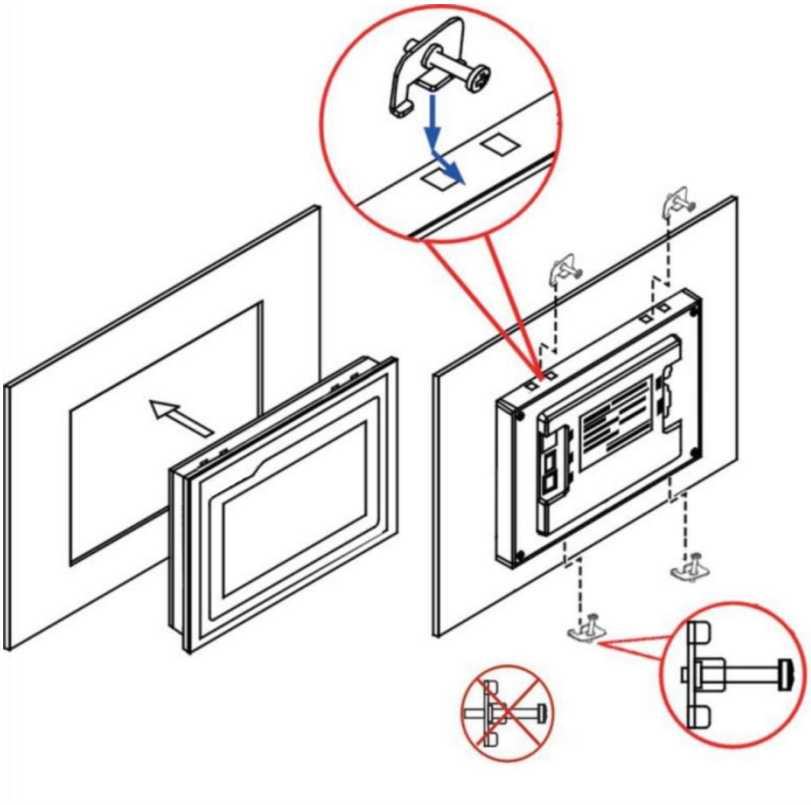


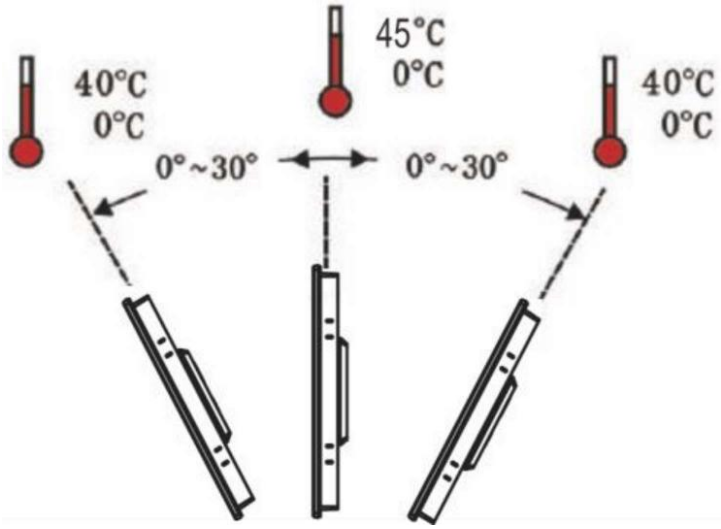
4.1.3. Port Definitions



Port	Name	Definition	Function
①	Power	DC24V/0V	Power supply for the touch screen
②	Communication	RS485+/RS485-	Communication with BMS
③	USB	Firmware upgrade; Data export	

4.1.4. Installation Diagram





Installation Angle

4.2. Display Appearance (4.3 inch)

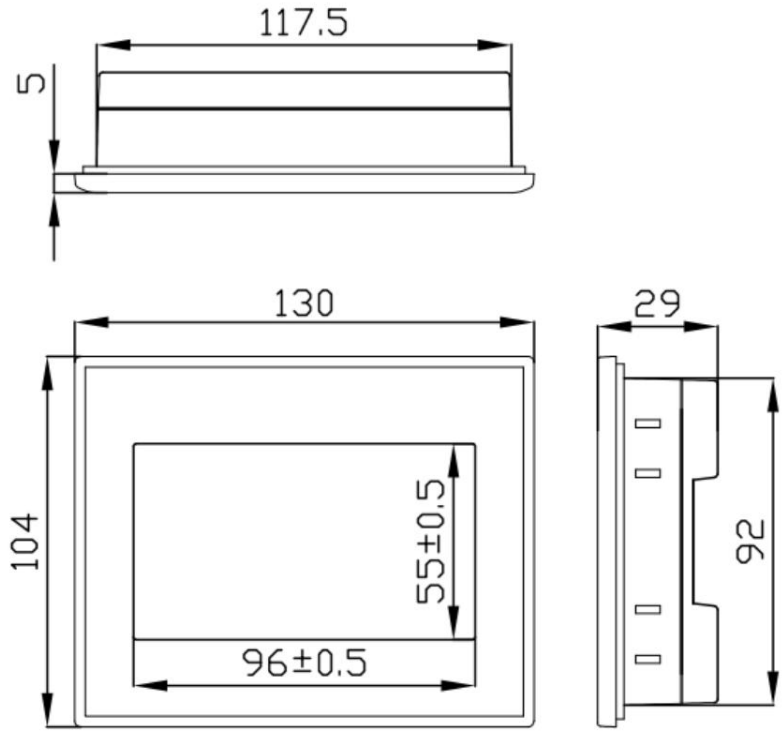
4.2.1. Product Specifications

Category	Details	Parameter

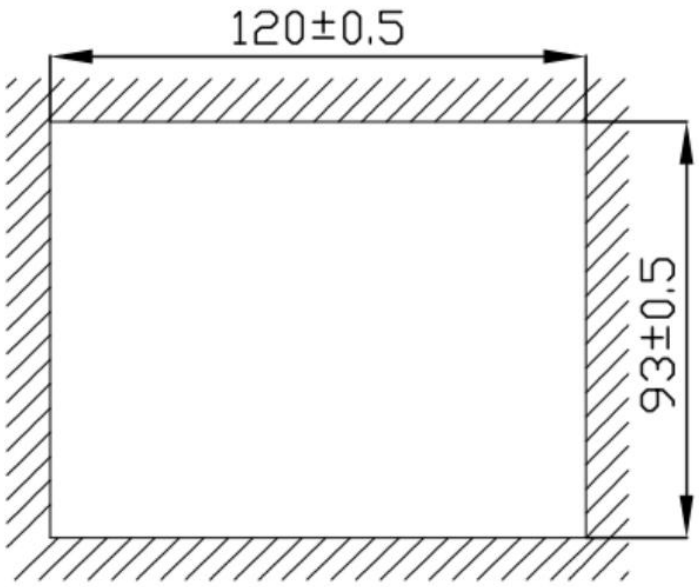
Product feature	LCD Screen	4.3"TFT
	Backlight Type	LED
	Resolution	480 x272
	Display Brightness	350cd/m
	Touch screen	4-Wire Resistive
	Input Voltage	24±20%VDC
	Rated Power	4W
	Processor	ARM 600MHz
	Memory	64MB
	System Storage	128MB
	Storage Space	8M
	Hardware Clock	Built-in
Environmental Conditions	Operating Temperature	0℃~45℃
	Operating Humidity	5%~90%(Non-condensing)
	Storage Temperature	-10℃~60℃
	Storage Humidity	5%~90%Non-condensing)
Product Specifications	Enclosure Color	Black
	External Dimensions	130*104mm
	Cutout Dimensions	120*93mm
	Display Dimensions	96*55mm

4.2.2. Product Dimensions

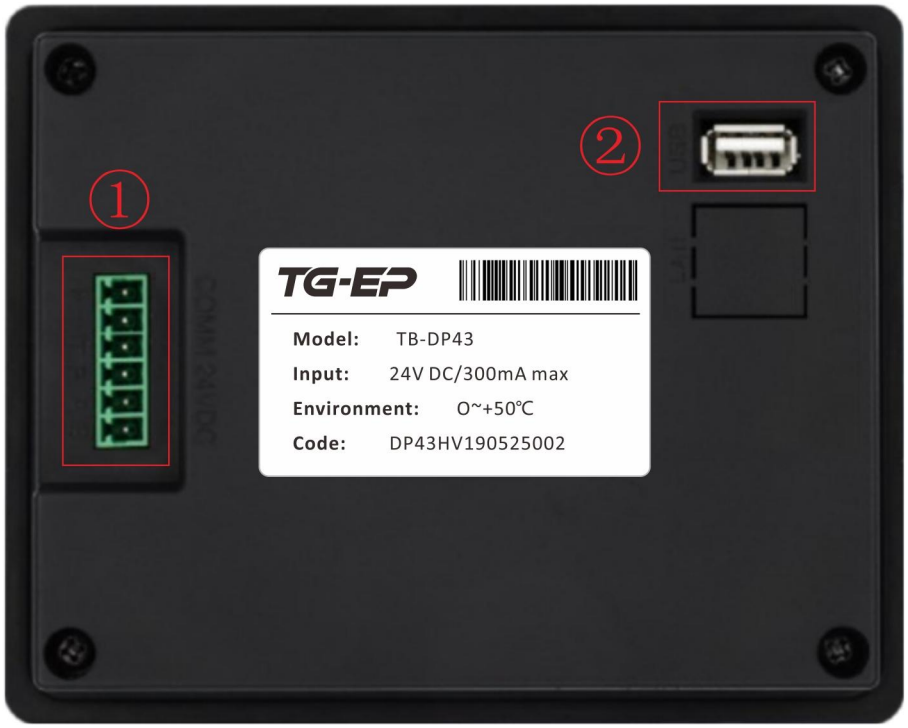
External Dimensions:

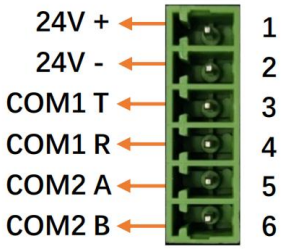


Cutout Dimensions:

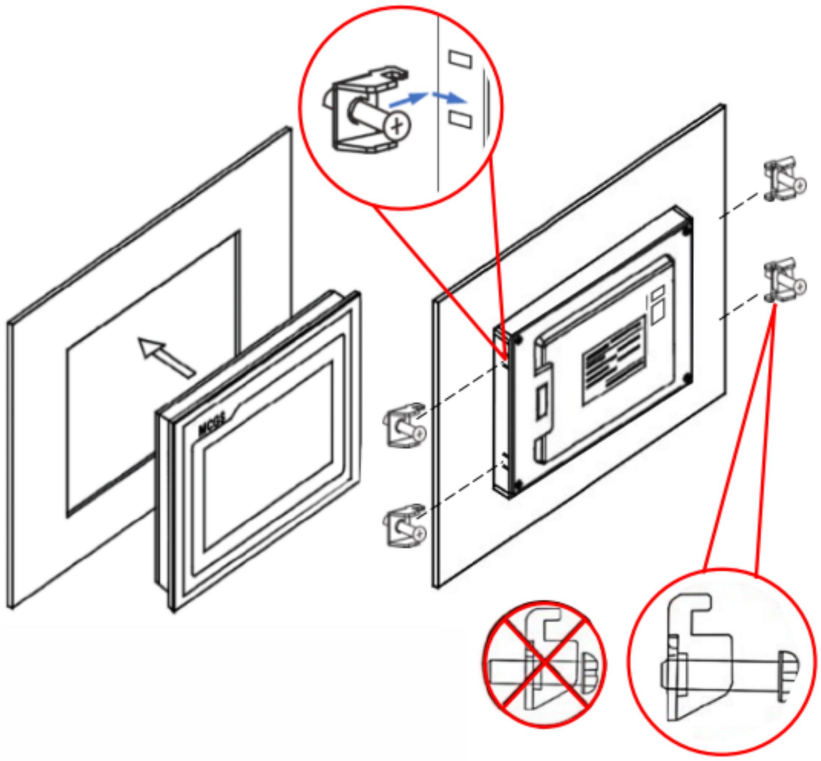


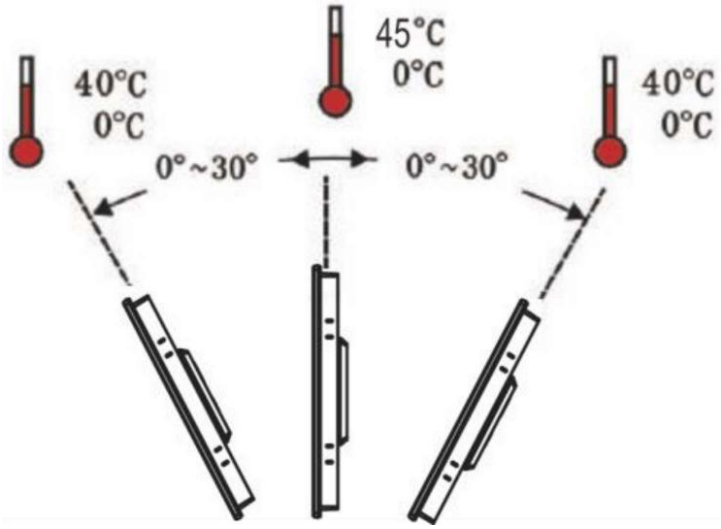
4.2.3. Port Definitions



Port	Name		Definition		Function
①	Power		1	+	DC24V
			2	-	0V
	Communi cation		4	COM1	RS232 RXD
			3		RS232 TXD
			2		GND(0V)
			5	COM2	RS485+
			6		RS485-
②	USB	Firmware upgrade; Data export			

4.2.4. Installation Diagram



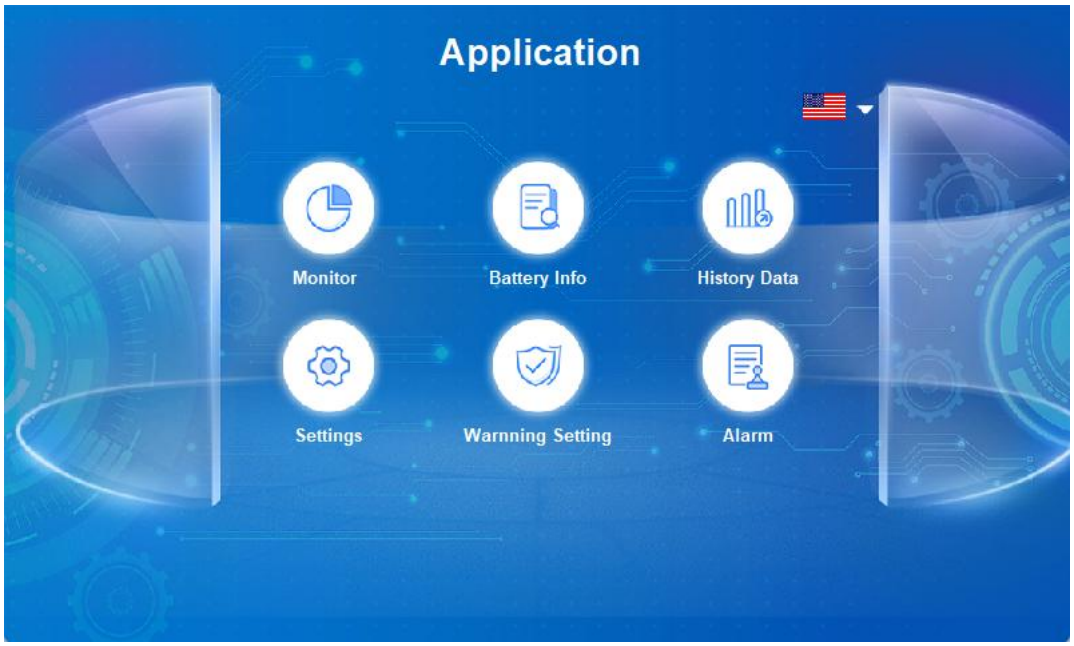


Installation Angle

5. Display Operation Instructions

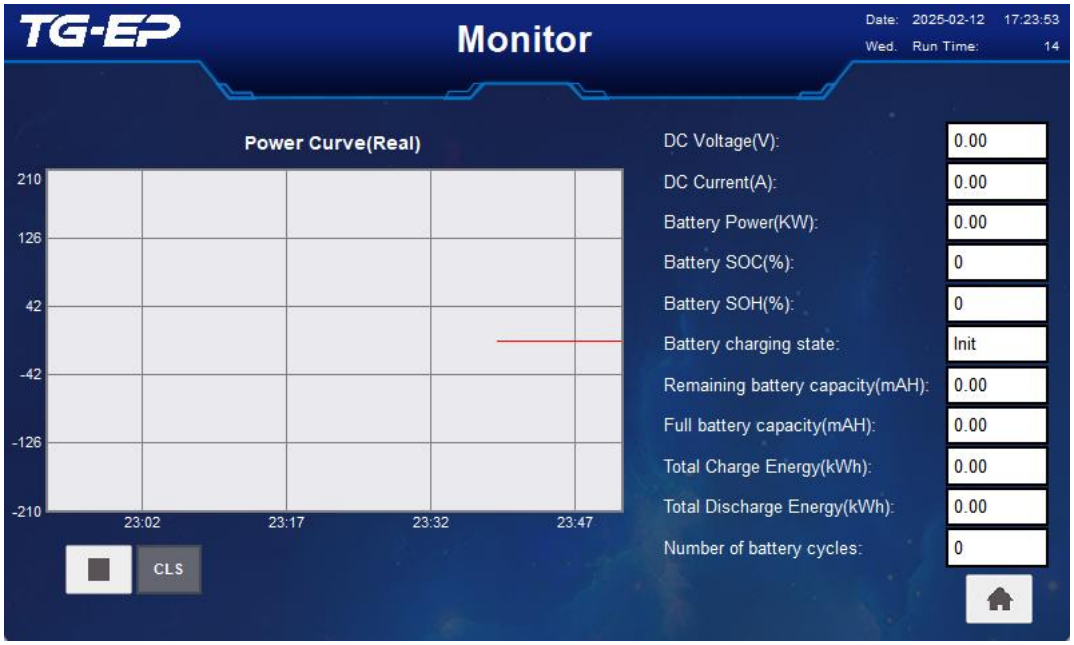
5.1. Application Home Page

As shown below, the application home page mainly includes six functional entries: "Status Monitoring", "Battery Information", "Historical Data", "Parameter Settings", "Alarm Settings", and "Fault Information". Additionally, the language can be switched between Chinese and English on this page.



5.2. Status Monitoring

As shown below, The status monitoring page displays the following information: Power curve and key data of Battery Pack.



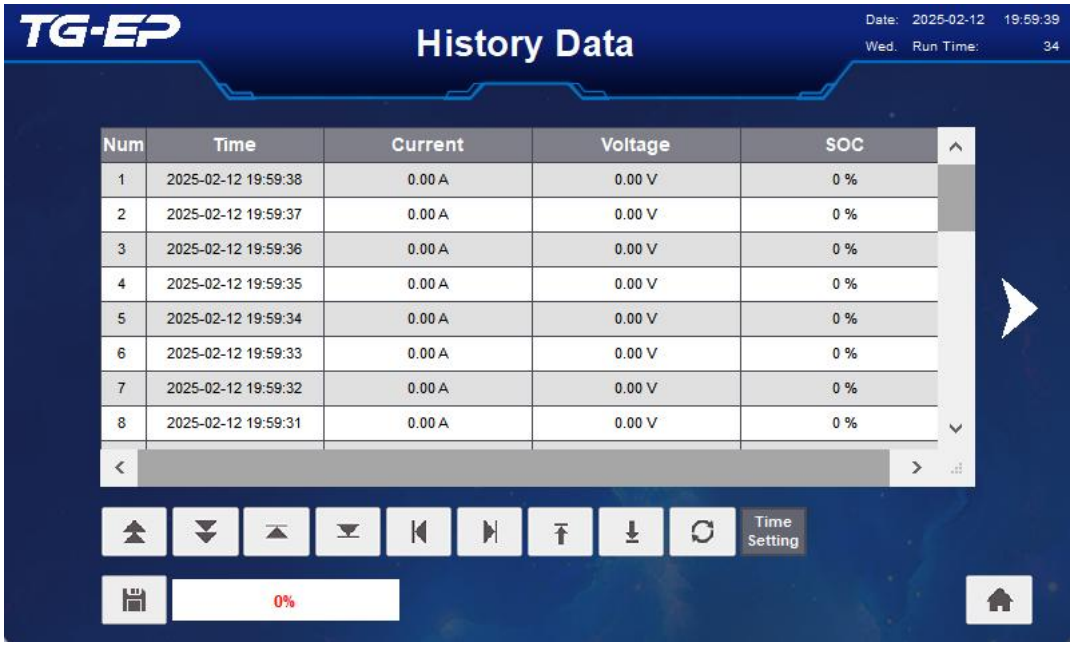
5.3. Battery Information

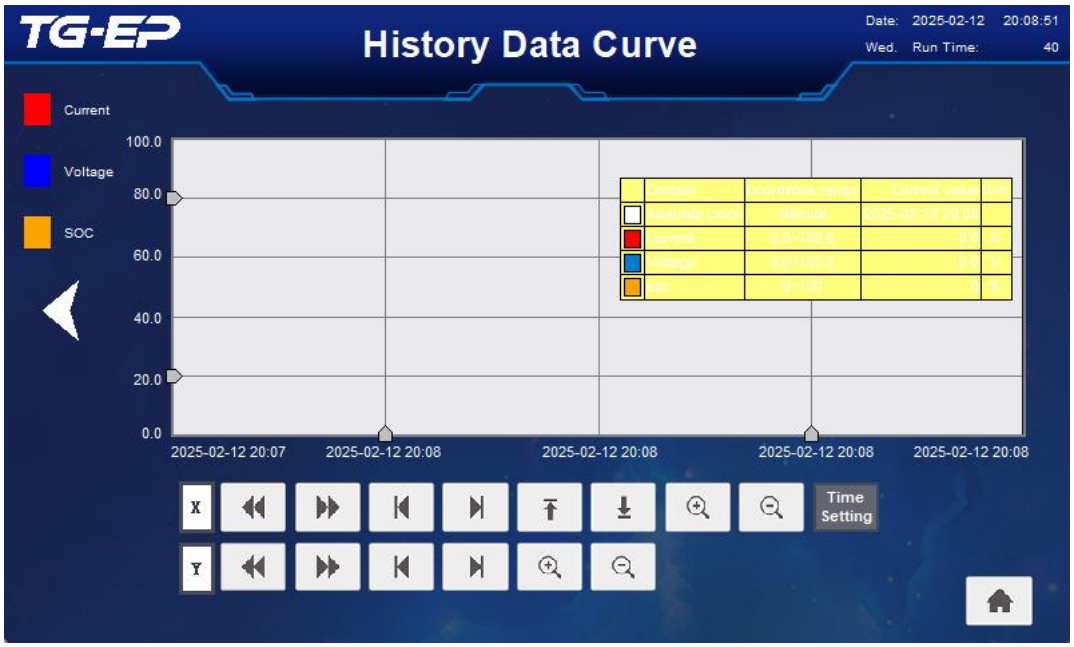
As show below, the battery information page provides detailed data for both the battery pack and battery modules.

5.4. Historical Data

As shown below, The historical data page allows users to query historical data for "Current", "Voltage" and "SOC" . Additionally, historical data trends can be analyzed by

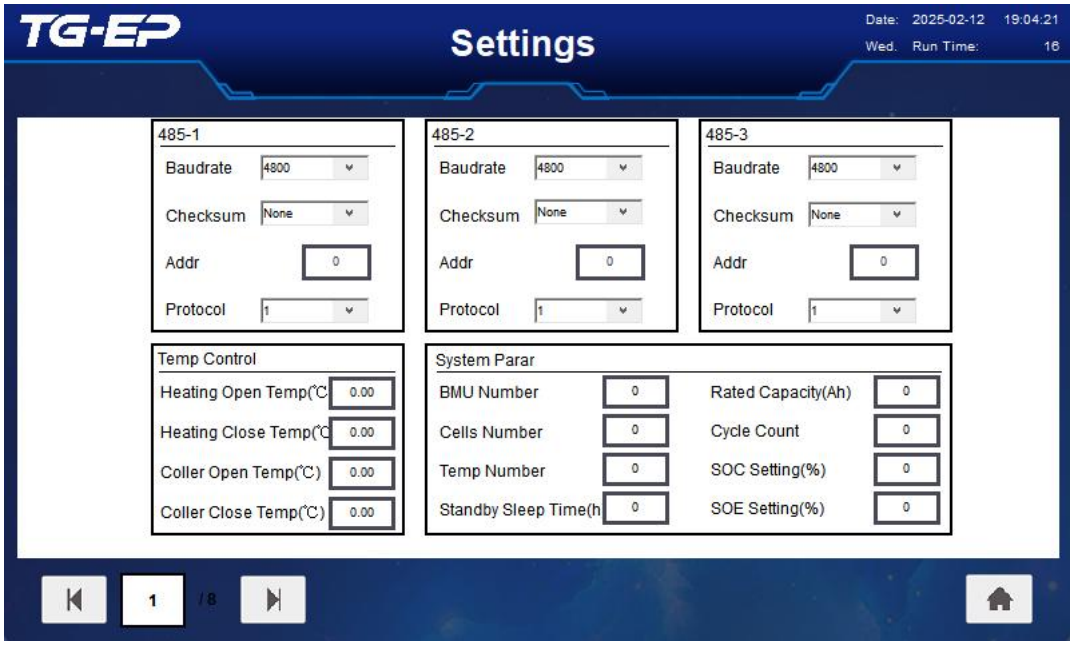
viewing historical data curves.





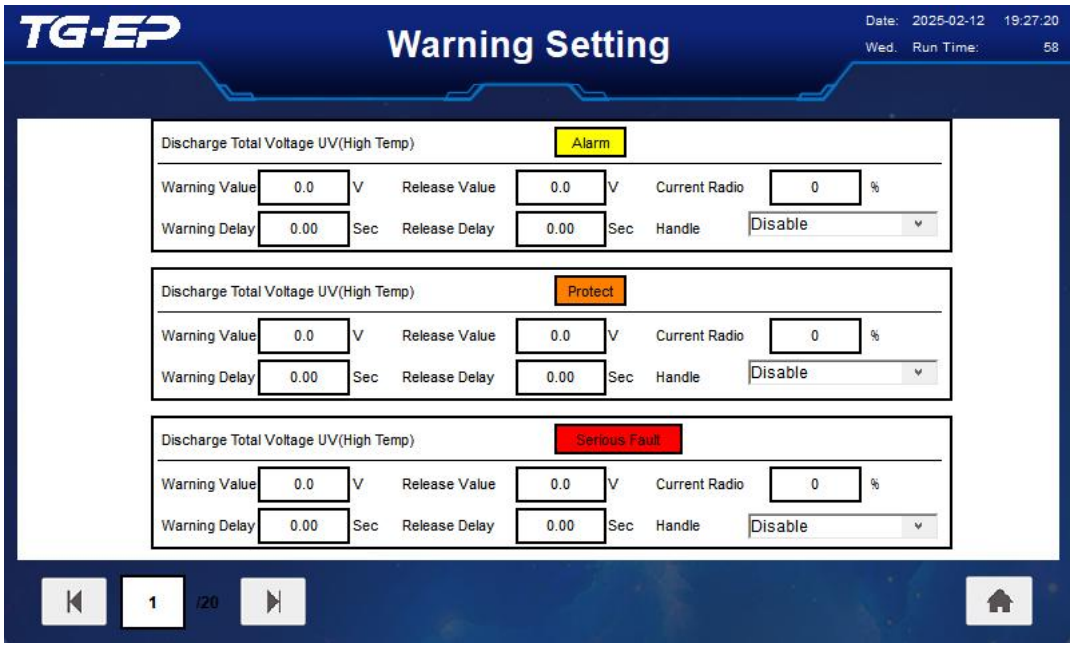
5.5. Parameter settings

As shown below, The parameter settings page allows configuration of all adjustable parameters. For a complete list of parameters, refer to the TBA-C1500 Specification Document.



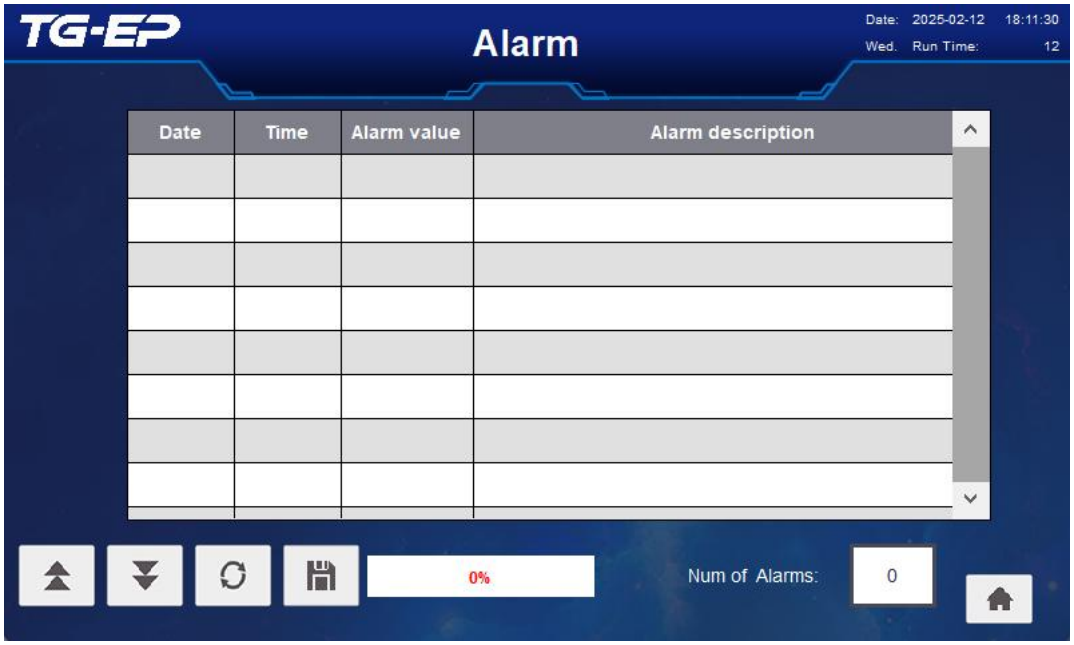
5.6. Alarm Settings

As shown below, The alarm settings page allows configuration of all alarm-related parameters. For a complete list of alarm parameters, refer to the TBA-C1500 Specification Document.



5.7. Fault Query

As shown below, The fault query page displays all recorded fault information.



6. BCU Parameter list

In battery faults, Level 1 indicates a minor fault, Level 2 indicates a moderate fault, and Level 3 indicates a severe fault.

Alarm: When a fault is triggered, the alarm status is reported. When the release conditions are met, the alarm status is cleared.

Relay Disconnection: When a fault is triggered, the alarm status is reported, and the relay is disconnected. When the release conditions are met, the alarm status is cleared, and the relay is reconnected.

Restart Release: When a fault is triggered, the alarm status is reported, and the relay is disconnected. When the release conditions are met, the alarm status is not cleared, and the relay remains disconnected until a power cycle is performed.

6.1. Alarm Trigger

1. During charging, monitor charging alarms and general alarms.

Trigger the charging or general alarm :

the current battery parameter value ≥ fault value and the duration ≥ delay time.

2. During discharging, monitor discharging alarms and general alarms.

Trigger the discharging or general alarm :

the current battery parameter value ≥ fault value and the duration ≥ delay time.

3. During standby, monitor general, charging, and discharging alarms.

Trigger the charging/discharging or general alarm:

the current battery parameter value ≥ fault value and the duration ≥ delay time.

6.2. Alarm Release

1. The fault is released (including charging, discharging, and general alarms) if the current battery parameter value < release value and the duration ≥ delay time.

2. During discharging, charging alarms are cleared.

3. During charging, discharging alarms are cleared.

6.3. Charge/Discharge Alarm Parameter

Fault Name	Fault Level	Fault Value	Delay	Release Value	Dela y	Reduce Current	Trigger
Discharge Total Voltage Under-voltage	1 level	2.90*Total Cells	3S	3.10*Total Cells	3S	No reduction	Alarm
	2 level	2.80*Total Cells	3S	3.00*Total Cells	3S	Reduce current to 0	Alarm
	3 level	2.70*Total Cells	3S	2.90*Total Cells	3S	Reduce current to 0	Relay disconnection
Discharge Cell Under-voltage	1 level	2.90V	3S	3.10V	3S	No reduction	Alarm
	2 level	2.80V	3S	3.00V	3S	Reduce current to 0	Alarm
	3 level	2.70V	3S	2.90V	3S	Reduce current to 0	Relay disconnection
Discharge Over-current	1 level	Rated current A	3S	Rated current-10A	3S	No reduction	Alarm

Fault Name	Fault Level	Fault Value	Delay	Release Value	Dela y	Reduce Current	Trigger
	2 level	Rated current+20A	3S	Rated current	3S	Reduce current to 0	Alarm
	3 level	Rated current+50A	3S	Rated current+20A	3S	Reduce current to 0	Relay disconnection
Discharge High Temperature	1 level	50℃	3S	45℃	3S	No reduction	Alarm
	2 level	55℃	3S	50℃	3S	Reduce current to 0	Alarm
	3 level	60℃	3S	55℃	3S	Reduce current to 0	Relay disconnection
Discharge Low Temperature	1 level	-5℃	3S	0℃	3S	No reduction	Alarm
	2 level	-10℃	3S	-5℃	3S	Reduce current to 0	Alarm
	3 level	-20℃	3S	-10℃	3S	Reduce current to 0	Relay disconnection
Discharge Voltage Difference	1 level	0.4V	3S	0.35V	3S	No reduction	Alarm
	2 level	0.6V	3S	0.55V	3S	Reduce current to 0	Alarm
	3 level	1.0V	3S	0.95V	3S	Reduce current to 0	Relay disconnection
Discharge Temperature Difference	1 level	10℃	3S	7℃	3S	No reduction	Alarm
	2 level	13℃	3S	10℃	3S	Reduce current to 0	Alarm
	3 level	15℃	3S	12℃	3S	Reduce current to 0	Relay disconnection
Low SOC During Discharge	1 level	15%	3S	17%	3S	No reduction	Alarm
Charge Total Voltage Under-voltage	1 level	3.55*Total Cells	3S	3.40*Total Cells	3S	No reduction	Alarm
	2 level	3.60*Total Cells	3S	3.45*Total Cells	3S	Reduce current to 0	Alarm
	3 level	3.65*Total Cells	3S	3.55*Total Cells	3S	Reduce current to 0	Relay disconnection
Charge Cell Under-voltage	1 level	3.55V	3S	3.40V	3S	No reduction	Alarm
	2 level	3.60V	3S	3.45V	3S	Reduce current to 0	Alarm
	3 level	3.65V	3S	3.55V	3S	Reduce current to 0	Relay disconnection

Fault Name	Fault Level	Fault Value	Delay	Release Value	Delay	Reduce Current	Trigger
Charge Over-current	1 level	Rated current+00A	3S	Rated current-20A	3S	No reduction	Alarm
	2 level	Rated current+20A	3S	Rated current	3S	Reduce current to 0	Alarm
	3 level	Rated current+50A	3S	Rated current+20A	3S	Reduce current to 0	Relay disconnection
Charge High Temperature	1 level	45℃	3S	40℃	3S	No reduction	Alarm
	2 level	50℃	3S	45℃	3S	Reduce current to 0	Alarm
	3 level	55℃	3S	50℃	3S	Reduce current to 0	Relay disconnection
Charge Low Temperature	1 level	5℃	3S	10℃	3S	No reduction	Alarm
	2 level	0℃	3S	5℃	3S	Reduce current to 0	Alarm
	3 level	-5℃	3S	0℃	3S	Reduce current to 0	Relay disconnection
Charge Voltage Difference	1 level	0.4V	3S	0.35V	3S	No reduction	Alarm
	2 level	0.6V	3S	0.55V	3S	Reduce current to 0	Alarm
	3 level	1.0V	3S	0.95V	3S	Reduce current to 0	Relay disconnection
Charge Temperature Difference	1 level	10℃	3S	7℃	3S	No reduction	Alarm
	2 level	13℃	3S	10℃	3S	Reduce current to 0	Alarm
	3 level	15℃	3S	12℃	3S	Reduce current to 0	Relay disconnection

6.4. General Alarm Parameter

Fault Name	Fault Level	Fault Value	Delay	Release Value	Delay	Reduce Current	Trigger
Insulation Fault	1 level	500Ω/V	3S	600Ω/V	3S	No reduction	Alarm
	2 level	350Ω/V	3S	450Ω/V	3S	Reduce current to 0	Alarm
	3 level	200Ω/V	3S	300Ω/V	3S	Reduce current to 0	Relay disconnection
T1 High	/	60℃	3S	50℃	3S	Reduce	Relay

Fault Name	Fault Level	Fault Value	Delay	Release Value	Delay	Reduce Current	Trigger
Temperature						current to 0	disconnection
T1 Low Temperature	/	-5℃	3S	-2℃	3S	Reduce current to 0	Relay disconnection
T2 High Temperature	/	60℃	3S	50℃	3S	Reduce current to 0	Relay disconnection
T2 Low Temperature	/	-5℃	3S	-2℃	3S	Reduce current to 0	Relay disconnection
High Voltage Anomaly		30V	15S	10V	3S	Reduce current to 0	Restart to release
Master-Slave Communication Fault	/	Mismatch between configured and online slave devices.	20S	Match between configured and online slave devices.	5S	Reduce current to 0	Relay disconnection
Standby Sleep	Standby Sleep Delay			1440min			
	Standby Sleep Current			2A			
Balance	Turn-on voltage			3450mV			Turn-on after 1 hour of inactivity
	Turn-on Voltage Difference			40mV			
	Turn-off Voltage Difference			20mV			
Full Charge Calibration	1. Maximum cell voltage ≥ Full charge calibration voltage (3650mV, configurable) AND Average cell voltage ≥ Full charge calibration average voltage (3650mV, configurable) 2. Total battery voltage ≥ Full charge calibration total voltage (3650mV * Number of cells, configurable)						If either condition is met for 1s, SOC is calibrated to 100%
Full Discharge Calibration	1. Minimum cell voltage ≤ 2700mV (configurable) And Average cell voltage ≤ 2700mV (configurable) 2. Total battery voltage ≤ Full discharge calibration total voltage (2700mV * Number of cells, configurable)						If either condition is met for 1s, SOC is calibrated to 0%

7. Other precautions

Before installation or operation, please carefully read this manual and precautions to prevent accidents. Ensure compliance with industry safety standards and engineering design specifications during installation and operation. Adhere to the precautions and safety instructions provided by Shenzhen Tringo Control Co., Ltd.

- The external switch on the circuit board is forbidden to connect with other equipment. If necessary, please connect with the technology engineer for confirmation, otherwise we will not bear any responsibility for damaging the circuit board.
- When assembling, the BMS should not directly touch the surface of the battery cell to avoid damaging the battery cell; The assembly should be firm and reliable.
- Be careful not to touch the components on the circuit board, such as lead head, soldering iron and solder, otherwise it may damage the circuit board.
- During use, attention should be paid to prevent static electricity, moisture, and water damage.
- Please follow the design parameters and use conditions during use, and do not exceed the values in this specification, otherwise the BMS may be damaged.
- Power on and off, you must operate in the order of power on and off.
- When connecting the battery pack, do not connect it wrongly or even reversely.
- After assembling the battery pack and the BMS, if no voltage output or charging is found during the initial power-on, please check whether the wiring is correct.
- The final interpretation right belongs to our company.

Shenzhen Tringo Control Co., Ltd.

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Our company reserves the right to modify the equipment parameters without prior notice.