Specification

Product Name：Active Balancing System

Model：ELAE48

Configuration	Parameter
Equalizing current	2.5-5A
Strings	≤24
Communication	RS485/CAN
Battery type	NMC/LiFePO4

Signature and seal of supplier	Signature and seal of client

Executed By	Wang Tao	Checked By		Approved By	
Date		Date		Date	

Version	Date	Editor	Version Revision Note
V0.7	2023.09.09	Wang Tao	Create first draft
V0.8	2024.01.25	Wang Tao	Modify some functional descriptions

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1.Application scope

This product is a fully functional 12-24 series lithium battery balancing management system with active balancing function, which can effectively solve the problem of inconsistent battery cell voltage during standby, charging, and discharging processes. Through RS485 communication and data exchange with the host computer, users can have a clearer understanding of the battery condition. Can monitor the voltage of each battery cell in real-time and achieve voltage balance between each battery cell by adjusting the current. Whether in standby mode or during charging or discharging, it can ensure that the voltage of each cell in the battery pack remains consistent, thereby improving the overall performance and service life of the battery.

Capable of data exchange with the host computer. Through the RS485 communication interface, users can transmit battery related data to the host computer for analysis and monitoring. In this way, users can have a clearer understanding of the battery's condition, including its health status, remaining capacity, charging and discharging times, and other information.

Note: The baud rate of the host computer is 19200.

2.Main parameters

<table>
<tr><td colspan="4">Main parameters of the system</td></tr>
<tr><td>Consumption</td><td colspan="2">Standby power≤22mA</td><td>Sleep power≤6mA</td></tr>
<tr><td>Operation Voltage Range</td><td colspan="3">48V Platform: 37.5V≤V≤64V
72V Platform: 37.5V≤V≤96V</td></tr>
<tr><td>Acquisition accuracy</td><td>Balance current acquisition accuracy≤10%</td><td>Voltage acquisition accuracy≤5mV</td><td>Temperature acquisition accuracy ≤±1℃</td></tr>
<tr><td>Standby sleep function</td><td colspan="3">Support</td></tr>
<tr><td>Equalizing current</td><td colspan="3">2.7~3.3A</td></tr>
<tr><td rowspan="3">Wake up function</td><td colspan="2">Timed wake-up function</td><td>Support</td></tr>
<tr><td colspan="2">Bluetooth wake-up function</td><td>Support</td></tr>
<tr><td colspan="2">RS485 Communication wake-up function</td><td>Reserve</td></tr>
<tr><td rowspan="3">Working mode</td><td colspan="2">Charge balance</td><td>Support</td></tr>
<tr><td colspan="2">Discharge balance</td><td>Support</td></tr>
<tr><td colspan="2">Dynamic balance</td><td>Support</td></tr>
<tr><td rowspan="2">LED instructions</td><td colspan="2">RUN</td><td>Support</td></tr>
<tr><td colspan="2">ALARM</td><td>Support</td></tr>
<tr><td>Number of module temperature detections</td><td colspan="3">1</td></tr>
</table>

Number of battery cell balanced collection	24
Simultaneously balancing quantity	Simultaneously balancing one channel

3. Functional characteristics

3.1、Cell and battery voltage detection

Real time monitoring of the voltage of series connected battery cells to achieve active balancing function. Under environmental conditions ranging from -20 ℃ to 70 ℃, the accuracy of cell voltage detection is ≤ 5mV. Users can adjust the voltage difference between balancing on and off, as well as the range of dynamic balancing, through the host computer.

3.2、Environmental temperature detection

Through non-contact temperature sensors (NTC) to detect the temperature of specific environments, the accuracy of the measurement results can reach a range of ± 1 degrees Celsius. The battery cell temperature sensor uses 10K with a B value of 3435.

Alarm and protection parameter settings can be modified through connected host computer devices.

3.3、Balanced current detection

By serializing a current detection resistor in a balanced circuit, real-time monitoring of the balanced current can be achieved. This approach aims to achieve quantitative calculation of balancing capacity and provide overcurrent protection function. The measurement accuracy of this balanced current can reach 10%. In addition, users can use the host computer to adjust the threshold setting for balanced overcurrent protection. By doing so, it is possible to more accurately control the operating status of the circuit, ensuring its safety and stability.

3.4、LED light indication

System state	Running state	RUN	ALM
		●	●
Standby	Normal	Flashing	Flashing
Discharge balance	Warning	Slow flashing	Flashing

	Protection	Flashing	Lighting
Charge balance	Warning	Lighting	Flashing
	Protection	Flashing	Lighting

3.5、Active balancing of intelligent individual battery cells

In charging or standby mode, uneven battery cells can be balanced to effectively improve the battery's service life and cycle life. In addition, the balanced opening voltage and balanced voltage difference can also be set through the host computer.

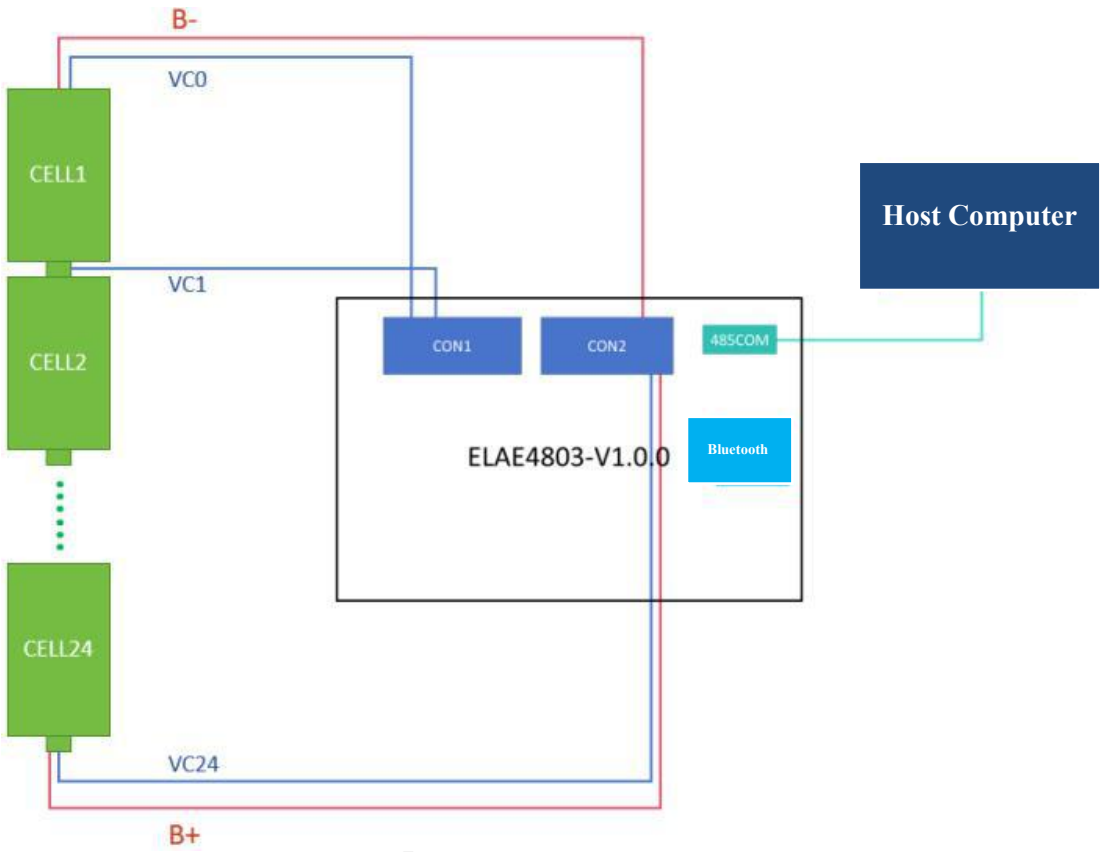
3.6、Host computer

The host computer uses BatteryMonitor version 2.1.8 or above, which can switch between Chinese and English (loading the English protocol when switching English), and load the protocol （Chinese file name:: 24S_V20_ADDR _BIKE_231007, Please refer to the operation instructions in the host computer file for instructions.

3.7、Software upgrading

By using the firmware update function of the host computer software, the upgrade operation of the main program can be achieved. In terms of connection, the host computer is connected to the active balancing board using the RS485 communication protocol.

4. Connection framework diagram



5. Function Description

5.1、Balance function

The active balancing board adopts a transformer balancing strategy, with adjustable discharge balancing voltage, charging balancing voltage, balancing opening voltage difference, and balancing exit voltage difference. The balancing opening condition allows any battery cell to achieve a balanced voltage difference.

Stop the equilibrium condition, and the voltage difference of the battery cell is less than the set value.

5.2、Standby state

After the device is connected to the power supply and powered on, if the active balancing board has no protection status such as over temperature or under voltage, the device will continue to remain in standby mode. In standby mode, the device reduces energy consumption. If there are protective issues such as overheating or insufficient voltage on the active balancing board after the power is turned on, the device will automatically shut down or

enter protection mode.

5.3、Equalizing current

The rated value of the balancing current capacity specified by the active balancing board is 3A, and its maximum allowable balancing current is 5A. The balance current of the device does not change due to the voltage difference between the batteries. The specific value of the balanced current mainly depends on the impedance value of the sampling line, and the change in impedance of the sampling line will directly affect the level of the balanced current.

5.4、Balanced overcurrent protection

When the current reaches the set protection threshold and the duration meets the delay time of overcurrent protection, the active balancing board will stop working.

After triggering the balanced overcurrent protection, the active balancing board will automatically enter a delayed recovery state.

If the number of balanced overcurrent occurrences exceeds a certain limit, the active balancing board will activate the balanced overcurrent protection lock function. At this time, the lock state must be unlocked by shutting down and restarting.

5.5、Wire breakage detection

When a wire break occurs in the balancing circuit, the active balancing board will stop balancing and send an alarm message to the host computer, which will continue until the wire connection is restored; Wire breakage detection, the system only checks a single sampling line each time to confirm whether there is a wire breakage condition. In standby mode, the system will execute at a frequency of detecting one line per minute; In the charging or discharging balance mode, the detection frequency is reduced to one detection every 3 minutes; In the dynamic equilibrium state, the detection frequency is further adjusted to be conducted every 10 minutes. Once the wires are repaired and connected, the active balance control board will restart the balance program within five minutes.

5.6、Automatic wake-up mode

After the active balancing board enters sleep mode, it will automatically wake up after a 4-hour interval. If there is no equilibrium condition during the period, it will re-enter sleep mode after 5 minutes. On the contrary, if there are balancing conditions, the active balancing board will start balancing operations.

Users can adjust the time interval for automatic wake-up based on their own needs and actual situation.

6. Main technical parameters of the product

6.1、Basic parameter settings

Serial Number	Parameter items			Default parameters		Unit	Can be set	Notes	
				LFP	NMP			LPF	NMP
1	Individual overvoltage	Warning	Individual high voltage warning	3500	4150	1mv	Yes		
			Individual high voltage recovery	3400	4100	1mv	Yes		
		Protection	Individual overvoltage protection	3650	4200	1mv	Yes		
			Individual overvoltage recovery	3400	4100	1mv	Yes		
2	Individual undervoltage	Warning	Individual low voltage warning	2800	3550	1mv	Yes		
			Individual low voltage recovery	3000	3600	1mv	Yes		
		Protection	Individual undervoltage protection	2600	3450	1mv	Yes		
			Individual undervoltage recovery	2900	3550	1mv	Yes		
3	Total voltage overvoltage	Warning	Total voltage high voltage warning	5600	6640	0.01V	Yes		
			Total voltage high voltage recovery	5420	6540	0.01V	Yes		
		Protection	Total voltage overvoltage protection	5830	6710	0.01V	Yes		
			Total voltage overvoltage recovery	5430	6550	0.01V	Yes		
4	Total voltage undervoltage	Warning	Total voltage low voltage warning	4540	5740	0.01V	Yes		

			Total voltage low voltage recovery	4850	5810	0.01V	Yes		
		Protection	Total voltage undervoltage protection	4260	5620	0.01V	Yes		
			Total voltage undervoltage recovery	4730	5770	0.01V	Yes		
5	Overtemperature environment	Warning	High temperature environment warning	500	500	0.1℃	Yes		
			High temperature environment recovery	470	470	0.1℃	Yes		
		Protection	Overtemperature environment protection	600	600	0.1℃	Yes		
			Overtemperature environment recovery	550	550	0.1℃	Yes		
6	Undertemperature environment	Warning	Low temperature environment warning	100	-100	0.1℃	Yes		
			Low temperature environment recovery	30	30	0.1℃	Yes		
		Protection	Undertemperature environment protection	-200	-200	0.1℃	Yes		
			Undertemperature environment recovery	-100	-100	0.1℃	Yes		
7	Transient overcurrent		Transient overcurrent protection	5	5	1A	Yes		
			Transient overcurrent delay	100	100	ms	Yes		
			Overcurrent recovery delay	60	60	1S	Yes		
			Overcurrent recovery times	5	5	1C	Yes		
8	Number of cell connected in series			LFP: 12S-24Ss					

			NMP: 10S-24s	
9	Balance function	Balanced discharge on	3400mv≤LFP≤4500mv 4200mv≤NMP≤4500mv	
		Balanced charging enabled	2000mv≤LFP≤3100mv 2000mv≤NMP≤4000m	
		Balanced opening voltage difference	Balance end voltage difference≤LFP≤=100mVmv Balance end voltage difference≤NMP≤4500m	
		Balance end voltage difference	10mVmv≤LFP\NMP≤Balanced opening voltage difference	
10	Timed wake-up interval		5min≤N≤250min	
11	Standby shutdown delay		1h≤N≤250h	

6.2、Basic working mode

6.2.1、Discharge balance mode

When the voltage of the battery cell exceeds 3.4V and the voltage difference condition is met, the active balancing board will start the discharge balancing program.

6.2.2、Charge balance mode

When the voltage of the battery cell drops below 3.1V and meets the voltage difference condition, the active equalization board will start the charging equalization mode.

6.2.3、Dynamic equilibrium mode

When the voltage of the battery cell is between 3.1V~3.4V and meets the voltage difference condition, the active balancing board will start the dynamic balancing mode.

6.2.4、Standby mode

If none of the above three situations are met, the active equalization board will enter standby mode.

7.Pin Definition

7.1、Cell sampling line

CON1:

Pin	Definition Description	Notes
PIN1	VC0	CELL1-
PIN2	VC1	CELL1+/CELL2-
PIN3	VC2	CELL2+/CELL3-
PIN4	VC3	CELL3+/CELL4-
PIN5	VC4	CELL4+/CELL5-
PIN6	VC5	CELL5+/CELL6-
PIN7	VC6	CELL6+/CELL7-
PIN8	VC7	CELL7+/CELL8-
PIN9	VC8	CELL8+/CELL9-
PIN10	VC9	CELL9+/CELL10-
PIN11	VC10	CELL10+/CELL11-
PIN12	VC11	CELL11+/CELL12-
PIN13	VC12	CELL12+/CELL13-
PIN14	VC13	CELL13+/CELL14-
PIN15	NC	NC
PIN16	NC	NC

CON2:

Pin	Definition Description	Notes
PIN1	VC14	CELL14+/CELL15-
PIN2	VC15	CELL15+/CELL16-
PIN3	VC16	CELL16+/CELL17-
PIN4	VC17	CELL17+/CELL18-
PIN5	VC18	CELL18+/CELL19-
PIN6	VC19	CELL19+/CELL20-
PIN7	VC20	CELL20+/CELL21-
PIN8	VC21	CELL21+/CELL22-
PIN9	VC22	CELL22+/CELL23-
PIN10	VC23	CELL23+/CELL24-
PIN11	VC24	CELL24+
PIN12	NC	NC
PIN13	B-	CELL1-

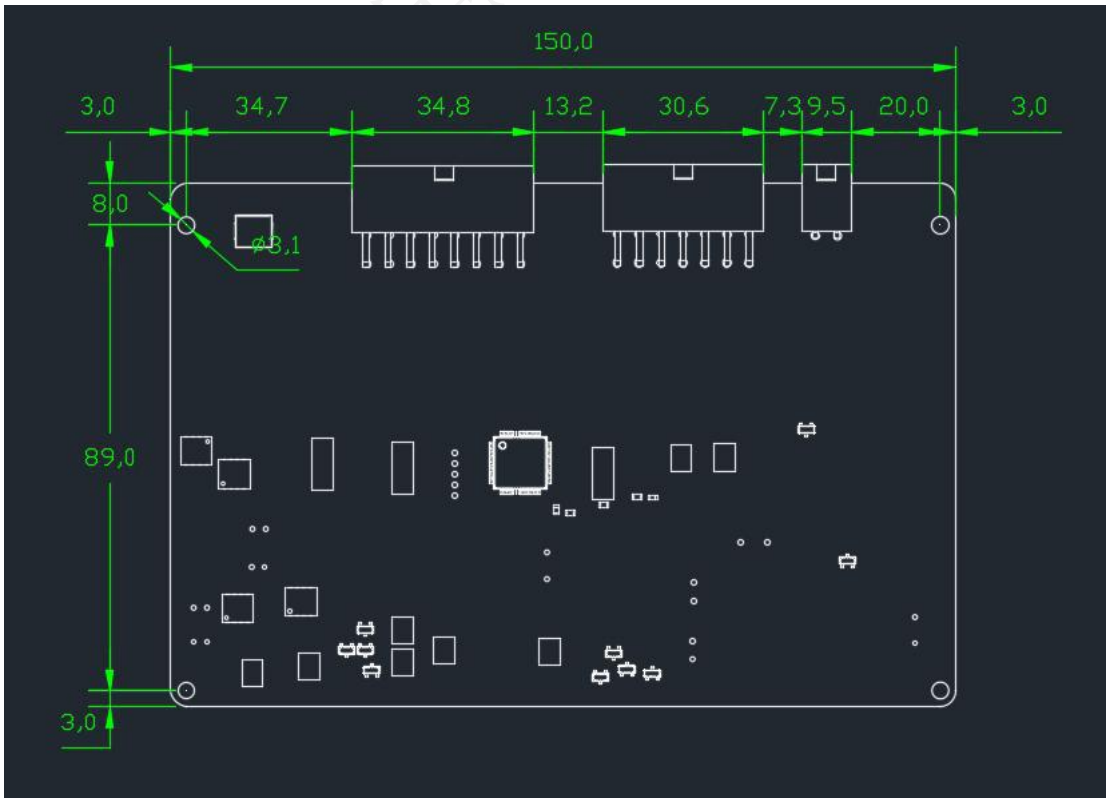
PIN14	B+	CELL24+

7.2、485COM:

Pin	Definition Description	Notes
PIN1	485B	485 differential signal transmission port B
PIN2	485A	485 differential signal transmission port A

8. Figure

9. Dimension



10. Communication instructions

10.1、RS485 Communication (Optional)

BMS has RS485 communication for battery pack integration, with a baud rate of 19200bps. The RS485 communication interface adopts a 2PIN connector.

10.2、Bluetooth communication

The active balancing board is equipped with built-in Bluetooth communication technology, which can work together with smartphone applications to achieve real-time monitoring of the balancing device.

11. Points for attention

- External switches on the active balancing board are prohibited from connecting to other devices. If necessary, please confirm with the technical team. Otherwise, we will not be responsible for any damage to the product.
- During use, be careful not to touch the components on the circuit board with the lead wire, soldering iron, solder, etc., otherwise it may damage the circuit board.
- During use, attention should be paid to anti-static, moisture-proof, waterproof, etc.
- During use, please follow the design parameters and usage conditions, and do not exceed the values specified in this specification, otherwise it may damage the product.
- After combining the battery pack and active balancing board, if there is no voltage output or charging failure during the initial power on, please check if the wiring is correct.
- The final interpretation right belongs to our company.