



BMS24T

for 2S-24S LiPo, LiFe & LiTO

Low power consumption

High accuracy

2.8" TFT LCD display

Programmable



Thanks for your purchasing the BMS24T for your vehicle.

Please read the ENTIRE instruction manual to become familiar with the features/functions of the BMS24T before operating or connecting any power sources (battery or external) to the BMS24T. It is suggested that you view the BMS installation video

from http://www.chargery.com/Video/BMS24T_C10325_operation_instructions.mp4 or <https://www.youtube.com/watch?v=39IYI3h1kOU> with Nissan Leaf battery

Feel free to send an email to jasonwang3a@163.com or call at (86) 755-2643 6165 should you have any questions and suggestions.

Jason Wang

Chargery BMS24T is designed special for LiPo, LiFe and LiTo battery pack applied to storage energy system and Electrical Vehicle including E-Motorcycle, E-Scooter and so on. The unit can measure or detect the battery voltage, cell voltage, charge & discharge current, battery temperature, and battery SOC (State of Charge), displayed with TFT color LCD.

Safety Notes

Please completely read the manual before connecting power to the BMS24T to make sure you can use this device correctly and safely

1. Ensure that the BMS24T has been programmed correctly and that the setting match your battery pack, otherwise battery damage will result and cause a dangerous situation. A Class Delta Fire, especially with Lithium batteries, may result.
2. Adjust all battery related setting carefully, as every system application will be different. Contact use for assistance and more details if you are at all uncertain as to what you are doing.
3. Do not allow water, moisture, metal wires or other conductive material into the device.
4. Never charge or discharge any battery having evidence of leaking, expansion/swelling, damaged outer cover or case, color-change or distortion.
5. Do not try to charge "non-rechargeable" dry cells.
6. Do not mix batteries of different types, different capacities or from different manufacturers.
7. Do not exceed the battery manufacturer's suggested maximum charge and discharge rates.
8. Carefully follow the battery pack manufacturer's recommendations and safety advice.



Warning

1. Do not allow Current Shunt to contact any metal including BMS metal case.
2. Do not allow BMS case to contact any metal panels.
3. Current Shunt must be connected between the negative side of the battery pack and the negative side of the load.
4. Mount BMS in such a way to prevent excessive vibration and also ensure that the BMS case will not contact the negative lead of the battery pack.

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Updated Features

1. BMS24T draw current from total battery pack even 24S lipo at full charge (100.8v)
2. Added an RS-232 port so an external device can read all data from the BMS24T
3. For same Battery positive and negative terminal when charge and discharge, BMS24T can control charge and discharge separately. And detect charge and discharge current with one current shunt.
4. Plug and Play, need not install USB driver.
5. Improved cell voltage detection accuracy
6. Added over-current protection during cell balancing
7. Add low temperature protection (on LCD unit V3.03)
8. Optimized SOC accuracy. New approaches are based on voltage and coulomb counting that take the individual cell impedances into consideration. Please configure the correct battery capacity via the Program setup menu before using the BMS24T.
9. Added current, AH and WH, and SOC to interface. The user can now read the charge or discharge current, total battery capacity, as well as current power and battery capacity remaining on one easy to use interface.
10. Updated relay controller to use a 12V 3A regulator powered by the battery pack. It can now drive both large current mechanical and solid state relays..
11. When using an external 13V to 100V 3A or larger power adapter, the BMS can manage 2S-24S battery packs without drawing any power from the battery pack.



1.2A balance

600A max. charge/discharge

Order information

Model	Description	Accessories
BMS24T-100	100A charge and discharge	100A shunt, and standard accessories
BMS24T-300	300A charge and discharge	300A shunt, and standard accessories
BMS24T-600	600A charge and discharge	600A shunt, and standard accessories

All standard accessories are listed on page 26, includes:

1. Battery balance wire, 3pcs
2. Relay controller wire, 1pcs
3. Temperature wire, 1pcs
4. Current sensor wire, 1pcs
5. Current shunt, 1pcs
6. USB data cable, 1pcs
7. Communication wire on COM2, connect main unit to display module, 1pcs
8. Communication wire on COM3, connect BMS to external device, 1pcs
9. Warning LED, 1pcs
10. Warning beeper, 1pcs

Optional accessories

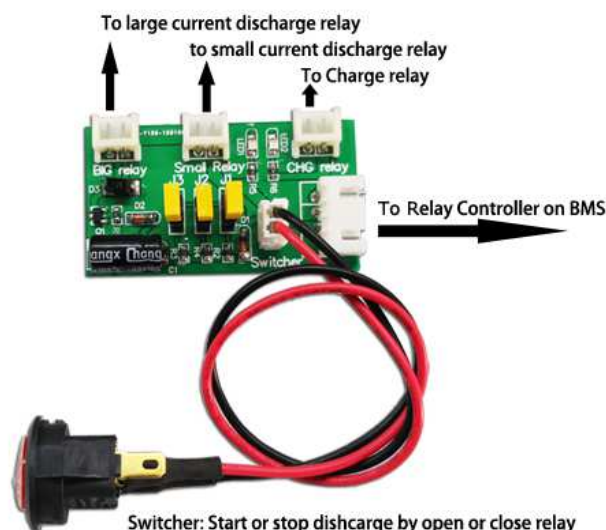
1. 12V 100A relay
2. 12V 200A relay
3. 12V 400A relay
4. 12V 600A relay
5. 12V 800A relay
6. Relay delay time board

Notes:

BMS24T includes main unit and display module, after power on the BMS24T and finish all parameters setup on display module, the BMS24T will work according to these parameters even disconnect the display module to the main unit, all data don't be displayed and no beeper and LED warning, but BMS24T can cut off charge or discharge when any cell over charged or over discharged. You can connect the external device to the COM3 on main unit to receive all data, and display these data. if need modify the parameters setup, please connect the display module again.

Disconnect and connect LCD unit to main unit when it is turned on frequently is not suggested, because it maybe damage main unit.

The BMS24T can fit with any lithium battery charger, when any cell over charged, the BMS24T will disconnect charge relay to cut off charge, if fit with CHARGER Y charger, need not the charge relay. Only connect CHARGER Y charger to BMS24T on COM1, when any cell reach OVP, the charge current will decrease automatically prevent any cell damaged. This feature can save charge relay cost and shorten charge time.





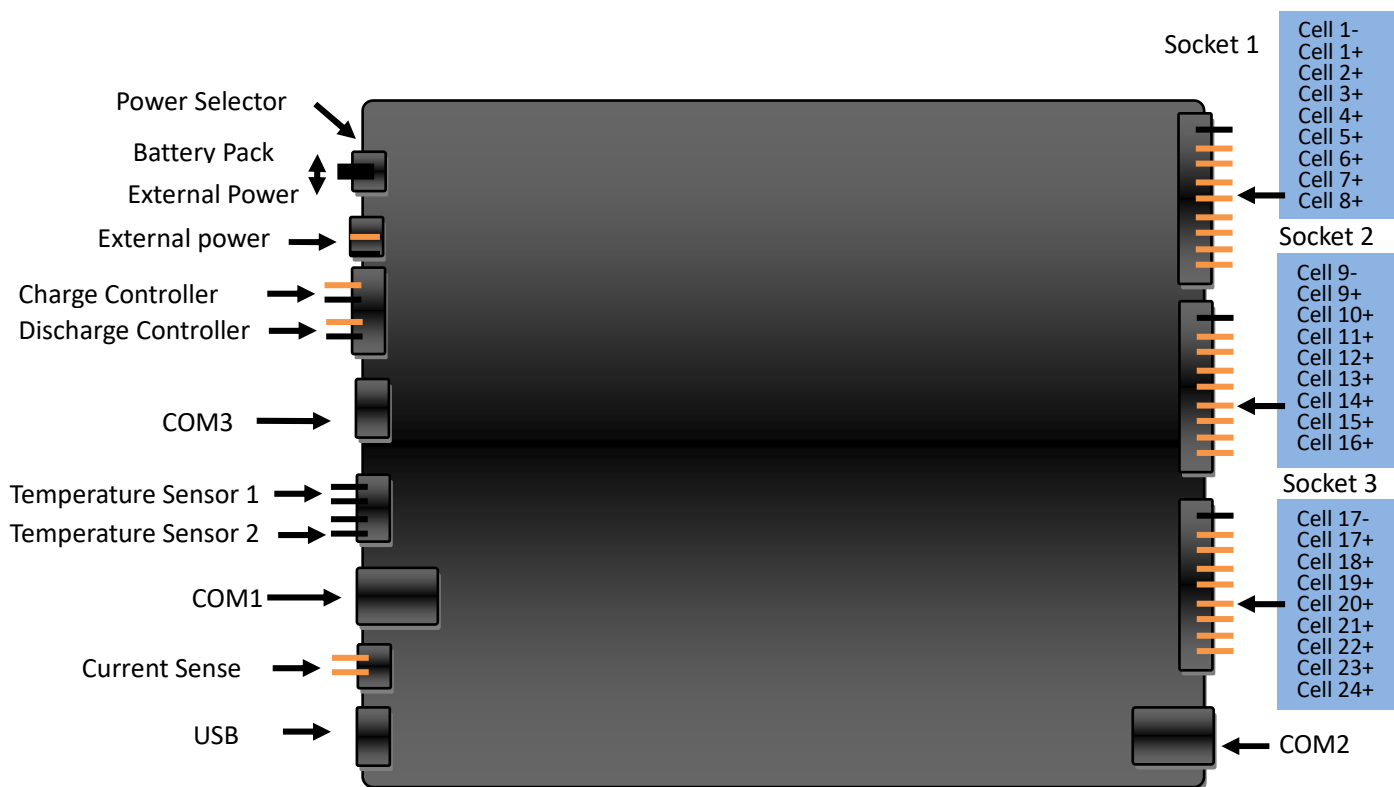
Special Features

1. The BMS24T uses advanced ADC measurement technology, high accuracy, high voltage and high current detection circuit. The maximum voltage measurements tolerance is within 5mV at up to 24S LiPo battery (100.8V)
2. Support regenerative braking, during braking operation can charge the batter pack and the discharge power (Wh) will decrease to response to the braking power.
3. Charge/discharge current up to **600A**. Bigger current can be customized.
4. **1.2A** per cell balance current is very useful for large capacity battery pack, the feature can resume all cell voltage balance status at the shortest time. Over temperature protection make sure the system safety during balance.
5. BMS24T calculate and display the charge and discharge power (Wh), generally the battery rated power is rated voltage multiply rated battery capacity.
6. TFT LCD screen provides rich information including current, voltage, power, capacity, battery status, SOC and temperature and so on.
7. BMS24T features a maximal safety protection, within the range parameters can be setup, BMS24T will alarm and cutoff charge or discharge according to users' setup, out of range of parameters, and trigged absolute maximum ratings BMS24T will force to cutoff charge or discharge to prevent the battery from fire.
8. Minimize the power consumption by draw current from all cells or external power supply.
9. Dual power design, the unit can be powered by all cells or external power supply.
10. Detect cell count at any time, and compare with the count detected when switch on first time. If it is not uniformity, the device will alarm and cutoff charge or discharge according to users' setup, the feature can prevent any cell connection from losing.
11. Sound alarm and LED alarm will be triggered when any warning events happened, and then wait several seconds cut off or Don't cut off charge or discharge. The delay time can be programmed.
12. Charge relay and discharge relay are controlled independently.
13. Two temperature sensors monitor battery temperature on different position.
14. Supports upgrading the firmware program by USB port.
15. BMS24T provide users the maximal flexibility, key parameters can be programmed.
16. BMS24T display battery SOC or called battery gauge similar with car dashboard. Cell count, battery pack voltage and battery gauge (%) is displayed simultaneously.
17. In case that the battery pack need not be charged and discharged, Press **STOP** button enter into sleep mode to save energy consumption, at this mode, Charge and Discharge is forbidden, and LCD back light is off. Press any key to resume normal work mode.
18. LCD back light ON time can be programmed to save energy, when it is OFF, press any key to resume "ON".

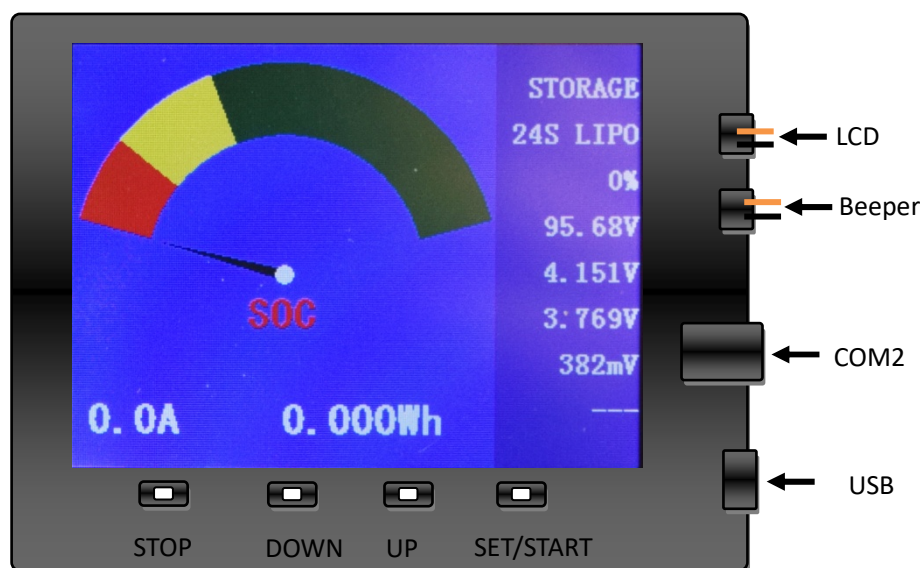
Protection functions

1. Cell count error protection
2. Over charge protection
3. Under voltage protection
4. Over current protection when charge or discharge
5. High temperature protection
6. Low temperature protection (on LCD unit V3.03)
7. Over differential cell voltage protection in discharge
8. Over differential battery temperature protection
9. Under SOC protection

Interface



BMS24T main module



BMS24T display module



Power Selector	Alternate External power supply or battery pack to power BMS24T. If select battery, the battery pack must be 16S to 24S LiFe or LiPo or LiTO. But if power by external power supply, BMS24T can do 2S-24S LiPo, LiFe or LiTo battery pack.
External power port	External power input, the voltage should be 13V to 100V, 3A minimum, the current depends on the relay coil, the connector is 5.5*2.1 DC jack,
Charge controller	Charge controller, connect or disconnect charge circuit, generally connect to relay or DC contactor. When any cell voltage is over setup, it will make relay "OPEN(disconnect)" to turn off the charger, otherwise BMS24T will output 12V power the coil to close (connect) the relay. The relay must be Normal Open (NO).
Discharge controller	Discharge controller, connect or disconnect discharge circuit, generally connect to relay or DC contactor. When any cell voltage is under setup, it will make the relay "OPEN" to turn off the motor or other load, otherwise BMS24T will output 12V power the coil to close the relay. The relay must be Normal Open (NO).
COM1	The COM1 port (black connector) is connected to external device such as Charger. If connect to Chargery charger, BMS24T can control charge current to shorten charge time
COM2	The COM2 (gray connector) port is connected to main unit and display module by gray spring wire
COM3	Output RS232 level on the port, any external device can read out all data from BMS24T
Temperature sensor	Two temperature sensors monitor the battery temperature, the sensor must tie to battery surface or gap of cells where the temperature should be the highest during charge or discharge. The temperature range is -20 to 150℃
LED ¹⁾	Connect to high light LED, the LED will flash when any warning event happened
Beeper ¹⁾	Connect to beeper or others to alarm. It will output 12V 25mA max.
Current sense	Connect to single current shunt. Charge current and discharge current can be measured simultaneously.
USB	Connect to PC update the firmware by Chargery UpdateTool.exe
Socket 1	Connect to 2S to 8S battery,
Socket 2	Connect to 9S to 16S battery. for over 8S battery, please connect 8S battery to socket 1 and then connect to socket 2, such as 8S + 2S for 10S and 8S +5S for 13S
Socket 3	Connect to 17S to 24S battery. for over 16S battery, please connect 8S battery to socket 1 and second 8S to socket 2, then connect other cells to socket 3, such as 8S + 8S + 6S for 22S

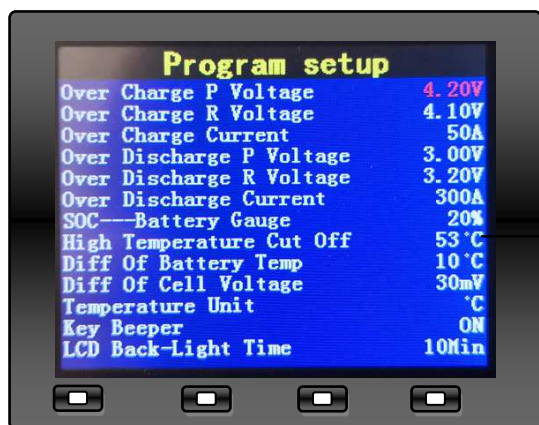
Note:

- 1) On the BMS display module

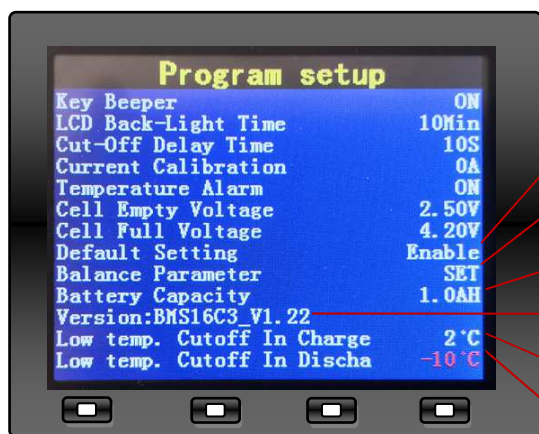
Absolute maximum or Minimum ratings

Maximal cell voltage	LiPo	4.35V	Larger than the absolute maximum voltage, BMS24T will force to cut off charge
	LiFe	3.90V	
	LiTO	2.80V	
Minimum cell voltage	LiPo	2.50V	Less than the absolute minimum voltage, BMS24T will force to cut off discharge
	LiFe	2.00V	
	LiTO	1.50V	
Battery temperature	LiPo&LiFe&LiTO	80℃	Over the temperature, BMS24T will force to cutoff the charge and discharge

Program Setup



Setup the highest battery temperature, when over the temperature, BMS will cut off charge or discharge



Resume default value in factory

Balance setup

Setup battery pack capacity, 1000AH max. it is as a reference when calibrate battery SoC.

Main unit Software version

Under the lowest temperature, forbid to charge

Under the lowest temperature, forbid to discharge

1. Press **SET/START** button for 3 seconds enter into Program Setup interface.
2. Press **UP** or **DOWN** button select the item, press **SET/START** shortly make the value flash, and press **UP** or **DOWN** change the value. Press **SET/START** button shortly confirm the change. After finish all setup, press **SET/START** for 3 seconds quit the setup menu.
3. When quit setup mode, BMS24T will record all parameters till next change.



NOTE: Please keep the default setup unless for special purpose.

Parameters		Min.	Type	Max.	Step	unit
Charge Protection						
Over Charge Protection(P) Voltage	LiPo	3.90	4.20	4.35	0.01	V
	LiFe	3.40	3.65	3.90	0.01	V
	LiTO	2.50	2.75	2.80	0.01	V
Over Charge Release(R) Voltage	LiPo	3.80	4.10	4.25	0.01	V
	LiFe	3.30	3.55	3.80	0.01	V
	LiTO	2.40	2.65	2.70	0.01	V
Over Charge current		0	50	600	1	A
Discharge Protection						
Over Discharge Protection(P) Voltage	LiPo	2.75	3.00	4.00	0.01	V
	LiFe	2.00	3.00	3.50	0.01	V
	LiTO	1.50	1.85	2.40	0.01	V
Over discharge Release(R) Voltage	LiPo	2.75	3.20	4.00	0.01	V
	LiFe	2.00	3.10	3.50	0.01	V
	LiTO	1.60	1.95	2.50	0.01	V
Over Discharge current		0	300	600	1	A
SOC--- Battery gauge		5	20	90	1	%
Temperature Protection						
Battery Temperature		30	50	80	1	℃
Difference(Diff) of battery Temperature(Temp)		5	10	30	1	℃
Voltage balance Protection						
Difference(Diff) of cell voltage		5	30	300	1	mV
Others						
Temperature Unit			℃	℉		
Key Beeper			ON	OFF		
LCD Back-Light time ⁽¹⁾		1	10	999	1	min
Cut-Off Delay Time ⁽²⁾		0	10	60	1	Second
Current Calibration ⁽³⁾		0	0	255	5	A
Temperature Alarm ⁽⁴⁾		ON		OFF		
Cell Empty Voltage ⁽⁵⁾		1.50	2.50	4.34	0.01	V
Cell Full Voltage ⁽⁵⁾		1.51	4.20	4.35	0.01	V
Default settings	Press SET/START restore all parameters to default value before delivery					
Balance Parameter setup: Press SET/START to setup and press for 3 seconds quit setup						
Balance Start Voltage ⁽⁶⁾	LiPo	3.3	3.6	4.1	0.01	V
	LiFe	3.0	3.2	3.4	0.01	V
	LiTO	1.75	2.20	2.6	0.01	V
Balance Stop Diff Voltage ⁽⁷⁾			5	12	200	mV
Balance in Charge	ON means Balance start during charge, OFF disable.					
Balance in Discharge	ON means Balance start during discharge, OFF disable.					
Balance ⁽⁸⁾ in Storage	ON means Balance start during storage, OFF disable.					

Parameters	Min.	Type	Max.	Step	unit
Battery capacity ⁽⁹⁾	0.1	1	1000	0.1	AH
Version:BMS24C3_v1.22 ⁽¹⁰⁾					
Low temp. cutoff in charge	-20	2	20	1	°C
Low temp. cutoff in discharge	-20	-10	20	1	°C

NOTES:

- Always on** means the LCD back-light will be ON forever.
- NO** means BMS24T will not cut off charge or discharge but alarm by LED flash and Beeper Sound.

Cut-Off Delay Time is very important and difference for different battery capacity and application, please carefully test and make a correct decision, for EV, you can select **NO** to control the EV car by manual **NOT** controlled by BMS24T, but when cell voltage and temperature trigger the absolute maximum or minimum ratings, the BMS24T will force to cut off charge or discharge to make sure the battery safety, and prevent battery pack from explode or fire.

- Current Calibration** is not recommended unless use new current shunt. Voltage and current is calibrated before delivery.
- Temperature Alarm OFF means battery temperature and Difference of battery Temperature is unable.
- Cell Empty Voltage and Cell Full Voltage is to set up cell voltage bar graph, the value should be as same as Over Charge Protection(P) Voltage and Over Discharge Protection(P) Voltage
- Setup the balance start voltage, when minimum cell voltage over the setting, balance will start automatically
- Setup the minimum cell voltage difference, when difference of cell voltage under setting, stop balance automatically
- Balance switcher, default Balance is OFF,
 - If balance in storage setup ON, balance will start in storage status, STORAGE means charge or discharge current under 1A. So the current shunt and current sensor wire must be connected to BMS.
When driving the car, balance in storage OFF is suggested. For storage system, ON is better.
 - If balance in charge setup ON, balance will start in charge
 - If balance in discharge setup ON, balance will start in discharge
 - Balance current is 1.2A max. per cell,
- Setup accurate battery capacity, then charge or discharge 25% of battery capacity, BMS will calibrate SOC automatically,
- Main unit software version



Balancer

BMS24T can resume cell voltage balanced status at the shortest time, it is based on 1.2A balance current per cell, balancing accuracy is 8mV. Balance can be operated in storage or in charge or in discharge or in both or in all, the feature can be setup on program setup menu. The balance function is unable before delivery, after the BMS display each cell voltage accurately, please enter into program setup menu to enable balance.

Although balance current per cell is larger than other brand BMS, Chargery BMS24T has temperature protection to prevent BMS from overheating. and has an over current protection for each cell.

In some conditions, cell voltage difference drop very slow, it seems don't balance, such as **battery capacity is over 100AH; cell voltage difference over 0.2V; or average cell actual voltage is just cell storage voltage.**

When BMS balance cell voltage, the balance current is 1.2A max. means the high voltage cell discharge 1.2AH per hour at most, with the difference drop between the high cell voltage and the lowest cell voltage, the balance current will drop, till the difference reach "balance stop diff voltage" setting.

The higher the battery capacity and the more the cell difference voltage, the longer the balance time. And the battery discharge platform voltage is storage voltage, so when the average cell voltage is just cell storage voltage, the difference drop very slow, and the balance time seems longer, or looks like the BMS don't balance or stop balance.

Compare balance and cell capacity/impedance accordance, the cell capacity/impedance accordance is more important. With battery discharge and charge cycles increase, the cell capacity and impedance accordance is worse slowly. Take a 100Ah battery as a sample, 5% difference on capacity, means 5Ah need to be balanced, if 1A balance, need 5 hours at least, consider the 10mV difference as stopping conditions, the balance current will very small at the end of balancing, the total balancing time will be longer than 5h, maybe 10h.

If we think the battery life ended or battery has to stop service when the battery capacity degrade to 70%, it means when the lowest cell capacity is 70Ah (for 100AH battery at the beginning), even other cell capacity is over 70Ah, the battery pack has to stop service. If some cell capacity is 80AH, the balance time will be 20-30 hours.

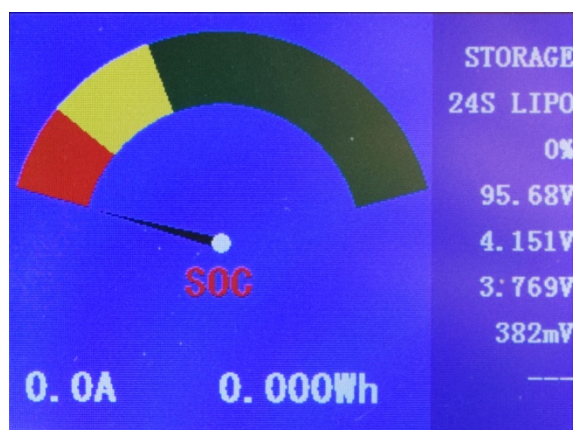
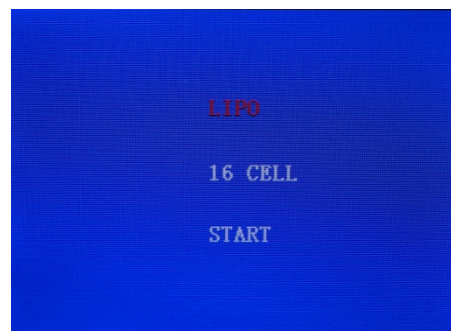
So after 50 or 100 cycles, it is essential to test battery capacity, and measure each cell impedance to identify which cell is with the highest impedance. High impedance cell has low capacity and decide total battery capacity and battery life even driving distance.

Operating guideline

Installation video: <https://www.youtube.com/watch?v=39IYI3h1kOU>

http://chargery.com/Video/BMS24T_C10325_operation_instructions.mp4

1. Connection balance wire to each battery. Each battery voltage must be around 3.8V for lipo, 3.2V for LiFe or 2.2V for LiTo. Many cells can be connected in parallel but the voltage should be as one battery. The detailed connection diagram is as the following page.
2. Connect main unit to display unit on COM2 port by gray communication wire.
3. Move the power selector to external power supply, don't connect external power to BMS.
4. Connect battery to BMS main unit by 9pin wire. Redundant should be removed or isolated. Move the power selector to battery, turn on BMS.
5. BMS24T LCD unit show model and LCD unit version, then battery type and cell count interface is displayed. Three battery type LiPo, LiFe and LTO can be selected. Cell count range is 2S to 24S, the cell count will be identified automatically. Press **DOWN** or **UP** button choose the item and press **SET/START** blink, then press **DOWN** or **UP** button modify, finally press **SET/START** button to run the BMS24T, or waiting for 8 seconds, the unit will start automatically. After started, battery type and cell count will not be changed unless power off BMS24T.
6. Check if each cell voltage is displayed correctly. If NOT, please check the cell connection.
7. Connect Beeper, LED to LCD unit,
8. Connect current shunt to battery negative and charger / load negative.
9. Connect charge relay to battery positive and charger positive, Connect discharge relay to battery positive and load positive, then connect relay controller to relay coil and then plug into BMS main unit. Redundant controller wire should be removed or isolated, **Avoid the controller wire short circuit.**
10. Connect temperature sensor, and current sensor to BMS main unit.
11. Press **SET/START** button for 3 seconds enter into Program Setup interface, modify all related parameters, such as Over Charge Current (50A default) and Over Discharge Current (300A default) according to your application. If need balance in Charge or in Discharge, please modify the Balance set on Program Menu. the balance function is off before delivery
12. SOC—battery gauge dashboard will be displayed first, as following. Press **UP/DOWN** button alter other interface. If SOC is zero, please turn off then turn on it again. Battery accurate capacity should be setup to get accurate SOC.



Charge or discharge
current

Charge or discharge
power

STORAGE is battery status, maybe CHARGE or DISCHARGE ⁽¹⁾

Cell count and battery type

SOC—battery gauge, display 0% lose temperature sensor

Battery pack voltage

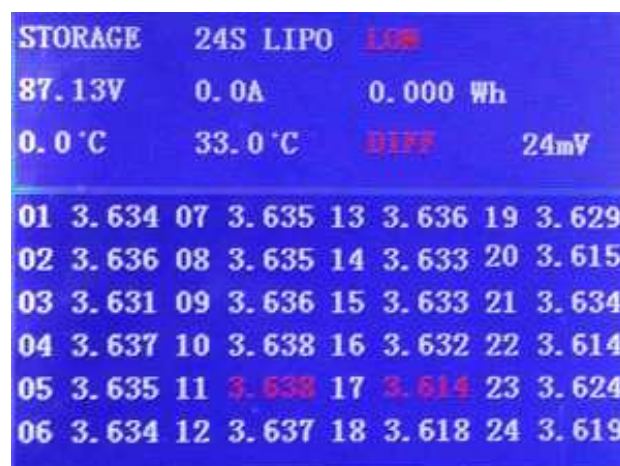
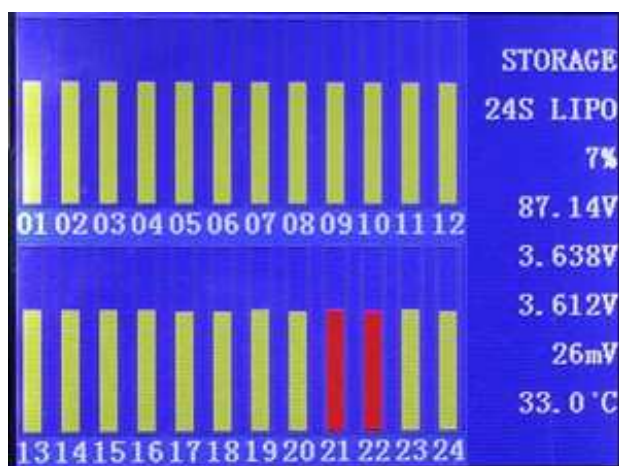
Highest cell voltage

Lowest cell voltage

Difference of cell voltage

Battery temperature

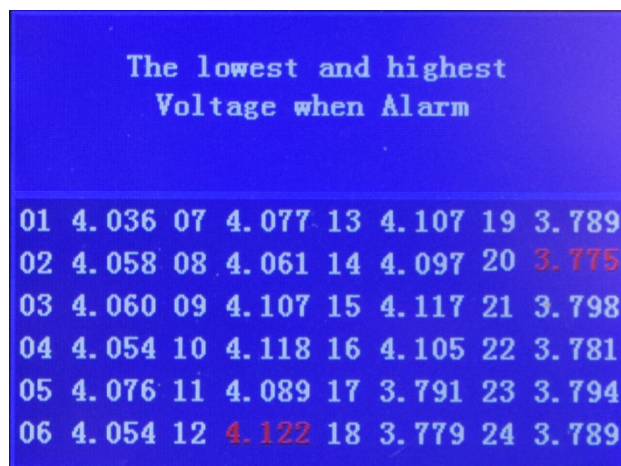
13. The following interface is cell voltage bar graph, the highest and the lowest cell voltage is displayed in RED



column.

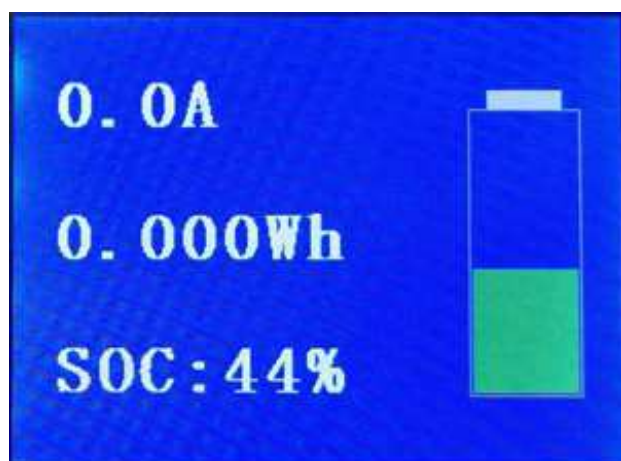
14. The third interface display all information including all cell voltage. The highest and the lowest cell voltage is displayed in RED text. Difference of cell voltage and difference of battery temperature is displayed.

When any warning events triggered, BMS24T will go to the interface and display error information. Such as if the battery connection break down, the cell count and ERROR will be displayed in turn. If the cell voltage over the setup value, the cell voltage and HIGH will be displayed in turn.



15. When any warning events triggered, Press UP or DOWN, you can check the cell voltage triggered warning events (over charger or over discharge), the voltage will be recorded till next warning.

16. The right interface display charge or discharge current, charged or discharged power and SoC. When SoC less than 30%, it is displayed in yellow. When under setup, the BMS will cut off discharge.



Notes

- When charge or discharge current less than 1.0A, battery status will be STORAGE.
- When balance setup is on, Please check if the cell voltage difference is going down, if the difference changes will slow. But the main unit case is warm, means balancing.
- when setup accurate battery capacity, charge or discharge the battery, the charged or discharged capacity is 25% at least, the SOC can be calibrated automatically.
- COM2 is to connect to charger if you have CHARGER charger, COM3 is to connect to external device.

Specifications

1. Battery range: 2S-24S LiPo & LiFe, LTO battery pack on BMS24T
2. Accurate scope of the cell voltage: -8mV/+8mV on BMS24T
3. Cell Voltage display range: 0.10~4.99V
4. The voltage of external power: 13-100V, 3A
5. Balance current: 1.2A per cell
6. Temperature display range: -20°C~150°C,
7. SOC indicator:
 - RED area @ 0~15% of SOC
 - YELLOW area @ 16~35% of SOC
 - GREEN area @ 36~100% of SOC
8. Main module Size: 128×114×33 (L×W×T, mm) or 5.1×4.5×1.3 (L×W×T, inch)
9. Main module weight: 420g excluding accessories
10. Display module size: 96×80×24 (L×W×T, mm) or 3.8×3.2×0.95 (L×W×T, inch)
11. Display module weight: 130g excluding accessories
12. Warning LED: 11000mCd, @ 2.0V, 20mA
13. Warning beeper: 85dB @ 12V, 25mA
14. Package: AL alloy case

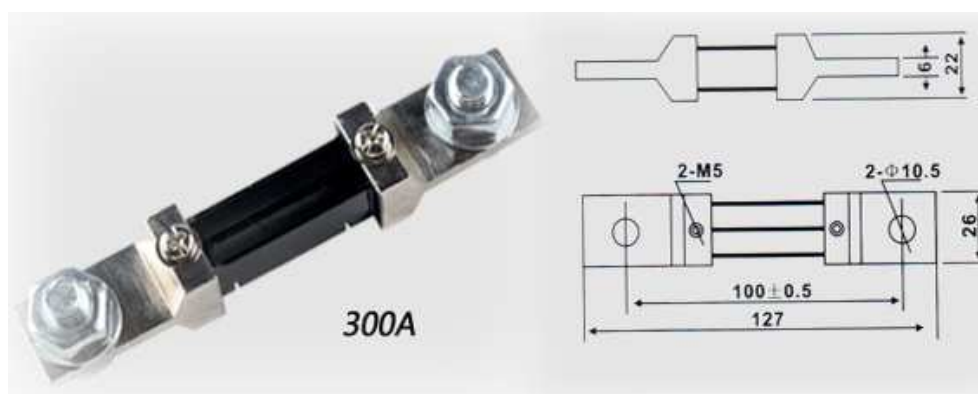


Current shunt and Current Sensor Specifications

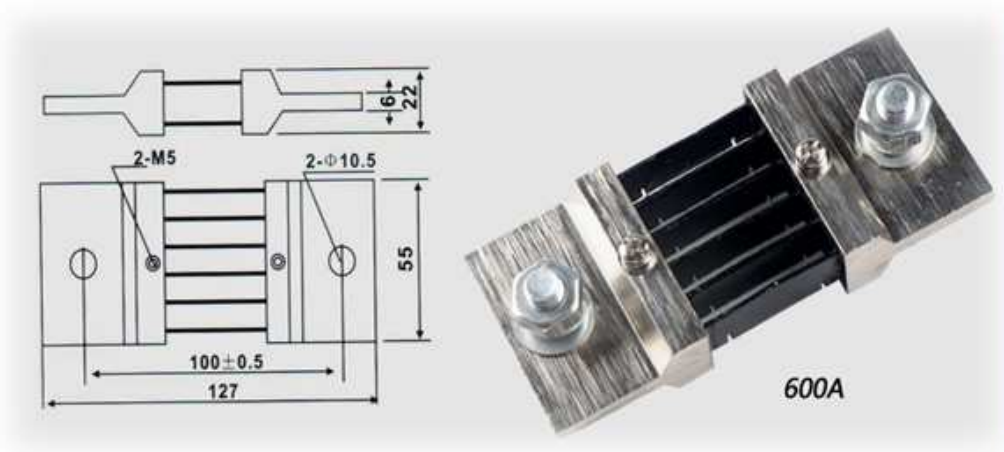
Please use correct current shunt according to actual maximal charge and discharge current, single shunt is enough for BMS24T, 75mV or less shunt is suggested.

Chargery can provide all kinds of shunt. All cell voltage and current are calibrated before delivery.

The 300A and 600A 75mV specification is as below.



300A shunt weight: 230g



600A shunt weight: 530g

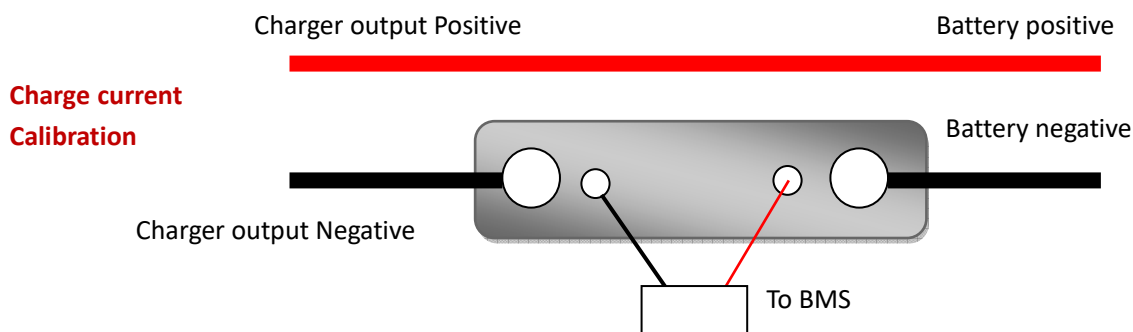
Current sensor wire



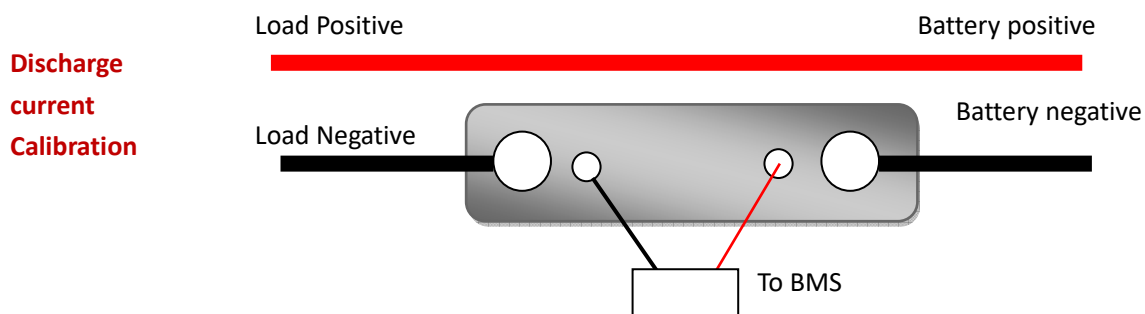
Current Calibration

Press **SET/START** 3 seconds enter into Program Setup and find the Current Calibration, you can calibrate the current to improve the measure accuracy. If use new current shunt, the current must be calibrated again.

1. Turn off charge and discharge, make the current blink, press **UP/DOWN** modify the value to zero, shortly press **SET/START** button finish 0A calibration.
2. Connect the current shunt as following calibrate charge current



3. Shortly press SET/START make the current blink and increase the current to new value (up to 125A, it must be less than current shunt, it is better to make it equal to your charge current, the key is the current must be accurate), turn on charger and charge battery at the current, 3 seconds later, press **SET/START** save the charge current calibration.
4. Connect the current shunt as following calibrate discharge current



5. Press SET/START again and decrease the calibration current to new value (up to -125A, it must be less than current shunt, it is better to make it equal to your motor current, the key is the current must be accurate) turn on motor and discharge battery at the current, 3 seconds later, press **SET/START/** save the discharge calibration.
6. Turn off motor, Press **SET/START** for 3 seconds quit Program Setup, current calibration is finished.

Here is a Current calibration video: <https://www.youtube.com/watch?v= LOJw83s18M>

Thanks Jimmy in USA.

Firmware Upgrades via USB Port

Please download the update tool on http://chargery.com/uploadFiles/Update_Tool_V1.03.zip, the USB driver need not installed on Version 3.0.

1. Connect the BMS main unit to display module, and Connect PC to BMS by USB data cable.
2. Power on BMS, the USB driver will be installed on your computer automatically

if update main unit, the LCD display module need not connect to main unit.

NOTE: BMS main unit and LCD display module must be updated separately

3. Execute Chargery update tool software v1.03, When the port number (such as com5) appears, this means the update tool identified the BMS. Click OPEN button lock the port please.
4. Click Open File button load the firmware file. The file should be .hex file. You can download the latest file here <http://chargery.com/update.asp>



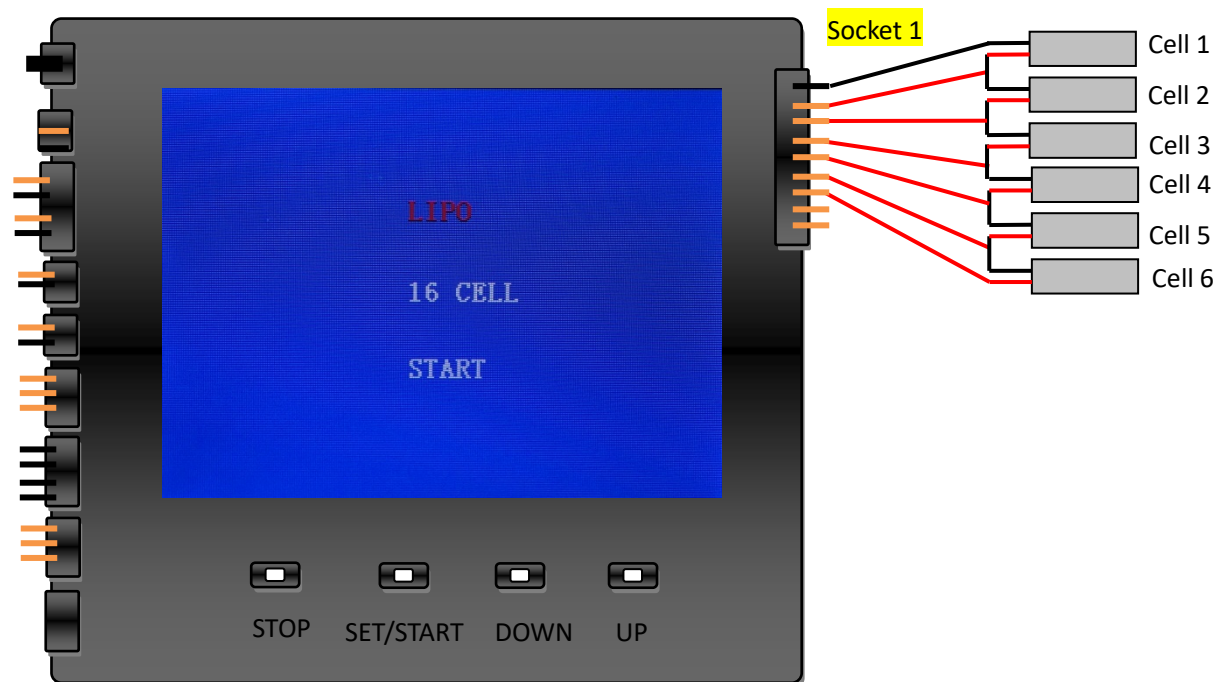
NOTE: BMS main unit and LCD display module have different firmware file.

5. Click Update button start to update, the update progress bar will appear, update complete information will be displayed on PC. BMS also display the progress bar simultaneously
6. Finish update, the BMS will start automatically.

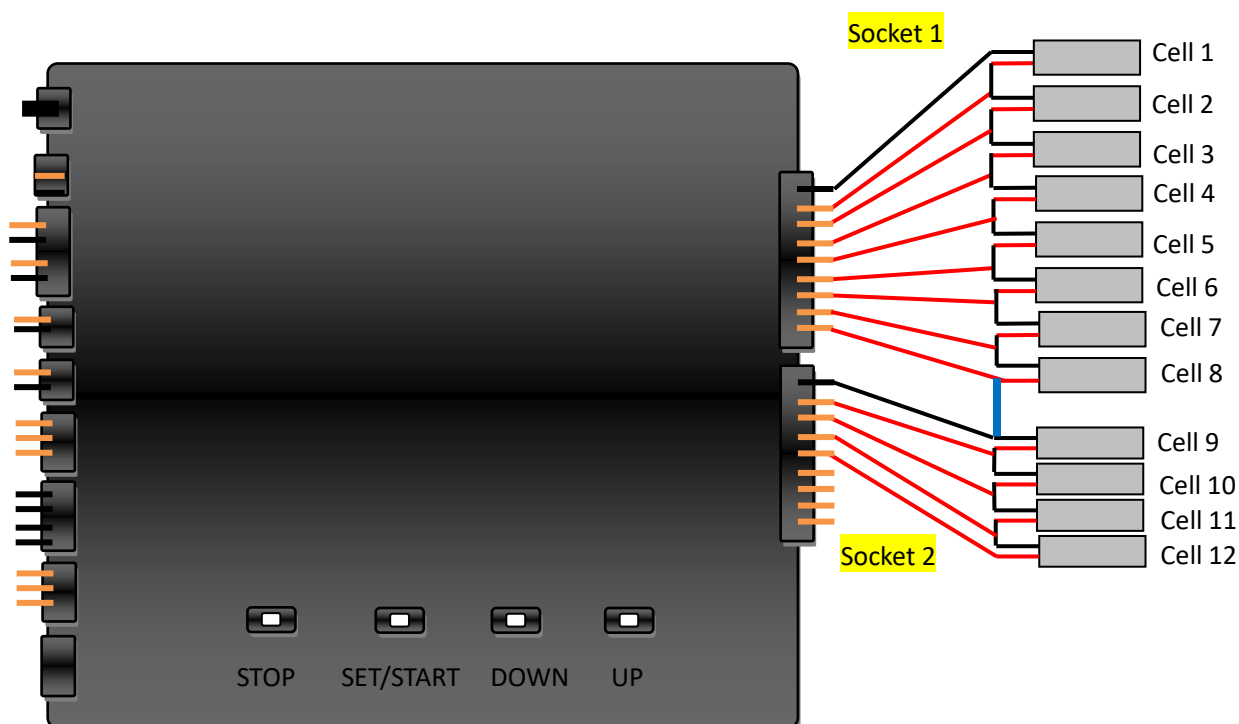
Typical Connection

There are 3 sockets connecting to battery pack, socket 1 is for 2S-8S, socket 2 for 9S~16S, and socket 3 for 17-24S battery.



1. 6S battery connect to the socket 1 directly, but external power supply is essential, it is as following.

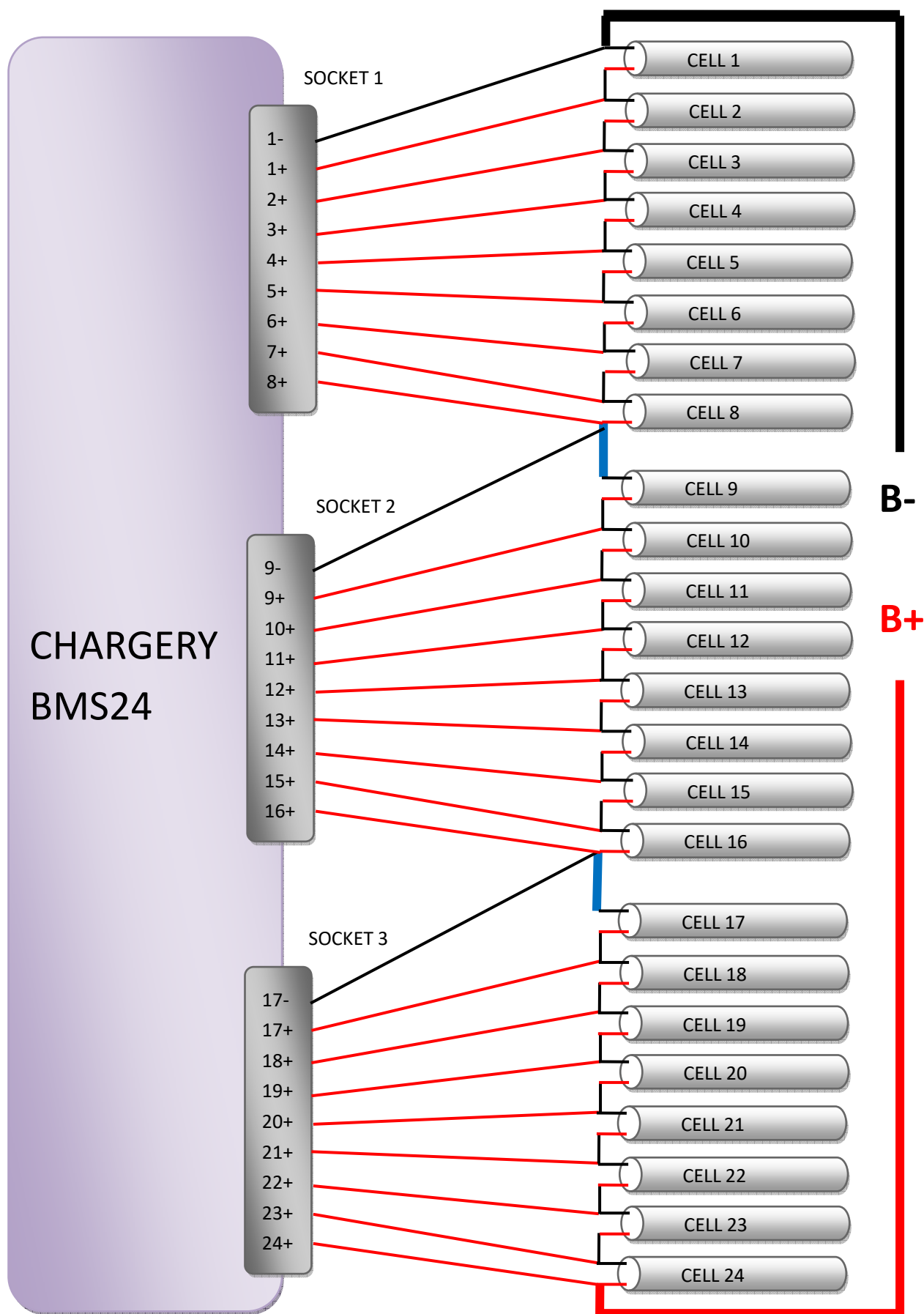


2. For over 8S battery pack, connect 8S to socket 1 and then socket 2 separately. Take 12S battery sample as following:

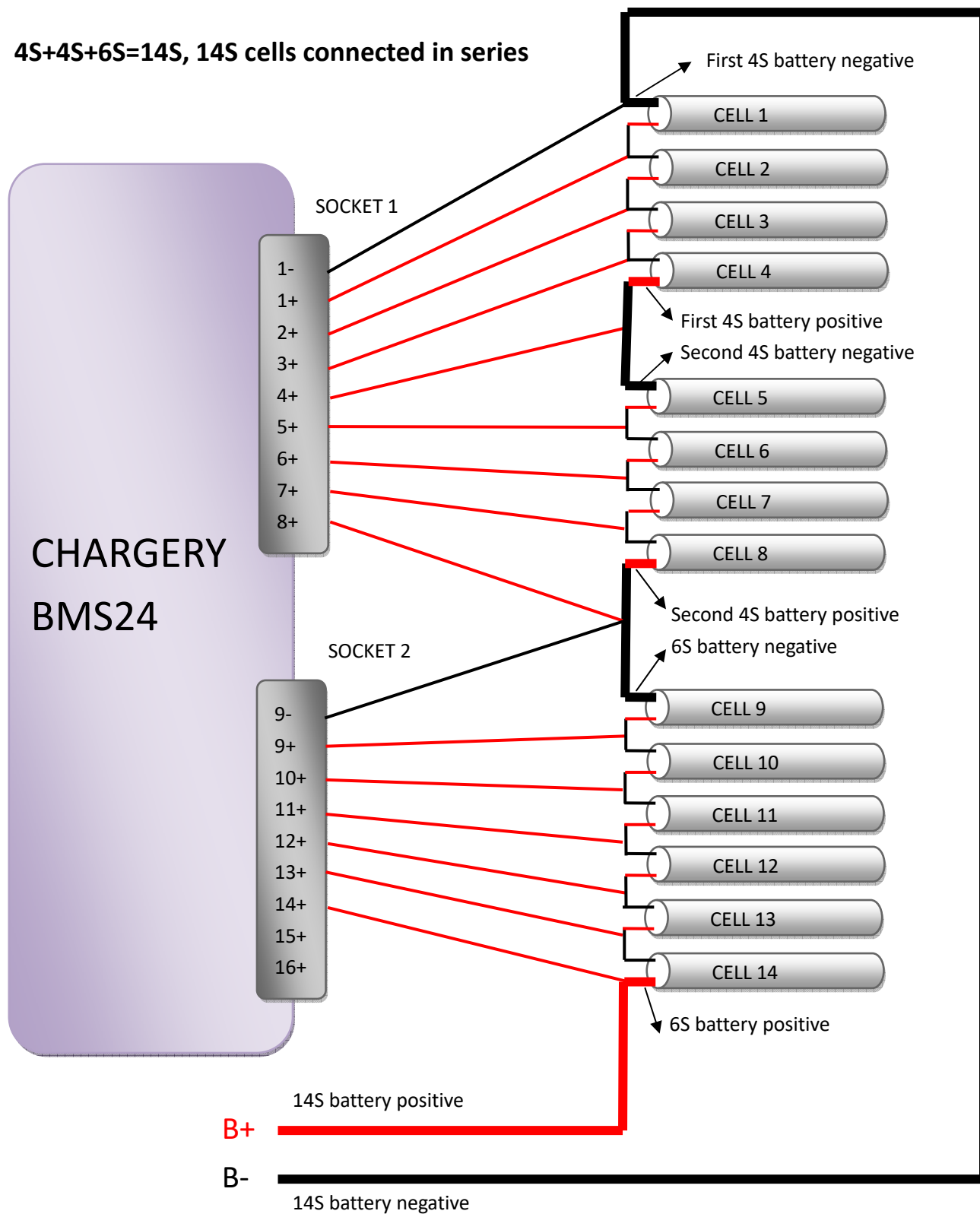


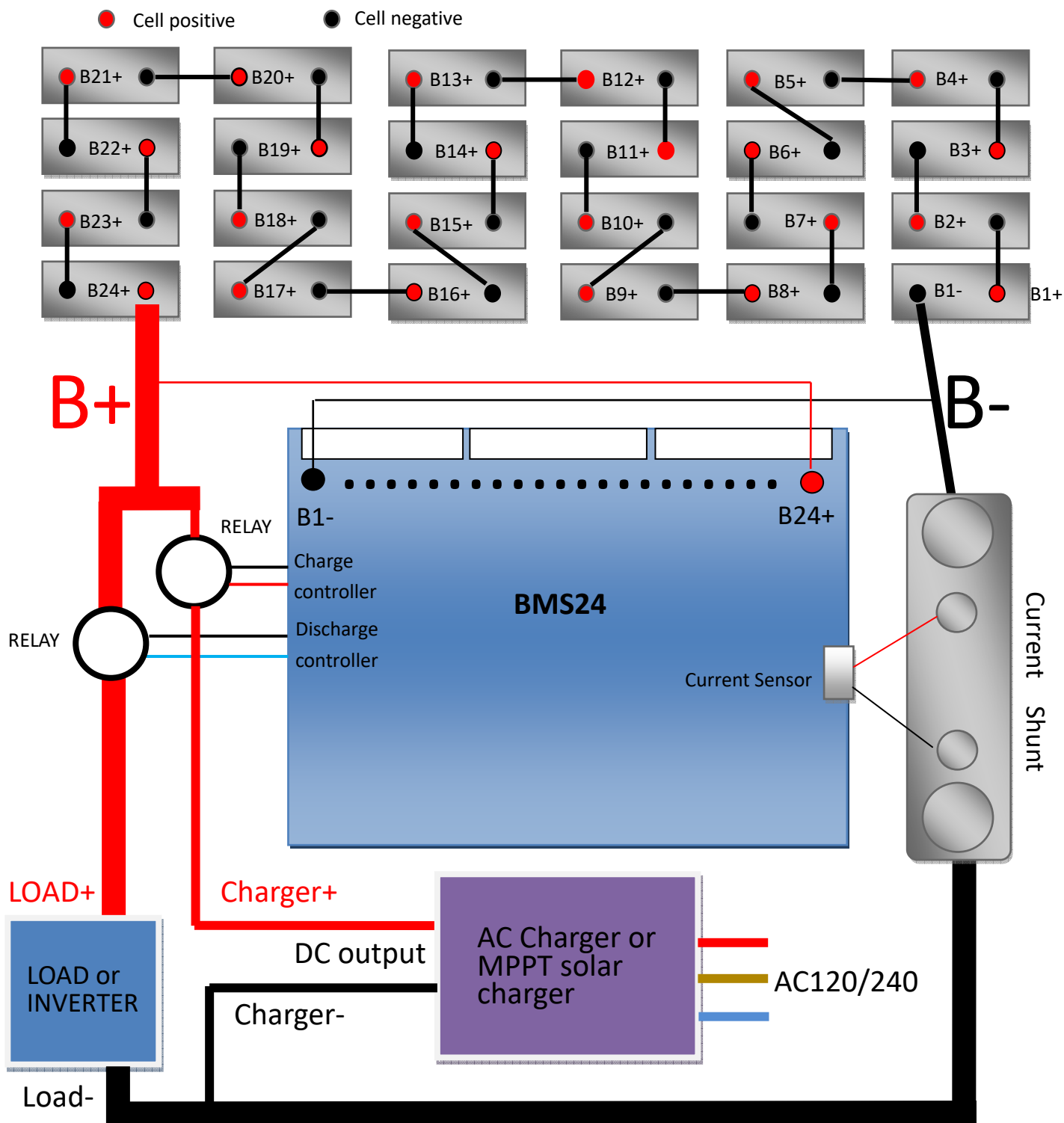


Cell Negative 
Cell positive 

24 cells connected in series

4S+4S+6S=14S, 14S cells connected in series



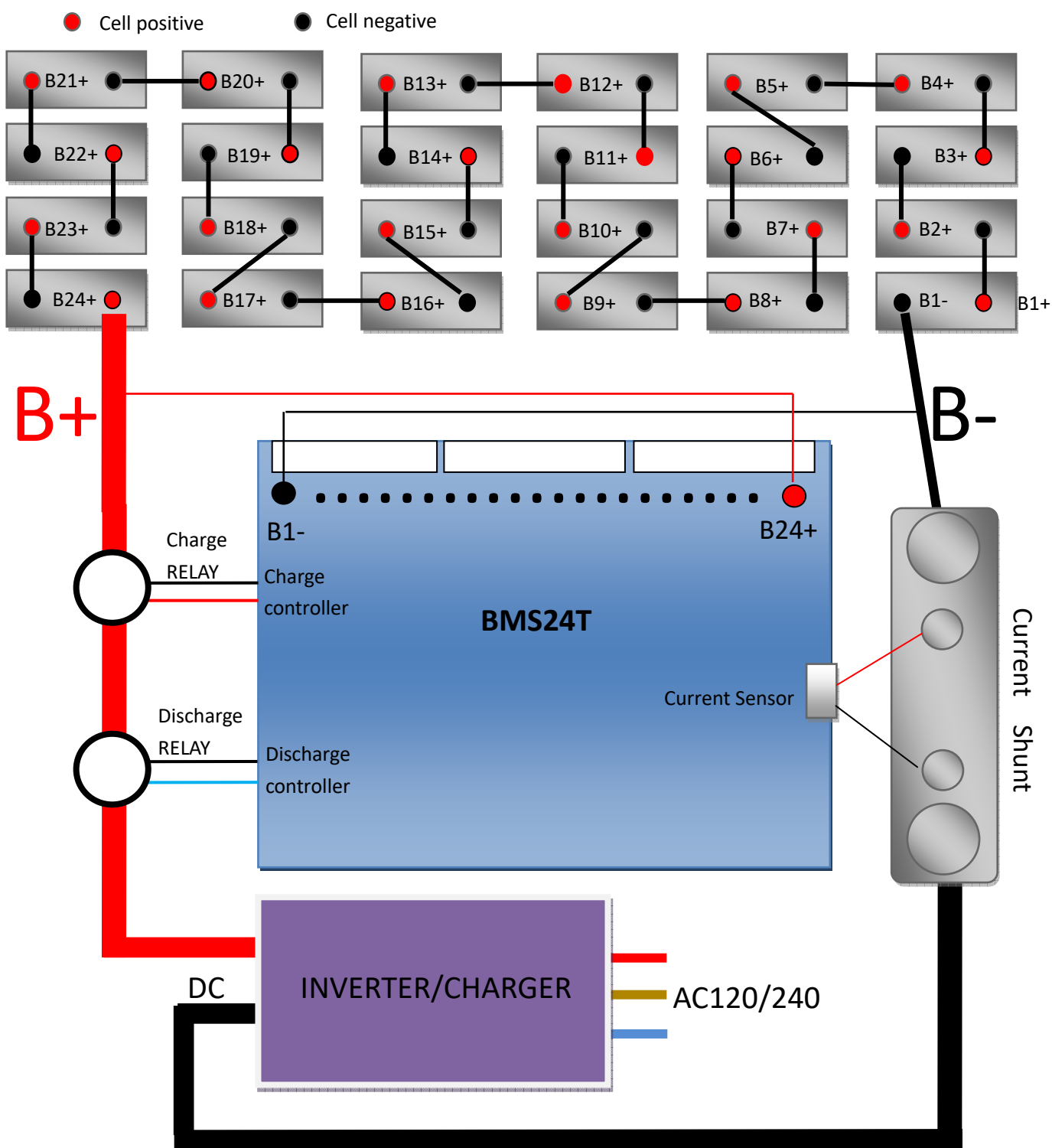


Heavy RED wires are positive of battery pack (B+/B24+), charger and load such as motor, and heavy black wire is negative of battery pack(B-/B1-), charger and load.

Warning

Before connect the relay to charge or discharge controller, please confirm the coil of relay voltage. The BMS controller will output V_{in} to power the coil, if the BMS24 will be powered by external power supply, V_{in} is external power supply output voltage, if powered by battery pack, V_{in} will be battery pack voltage. If the V_{in} is not correct on driving coil, please use voltage regulator to power coil.

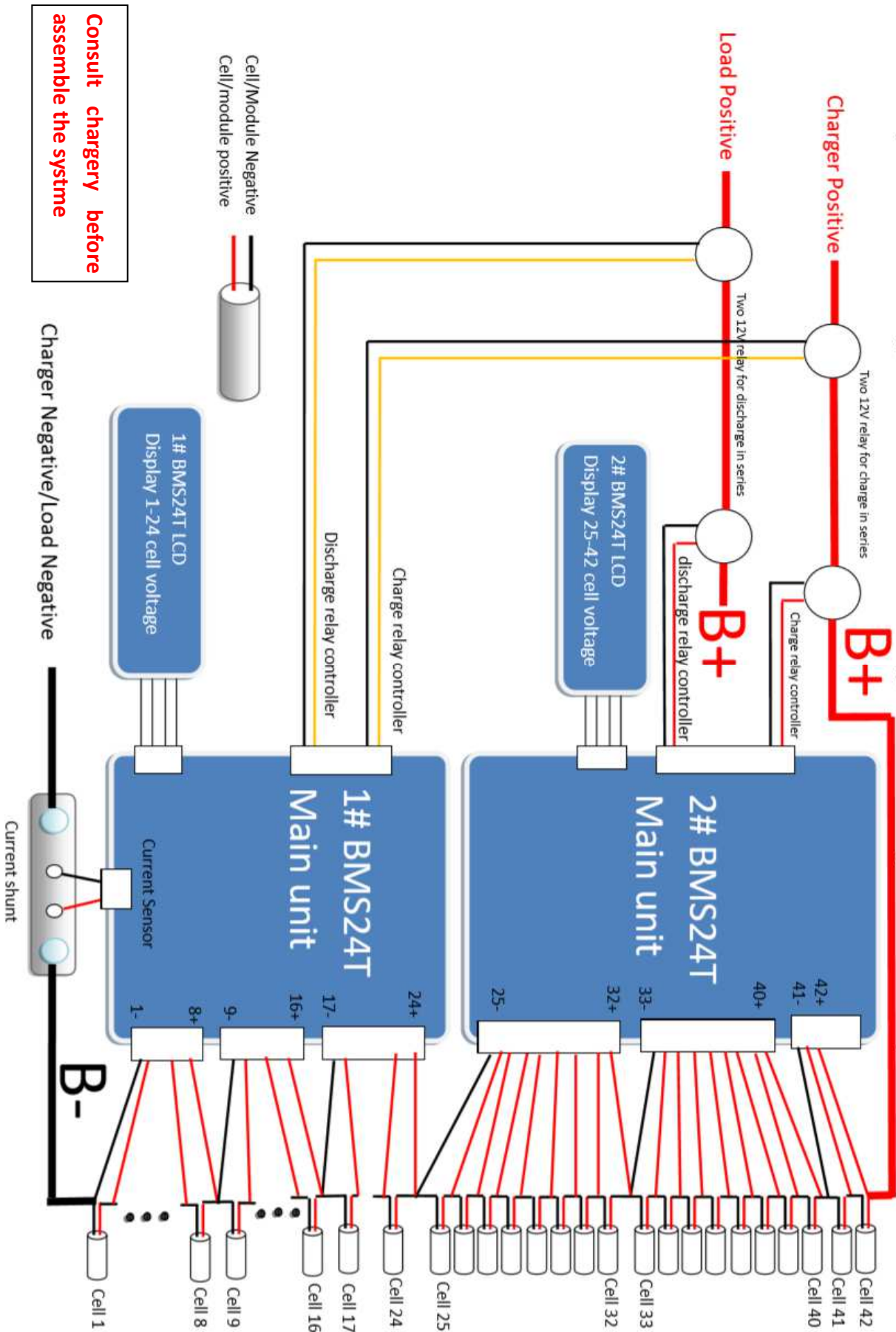
When charge and discharge on one port (such as only one battery positive and one battery negative terminal on inverter), the charge relay and discharge relay can be connected in series, but the charge relay must be with enough rated current that is over maximal discharge current.



Heavy RED wires are positive of battery pack (B+/B24+), charger and load such as motor, and heavy black wire is negative of battery pack(B-/B1-), charger and load.

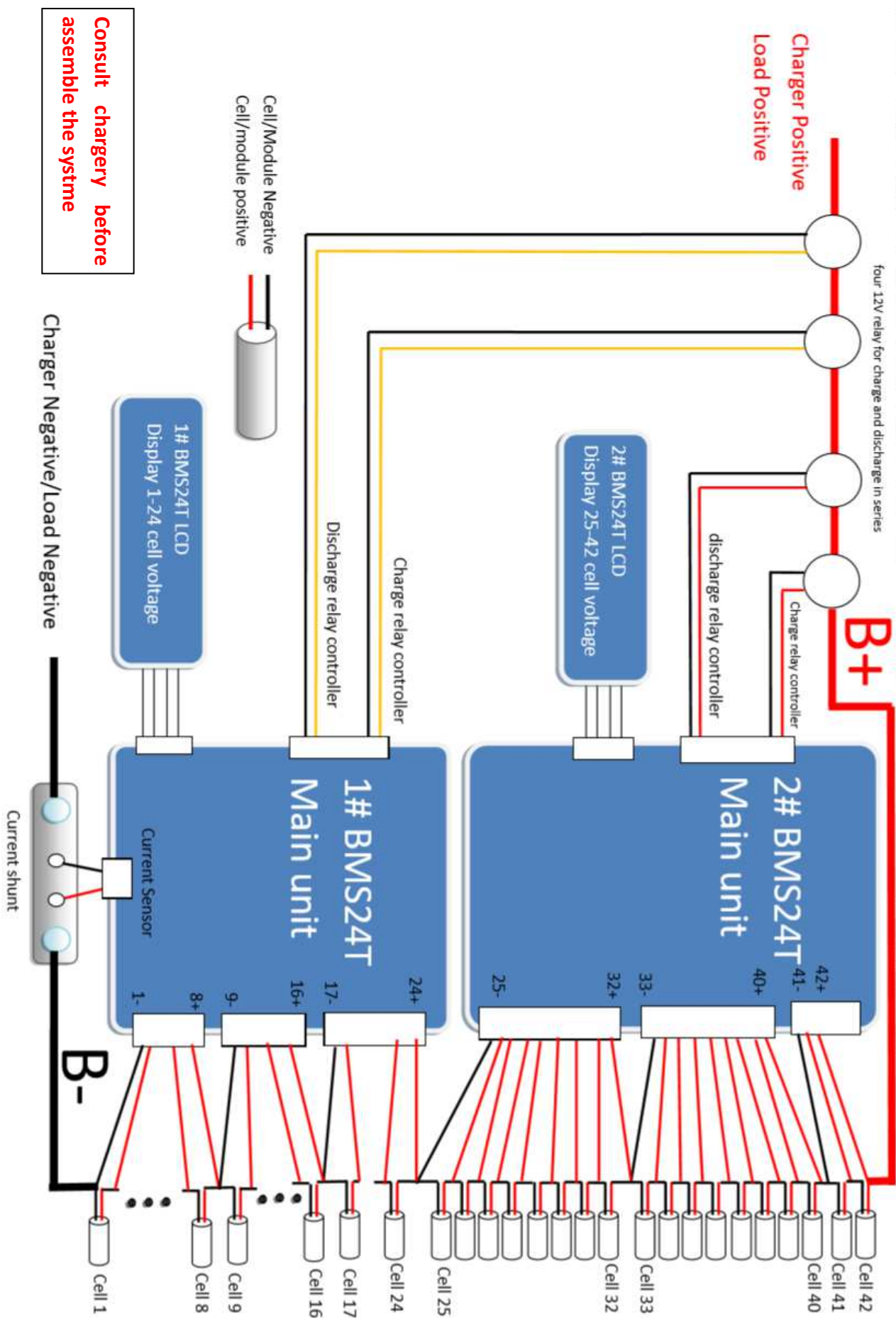


42S battery connection diagram on 2 BMS24T-----charge and discharge on different port



Consult chargery before
assemble the system

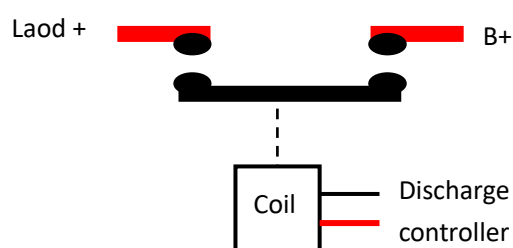
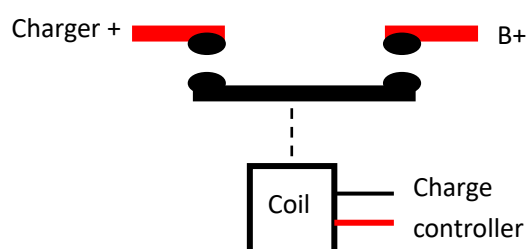
42S battery connection diagram on 2 BMS24T-----charge and discharge on same port



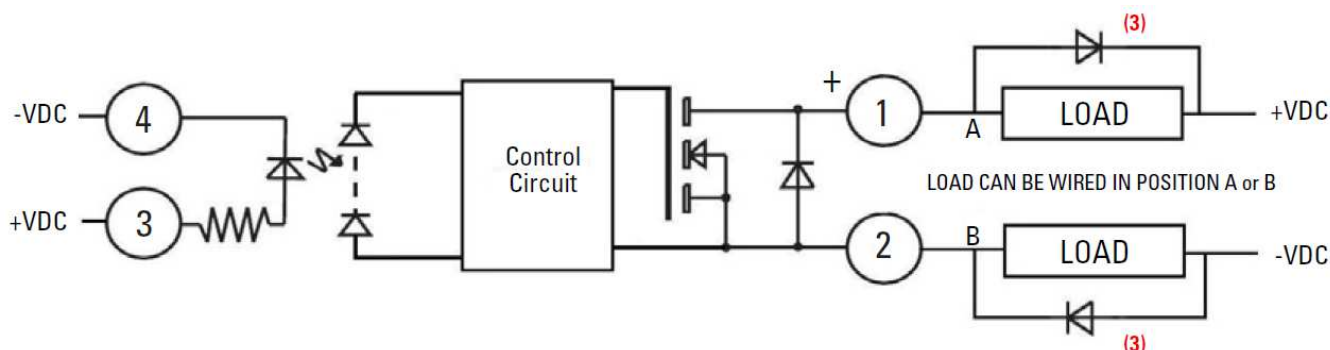
Charge relay and discharge relay lectotype for BMS24T

BMS24T v3.0 can output 12V 3A from total battery pack to power the charge and discharge relay. So the relay coil driven voltage must be 12V and total current for charge and discharge relay don't be larger than 2.5A.










1. Relay DC current should be over 1.2 times as charge or discharge current. If discharge current is 100A, 120A relay for discharge is suitable.
2. If BMS24T is powered by external power supply, the external voltage should be 15-60V and can output 3A at least to drive the relay and power the BMS24T.



3. For solid state relay, the driven voltage (+VDC, -VDC), adequate Heats Sink and rated load current is very important, please pay attention to its wire connection.



Accessory

USB data cable 	Battery connection XHR-9PIN, 600mm 	
Temperature sensor, 600mm 	Relay controller wire 600mm 	
Warning LED, 300mm 	Warning Beeper, 300mm 	
Current sensor wire, 600mm 	Communication wire (3 meters) 	COM3 Data line 

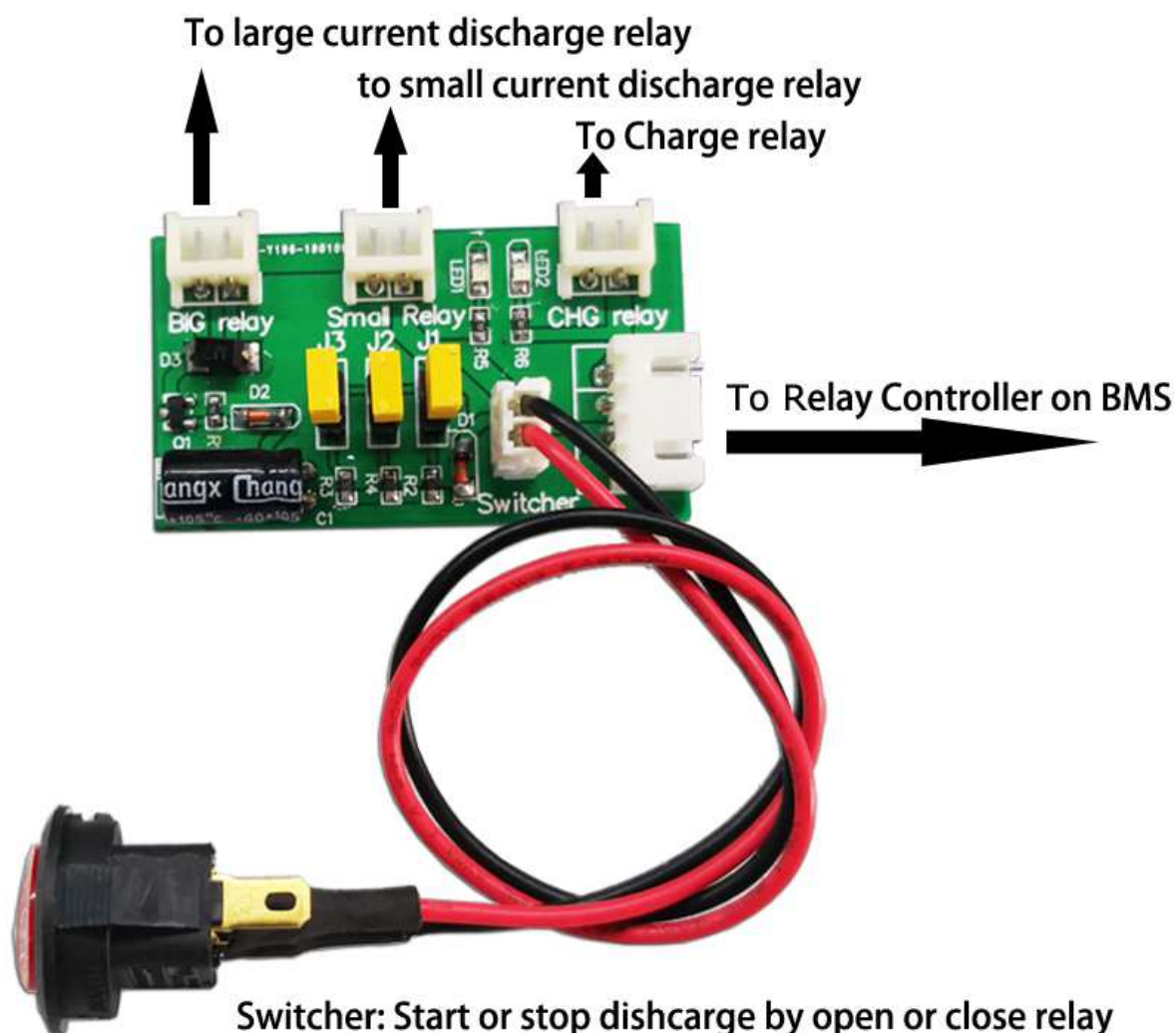
Optional accessories

- 12V 100A, 200A 400A, 600A and 800A relay (DC contactor), all is normal open.

Rated Operating voltage	12V – 500V DC				
Continuous (Carry) Current, Typical	100A	200A	400A	600A	800A
Voltage drop at 100A load	≧80mV	≧80mV	≧80mV	≧80mV	≧80mV
Coil operating voltage range	12V±20%	12V±20%	12V±20%	12V±20%	12V±20%
Close (includes bounce), Typ.	10 ms	10 ms	10 ms	10 ms	10 ms
Release (includes arcing), Max	40 ms	40 ms	40 ms	40 ms	40 ms
Bounce (after close only), Max.	3 ms	3 ms	3 ms	3 ms	3 ms
Insulation Resistance @ 500VDC	20MΩ	20MΩ	20MΩ	20MΩ	20MΩ
Coil power	4-10 w	4-10 w	4-10 w	4-10 w	4-10 w
Load Life	20000 Cycles	20000 Cycles	20000 Cycles	20000 Cycles	20000 Cycles
Mechanical Life	1 million	1 million	1 million	1 million	1 million
Operating Ambient Temperature	-40 to +85 °C	-40 to +85 °C	-40 to +85 °C	-40 to +85 °C	-40 to +85 °C
Weight, Nominal	0.3 Kg	0.5 Kg	1.0 Kg	1.6 Kg	3 Kg



2. Relay delay time board



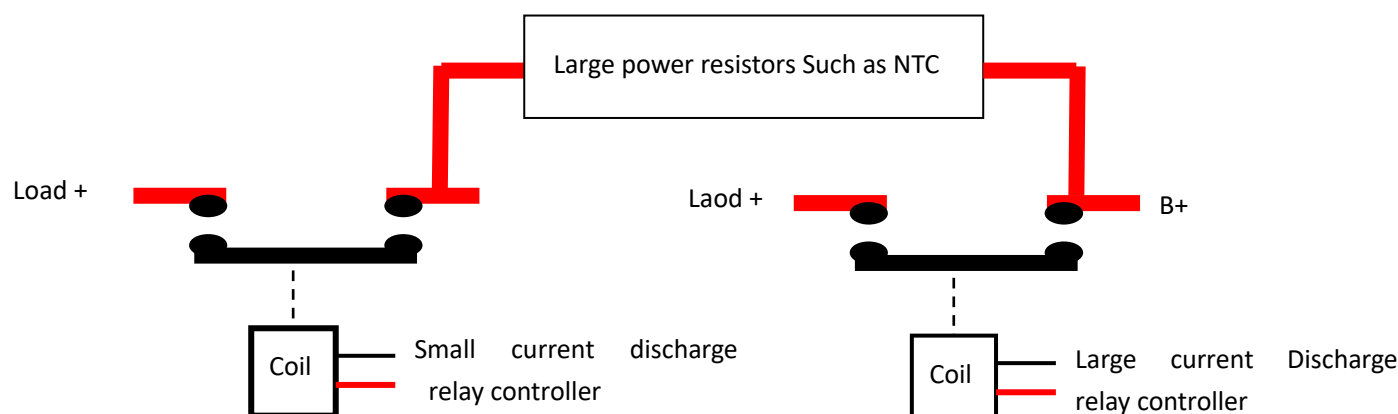
When battery start to discharge and power the motor, the surge current is very large, in order to restrain the current, CHARGER designed the special board, it can fit with CHARGER BMS8T, BMS16, BMS16T and BMS24T and so on.

The board gets the relay driven signal from BMS, charge relay coil and small current discharge relay will be closed without any delay. But the large current discharge relay will be closed after a delay time. When large current relay closed, the small relay will be open automatically according to the below connection diagram.

The delay time can be adjusted by J1, J2 and J3.

- Short circuit all jumpers: J1, J2 and J3, the delay time is 2 seconds,
- Short circuit two of 3 jumpers: J1 and J2, or J2 and J3, or J1 and J3, the delay time is 3 seconds.
- Short circuit one of 3 jumpers: J1, or J2 or J3, the time is 6 seconds.

The small current relay and large current connection is as below,



The large power resistors must be chosen by delay time and load current.

Surge Power Rating: During start up, certain loads require considerably higher surge of power for short duration (lasting from tens of milliseconds to few seconds) as compared to their Maximum Continuous Running Power Rating. The inverter continuous power should be higher than the surge power rating of these appliances. Some examples of such loads are given below: Electric Motors: At the moment when an electric motor is powered ON, the rotor is stationary (equivalent to being "Locked"), there is no "Back EMF" and the windings draw a very heavy surge of starting current (Amperes) called "Locked Rotor Amperes" (LRA) due to low DC resistance of the windings. For example, in motor driven loads like Air-conditioning and Refrigeration Compressors and in Well Pumps (using Pressure Tank), the Starting Surge Current / LRA may be as high as 10 times its rated Full Load Amps (FLA) / Maximum Continuous Running Power Rating. The value and duration of the Starting Surge Current / LRA of the motor depends upon the winding design of the motor and the inertia / resistance to movement of mechanical load being driven by the motor. As the motor speed rises to its rated RPM, "Back EMF" proportional to the RPM is generated in the windings and the current draw reduces proportionately till it draws the running FLA / Maximum Continuous Running Power Rating at the rated RPM.

Take a sample, if motor rated current is 100A, the surge current may be 1000A, it is over the maximal discharge current of battery, so need a power resistor to restrict the current to such as 100A (. so need a 200A small relay and a large power resistor. The resistor value should be over 0.48 OHM (If battery voltage is 48V), and the rated power depend on delay time. The 10pcs 5D-20 (5ohm) in parallel (6 seconds delay time), 5pcs 3D-20 (3ohm) in parallel (3 seconds delay time) or 2pcs 1D-20 (1ohm) in parallel (2 seconds delay time) is suggested.

Anyway, it is better to consult inverter or motor supplier before test the small relay and power resistor.

Finish all connection and setup, check and confirm all is ok, when ready to go, please disconnect all other switchers on other device , finally turn on the switcher on the board, the battery will start to charge or discharge.

LED 2 ON	all cell voltage is in normal range, No cell voltage over OVP. Charge relay closed.
LED 1 ON	all cell voltage is in normal range, No cell voltage under UVP, Small discharge relay closed for a short time that is delay time.
LED 3 ON LED 1 OFF	all cell voltage is in normal range, No cell voltage under UVP, Small discharge relay OPEN and large discharge relay closed, motor round at rated RPM

When the battery is not in use, please power off the switcher to save battery energy. The switcher should be installed on convenient place to be operated.

Related parts

The following device is related with BMS24T

MODEL	DESCRIPTION	COMMENTS
BMS16	For 2S-16S, balance is not available.	
BMS8T	For 2S-8S, 1.2A balance current per cell	
BMS16T	For 2S-16S, 1.2A balance current per cell	
C10325	AC charger for 4S-24S battery pack	1-25A charge, 1500W max.





Total solution on E-Vehicle application

If use Chargery charger, the charge relay can be ignored, BMS24T can communicate with charger, when any cell over charged, BMS will send signal to charger, the charger will decrease charge current till the cell voltage under safe value. If use other brand charger, BMS24 only make the relay OPEN, if charge current is big such as over 10A, the relay will open and close repeatedly. The relay life will be shortened and charge time will be longer.

Chargery charger and BMS save a relay cost and shorten the charge time.



NOTE

Chargery charger decrease charge current according to "Over Charge Protection(P) Voltage" on BMS setup, so please setup the charge terminal voltage setup in accordance with Over Charge Protection(P) Voltage on BMS.



Version History

Software Version	Description
V1.05	Released first time
V1.06	Fix press STOP enter into sleep mode, and Beeper & LED warning.
V1.07	Support LTO battery, model is BMS24T
V1.11	Negative temperature can be measured.
V1.12	Add charge protection, Don't charge under 2℃
V1.13 (Hardware V2.2)	Add display module, improve voltage bar graph display, the lowest negative 20℃ can be detected
V1.14 for LCD	Fix the charge and discharge WH bug
V1.15 for LCD	SOC can be setup to 0%
V1.16 for LCD	Start automatically on battery type and cell count setup interface, need not press START button.
V1.21 for LCD	<ul style="list-style-type: none"> ● Fix a bug when display temperature difference at F. ● Fix a bug on adjusting balance start voltage on LiTo battery ● Add balance control item in storage status on Program Setup interface <ul style="list-style-type: none"> ---balance in Storage on or off -- balance in Charge on or off -- balance in Discharge on or off <p>Charge status: charge current displayed over 1A</p> <p>Discharge status: discharge current display under -1A, such as -10A</p> <p>Storage status: current displayed between -1A ~ 1A</p> <p>So current shunt and current sensor wire must be connected to BMS main unit.</p> <ul style="list-style-type: none"> ● Improved SoC of LiTo battery
V1.22 for LCD and V1.18 for main unit.	<ul style="list-style-type: none"> ● Improved SoC arithmetic ● Fix a big when over discharge resume
Old version(main unit version V1.18, LCD unit V1.22) discontinued. The obvious different of old and new main unit is new main unit with COM3 port. New main unit must fit with new LCD unit (V3.0 to V3.03) that has different program.	
Software Version of LCD unit	Description
V3.0	Update hardware and software at the same time, Release first time
V3.01	debug a mistake on display
V3.02	adjusted maximal cell difference can be set up to 1000mV
V3.03	Add low temperature cutoff
Software Version of main unit	Description
V1.18	first released
V1.19	optimize over charge protection, don't cut off charge when cell voltage difference over setup.
V1.20	optimize current detection
V1.21	add current mode send out
V1.22	Add SOC send out



Frequent questions

1. Charge or discharge relay/DC contactor don't be open(disconnect) or closed (connect)

- Confirm relay coil driven voltage, it must be 12V only for V3.0
- Confirm relay coil consume power or current, don't be over 1A for each relay or total current with two relay don't be over 2.6A
- Without alarm the charge and discharge relay controller voltage is 12V,
- When any alarm events happen, the charge and discharge relay controller voltage is 0V,
- Without any warnings, the relay always closed

2. Cell voltage display is not accordance with actual cell voltage

- Check 9pin balance wire connection is good.
- Measure actual cell voltage on BMS balance port.
- Disconnect battery, measure resistance on balance port. Such as, if cell 5 voltage is not correct, measure resistance between cell 5- and 5+ on balance port. Generally it is very large (100K ohm or so).
- Or send back to us and calibrate the cell voltage again.

3. SOC is zero,

- Restart BMS main unit---power off it and power on again.

4. SOC is wrong

- Setup accurate battery capacity on program setup interface
- Charge or discharge the battery. Charged capacity or discharged capacity is 25% of battery rated capacity at least.
- BMS will calibrate the SOC automatically after charge or discharge.

5. Charge or discharge current display is not stable or wrong

- The wire length from current shunt to battery negative should be as short as possible.
- Check charge current or discharge current ripple, especially on inverter.
- Add low-pass filter on current sensor or
- Update main unit to V1.21, need not calibrate current.
- If exchange shunt, or other reasons need calibrate current, the calibration video is here
[https://www.youtube.com/watch?v= LOJw83s18M](https://www.youtube.com/watch?v=LOJw83s18M)

6. Cell voltage difference drop slow during balance

- Setup balance in storage is ON
- Setup balance in charge is ON
- Setup lower balance start voltage
- Confirm the BMS main unit blue case is warm, if yes, means the balance is in working.
- If a cell voltage is always lower than others, such as cell 5, please disconnect all battery and measure resistance between cell 5- and 5+ on balance port. Generally it is very large (100K ohm or so). If only 10 ohm or less, please return back to us for repair.
- For over 50Ah battery, the balance time is longer
- After discharge, check the cell voltage difference on LCD, if over 100mV even 200mV, means the cell impedance difference or capacity difference is very large. Exchange lower voltage cell in discharge or higher voltage cell in charge is suggested.

7. STOP button freeze

- When current displayed is zero, that is to say, the battery don't be in charging or discharging, press STOP button make the BMS enter into sleep mode to save battery energy.
- If need wake up BMS, please press UP, DOWN or START Button.



- c) If stop charging or stop discharging, please realize it on charger or load/inverter or other switcher.

8. BMS power consumption

- a) At normal work mode, the BMS draw current from 24S battery (100V) is 3mA at LCD back light is off, and 6mA at LCD back light is ON.
- b) At sleep mode, the BMS draw current from 24S battery (100V) is less than 1mA at LCD back light is off.

9. Relay closed continuous power consumption.

- a) 12V 100A relay, coil current is 0.75A at 12V drive voltage.
- b) 12V 200A relay, coil current is 0.96A at 12V drive voltage.
- c) 12V 400A relay, coil current is 1.24A at 12V drive voltage.
- d) 12V 600A relay, coil current is 1.3A at 12V drive voltage.

Because relay coil current is far more than BMS working current, to avoid any cell over discharged, please operate as below,

- if the battery is not in use (exclude charging), please disconnect all relay coil driven wire immediately,
- If storage for over 1 month, please make BMS enter into sleep mode.
- If storage for over 3 months, please turn off BMS directly.

10. Show timeout during updating,

- a) Update tool software version must be v1.03
- b) Connect BMS main unit or LCD unit to PC by USB cable.
- c) Turn on BMS main unit.
- d) Execute update tool software and lock the com port by click OPEN button.
- e) Download correct firmware according to product model and save your PC.
- f) Click open file button and upload the correct firmware.
- g) Click update button finish update.

11. Charging stop, the possible reasons are as below.

- a) Any cell voltage reach "Over Charge Protection(P) Voltage " setting
- b) The highest cell voltage over "Over Charge Release(R) Voltage" setting.
- c) Charging current over "Over charge current" setting.
- d) Battery temperature over "high temperature cutoff" setting.
- e) Battery temperature under "low temp cutoff in charge" setting.
- f) Battery temperature difference over "diff of battery temp" setting.
- g) Charger stop charging,

12. Discharging stop, the possible reasons are as below.

- a) Any cell voltage reach "Over discharge Protection(P) Voltage " setting
- b) The lowest cell voltage under "Over discharge Release(R) Voltage" setting.
- c) Discharging current over "Over discharge current" setting.
- d) SOC under "SOC----battery gauge" setting.
- e) Cell voltage difference over "Difference(Diff) of cell voltage" setting.
- f) Battery temperature over "high temperature cutoff" setting.
- g) Battery temperature under "low temp cutoff in discharge" setting.
- h) Battery temperature difference over "diff of battery temp" setting.
- i) Others



Warranty and Service

Chargery Power Co., Ltd. as manufacture of power system warrants its BMS24T and current Sensor to be free of defects in material and workmanship. This warranty is effective for 12 months from date of purchase. If within the warranty period the customer is not satisfied with the products performance resulting from a manufacturing defect, the accessory will be replaced or repaired.

Your selling dealer is your first point of contact for warranty issues. Return postage costs are the responsibility of the user in all cases. Please submit copy of original receipt with the return.

Damage due to physical shock (dropping on the floor, etc.), inappropriate power supply (unstable output voltage and insufficient power, etc.), water, moisture, and humidity are specifically NOT covered by warranty.



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