



## BMS16

**BMS for 2S-16S LiPo & LiFe**

Low power consumption

High accuracy

2.8" TFT LCD display

Programmable



**T**hanks for your purchasing the BMS16 for your vehicle.

**R**ead the ENTIRE instruction manual to become familiar with the features/functions of the device before operating.

**F**eel free to send an email to [jasonwang3a@163.com](mailto:jasonwang3a@163.com) or call at 86 755 2643 6165 should you have any questions and suggestions.

A handwritten signature in black ink, appearing to be 'Jason Wang'.

Jason Wang



Chargery BMS16 is designed special for LiPo & LiFe 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 read the entire manual completely before using, to make sure you can use this device better and more safely.

1. Ensure the BMS program and settings match the battery pack, otherwise the battery will be damaged and a dangerous situation may arise, especially for Lithium batteries, which may cause fire.
2. For storage energy system application and for Electrical vehicle application will have many differences, please adjust those key parameters carefully, or contact us for more details.
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.

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## Special update

1. Relay controller use 12V 3A large current regulator from 16S battery pack. It can drive larger current mechanical relay or state solid relay.
2. If use external adaptor, the BMS can do 2S -16S battery, and the external voltage range is 15-60V.
3. Use external current shunt, maximal 100A continuous updated to 300A
4. For same Battery positive and negative terminal when charge and discharge, BMS16 can control charge and discharge separately. And detect charge and discharge current with one current shunt.

## Order information

Model	Description	Accessories
BMS16 V2.0	300A charge and discharge	300A shunt, and standard accessories

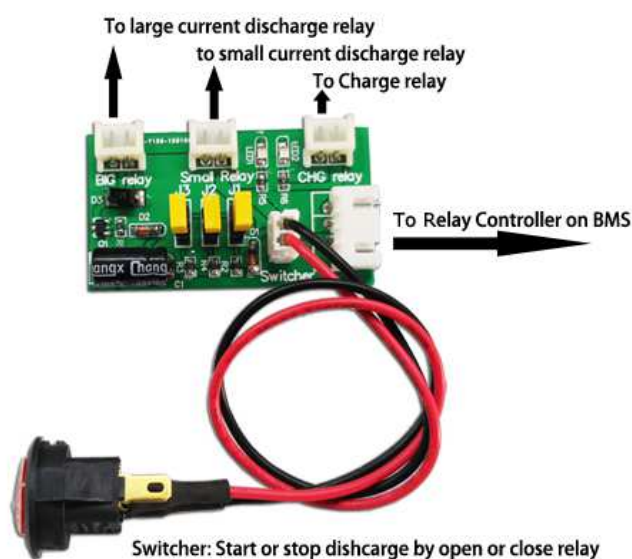
## Package

All standard accessories are listed on page 13, includes:

1. Base unit, 1pcs
2. Battery balance wire, 2pcs
3. Relay controller wire, 1pcs
4. Temperature wire, 1pcs
5. Current sensor wire, 1pcs
6. 300A current shunt, 1pcs
7. USB data cable, 1pcs
8. Warning LED, 1pcs
9. Warning beeper, 1pcs

Optional accessories

1. 12V 100A relay
2. 12V 200A relay
3. 12V 400A relay
4. 12V 800A relay
5. Relay delay time board (right picture)





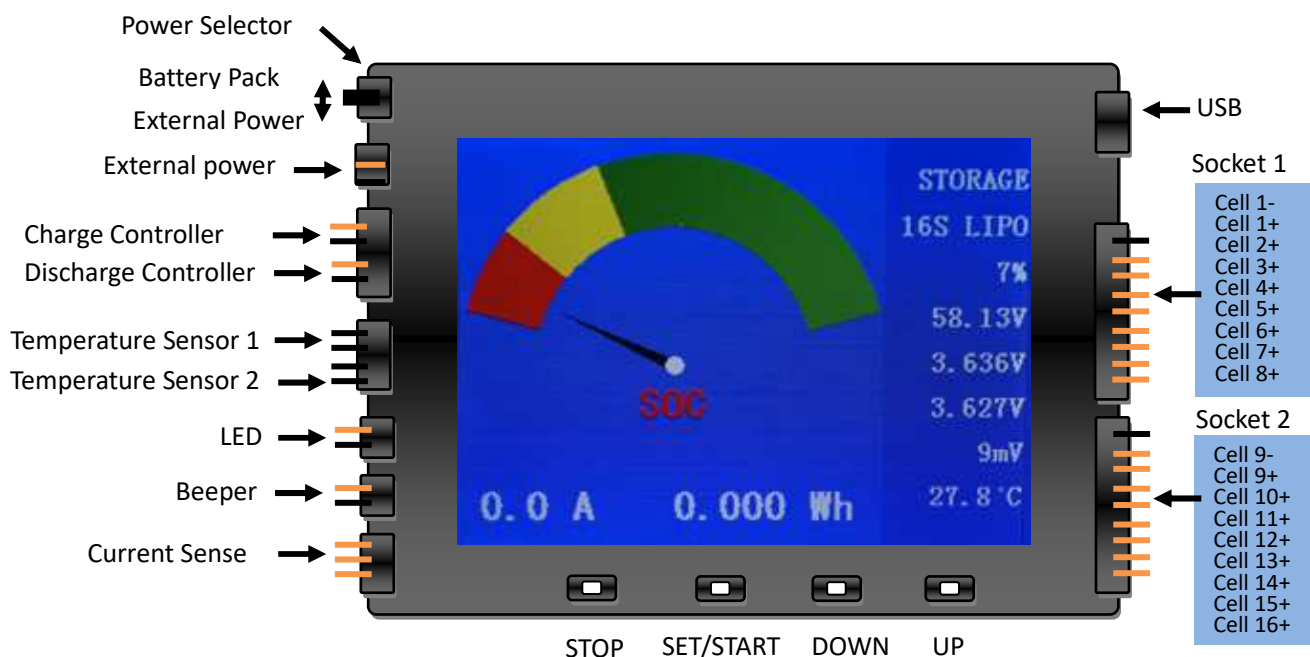
## Special Features

1. The BMS16 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 16S LiPo battery (68V)
2. Charge/discharge current up to 300A continue, 600A burst.
3. BMS16 calculate and display the charge and discharge power (Wh), generally the battery rated power is rated voltage multiply rated battery capacity.
4. TFT LCD screen that provides rich information including current, voltage, power, capacity, control status, SOC and temperature and so on.
5. BMS16 features a maximal safety protection, within the range parameters can be setup, BMS16 will alarm and cutoff charge or discharge according to users' setup, out of range of parameters, and triggered absolute maximum ratings BMS16 will force to cutoff charge or discharge to prevent the battery from fire.
6. Minimize the power consumption by draw current from all cells or external power supply.
7. Dual power design, the unit can be powered by all cells or external power supply.
8. 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.
9. Sound alarm and LED alarm will be triggered when any warning events happened, and then wait several seconds cut off or NOT charge or discharge. The delay time can be programmed.
10. Charge relay and discharge relay are controlled independently.
11. Two temperature sensors monitor battery temperature on different location.
12. Supports upgrading the firmware program by USB port.
13. BMS16 provide users the maximal flexibility, key parameters can be programmed.
14. BMS16 display battery SOC or called battery gauge similar with car dashboard. Cell count, battery pack voltage and battery gauge (%) is displayed simultaneously.
15. In case that the battery pack need not be charged and discharged, Press STOP button enter into sleep mode to save energy consumption. Charge and Discharge is cut off, LCD back light is off. Press any key to resume normal work mode.
16. 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. Over temperature
6. Over differential cell voltage
7. Over differential battery temperature
8. Under SOC protection

## Interface of BMS16



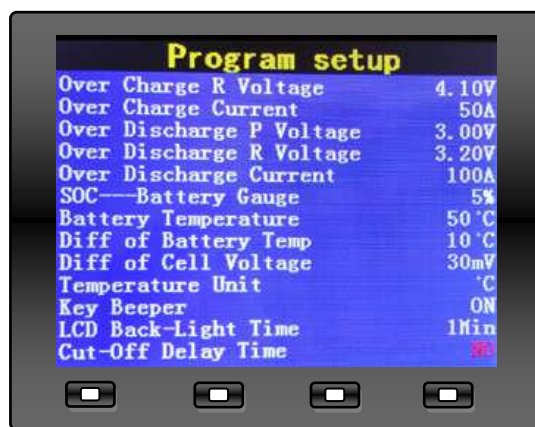
Power Selector	Alternate External or battery pack to power BMS16. If select all cells power the unit, the battery pack must be 8S to 16S LiFe or LiPo. But if power by external power supply, BMS16 can do 2S-16S LiPo or LiFe battery pack.
External power supply	External power input, the voltage should be 15V to 60V, 3A minimum, the current depends on the relay, the connector is 5.5*2.1 DC jack.
Charge controller	Charge controller, turn on or turn off charge circuit, generally connect to relay or DC contactor. When any cell voltage is over setup, it will make relay "OPEN" to turn off the charger, otherwise BMS16 will output <b>12V</b> power the coil to close the relay. The relay must be form OPEN.
Discharge controller	Discharge controller, turn on or turn off 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 BMS16 will output <b>12V</b> power the coil to close the relay. The relay must be form OPEN.
Temperature sensor	Two temperature sensor 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 0-150°C
LED	Connect to high light LED, the LED will flash when any warning event happened
Beeper	Connect to beeper or others to alarm. It will output 12V 25mA max.
Current sense	Connect to current shunt, Charge current and discharge current can be measured by one shunt.
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



## Absolute maximum or Minimum ratings

Maximal cell voltage	LiPo	4.35V	Larger than the absolute maximum voltage, BMS16 will force to cut off charge
	LiFe	3.90V	
Minimum cell voltage	LiPo	2.50V	Less than the absolute minimum voltage, BMS16 will force to cut off discharge
	LiFe	2.00V	
Battery temperature	LiPo&LiFe	100℃	Over the temperature, BMS16 will force to cutoff the charge and discharge

## Program Setup



1. Press **SET** button for 3 seconds enter into Program Setup interface.
2. Press **UP** or **DOWN** button select the item, press **SET** shortly make the value flash, and press **UP** or **DOWN** change the value. Press **SET** button shortly confirm the change. After finish all setup, press **SET** for 3 seconds quit the setup menu.
3. When quit setup mode, BMS16 Will remember all parameters till next change.

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

Parameters		Min.	Type	Max.	Step	unit
<b>Charge Protection</b>						
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
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
Over Charge current		5	100	300	1	A
<b>Discharge Protection</b>						
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
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
Over Discharge current		5	100	300	1	A
SOC--- Battery gauge		5	20	90	1	%
<b>Temperature Protection</b>						
Battery Temperature		30	50	80	1	℃
Difference(Diff) of battery Temperature(Temp)		5	10	30	1	℃
<b>Voltage balance Protection</b>						
Difference(Diff) of cell voltage		5	30	300	1	mV
<b>Others</b>						
Temperature Unit			℃	℉		





Key Beeper			ON	OFF		
LCD Back-Light time <sup>(1)</sup>		1	10	999	1	min
Cut-Off Delay Time <sup>(2)</sup>		0	10	60	1	Second
Current Calibration <sup>(3)</sup>		0	0	255	5	A

**NOTES:**

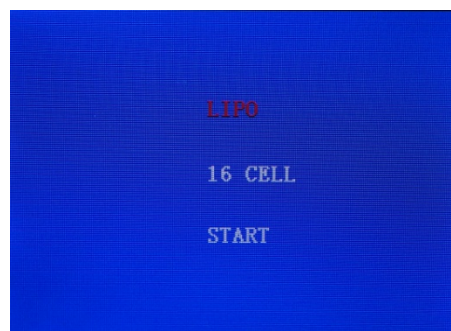
1. **Always on** means the LCD back-light will be ON forever.
2. **NO** means BMS16 will not cut off charge or discharge but alarm by LED flash and Beeper Sound.
3. **Current Calibration** is not recommended, voltage and current is calibrated before delivery.

## Warning

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 **NOT** controlled by BMS16, but when cell voltage and temperature trigger the absolute maximum or minimum ratings, the BMS16 will force to cut off charge or discharge to make sure the battery safety, and prevent battery pack from explode or fire.

## Operating guideline

1. Connect Beeper, LED, and Current Sensor to BMS16, and then connect relay Controller and temperature sensor too.
2. Connect the battery to BMS16, keep the cell polarity correct. The detailed connection diagram is as the following typical connection drawings. move the power selector power on the device.
3. BMS16 will initialize the beeper and LED, beeper sounds once time, after display BMS16 and version, the battery type and cell count interface is displayed. Two battery type LiPo and LiFe can be selected. Cell count range is 2S to 16S, the cell count will be identified when the battery pack connect to the BMS16. Press DOWN or UP button choose the item and press SET blink, then press DOWN or UP button changed, finally press START button to run the BMS16 or waiting for 8 seconds the BMS16 will start automatically. After started, battery type and cell count will not be changed unless power off BMS16.
4. SOC—battery gauge dashboard will be displayed first, as following. Press UP/DOWN button alter other interface.



Charge or discharge  
current

Charge or discharge  
power

STORAGE is battery status, maybe CHARGE or DISCHARGE <sup>(1)</sup>

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

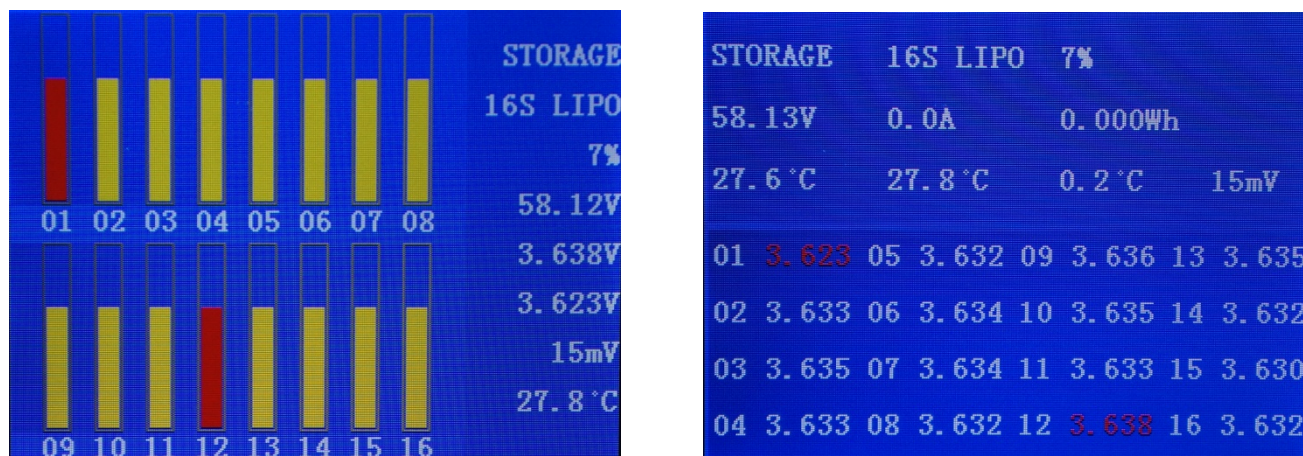
Battery temperature

**Notes**



### 1) When charge or discharge current less than 0.5A, battery status will be STORAGE.

5. The following interface is cell voltage column, the highest and the lowest cell voltage is displayed in RED column.



6. 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, BMS16 will go to the interface and display error information. Such as if the battery connection bread 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.

## Specifications

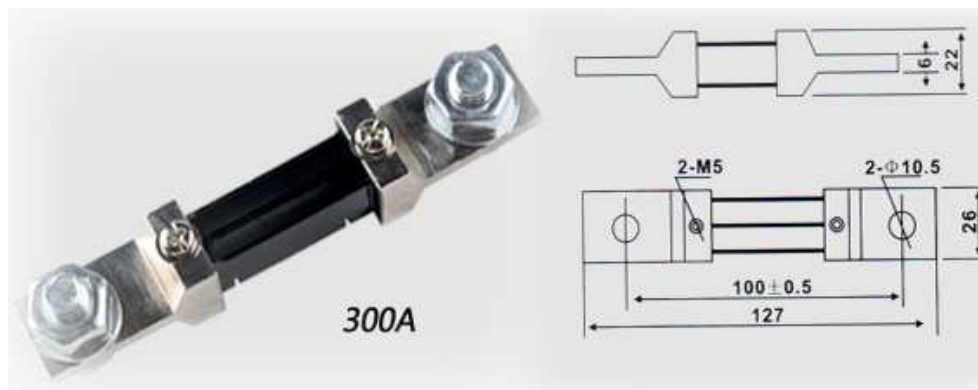
- Battery range: 2S-16S LiPo & LiFe battery pack
- Accurate scope of the cell voltage: -5mV/+5mV
- Cell Voltage display range: 0.10~4.99V
- The voltage of external power: 13.5-60V.
- Temperature display range: 0.0°C~150°C,
  - Display 0.0 when under 0.0°C
- SOC indicator:
  - RED area @ 0~15% of SOC
  - YELLOW area @ 16~35% of SOC
  - GREEN area @ 36~100% of SOC
- Size: 105\*80\*24 (L\*W\*T, mm)
- Weight: 190g
- Warning LED: 11000mCd, @ 2.0V, 20mA
- Warning beeper: 85dB @ 12V, 25mA
- Package: AL alloy case

## Current Shunt Specifications

Please use correct current shunt according to actual maximal charge and discharge current, single shunt is enough for BMS16, 75mV or less shunt is suggested. BMS16 can detect charge and discharge current by same shunt.

All cell voltage and current are calibrated before delivery.

The 300A 75mV specification is as below.



300A shunt weight: 230g

## Current sensor wire



## Current Calibration

Press SET 3 buttons enter into Program Setup and find the Current Calibration, you can calibrate the current to improve the measure accuracy.

1. Shortly press SET make the 0A blink
2. Turn off charge and discharge, and short press SET button.
3. Press SET again and increase it to any current value (up to 255) and charge or discharge at the current.
4. Press SET save calibration data.
5. Press SET for 3 seconds quit.

## Firmware Upgrades via USB Port

1. Go to <http://www.chargery.com/uploadFiles/ChargeryupdateTool.zip> to download the [ChargeryupdateTool.zip](#).
2. Connect BMS16 to PC with USB cable, the USB driver will be installed automatically
3. Double click to run the update tool and enter program interface.
4. When the port number (such as com5) appears, this shows the update tool identified the BMS16. Click OPEN button lock the port please.
5. Click Open file button open the firmware file. If there is no firmware file on the PC, you can download the file on <http://www.chargery.com/uploadFiles/firmwareFiles/> to the PC.
6. Click the Update button, then the update progress bar will appear on the bottom, update complete will be displayed on PC after finish update. BMS16 display the progress bar simultaneously and enter into cell count setup interface after update is completed.



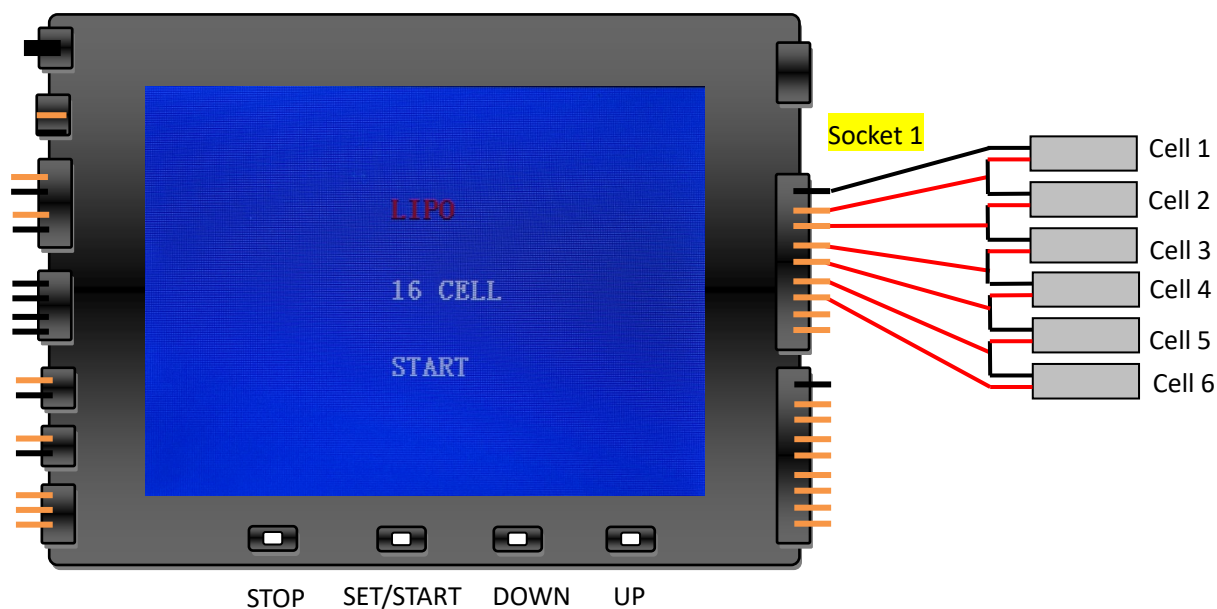
**BMS16 v2.0**

**300A charge and discharge current**

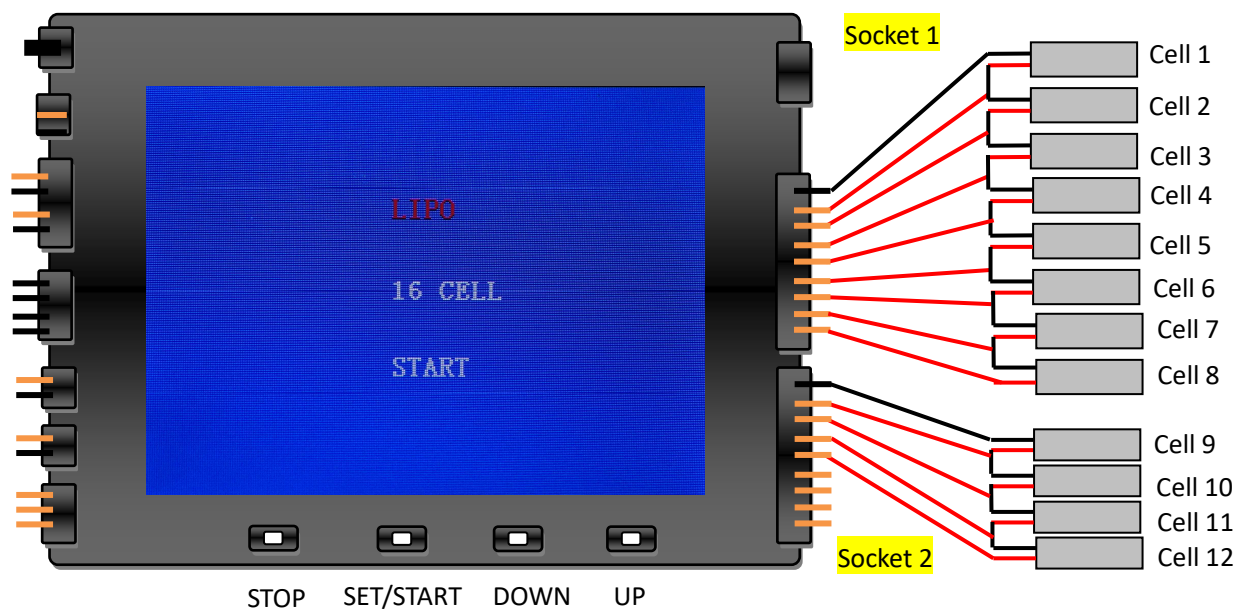
## Typical Connection

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

1. 6S battery connect to the socket 1 directly, 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:

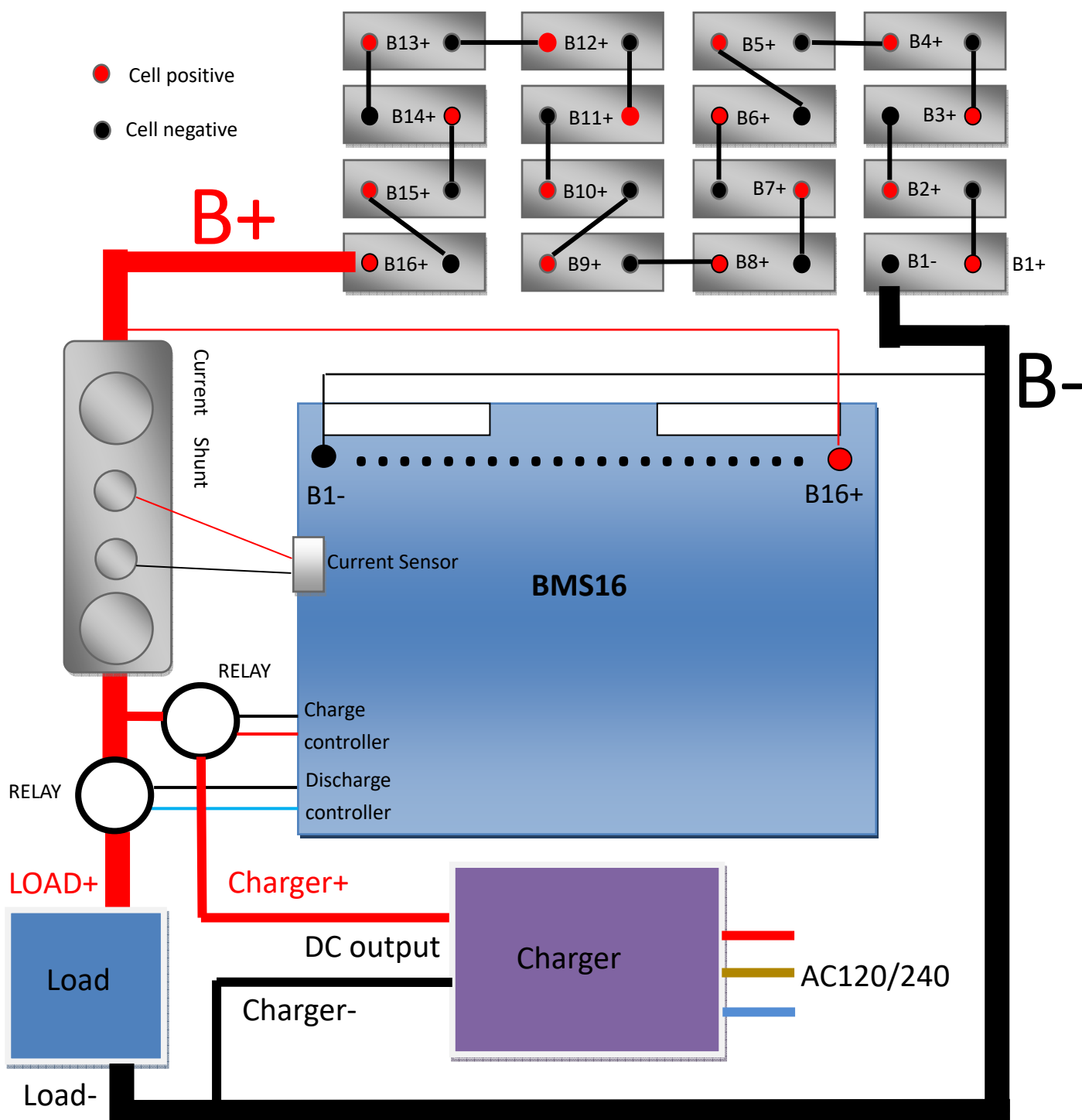




## Accessory

<p><b>USB data cable</b></p> 	<p><b>Battery connection XHR-9PIN, 600mm</b></p> 
<p><b>Temperature sensor, 600mm</b></p> 	<p><b>Relay controller wire 600mm</b></p> 
<p><b>Warning LED, 300mm</b></p> 	<p><b>Warning Beeper, 300mm</b></p> 
<p><b>Current Sensor wire 600mm</b></p> 	

## Current Sensor and Relay Connection



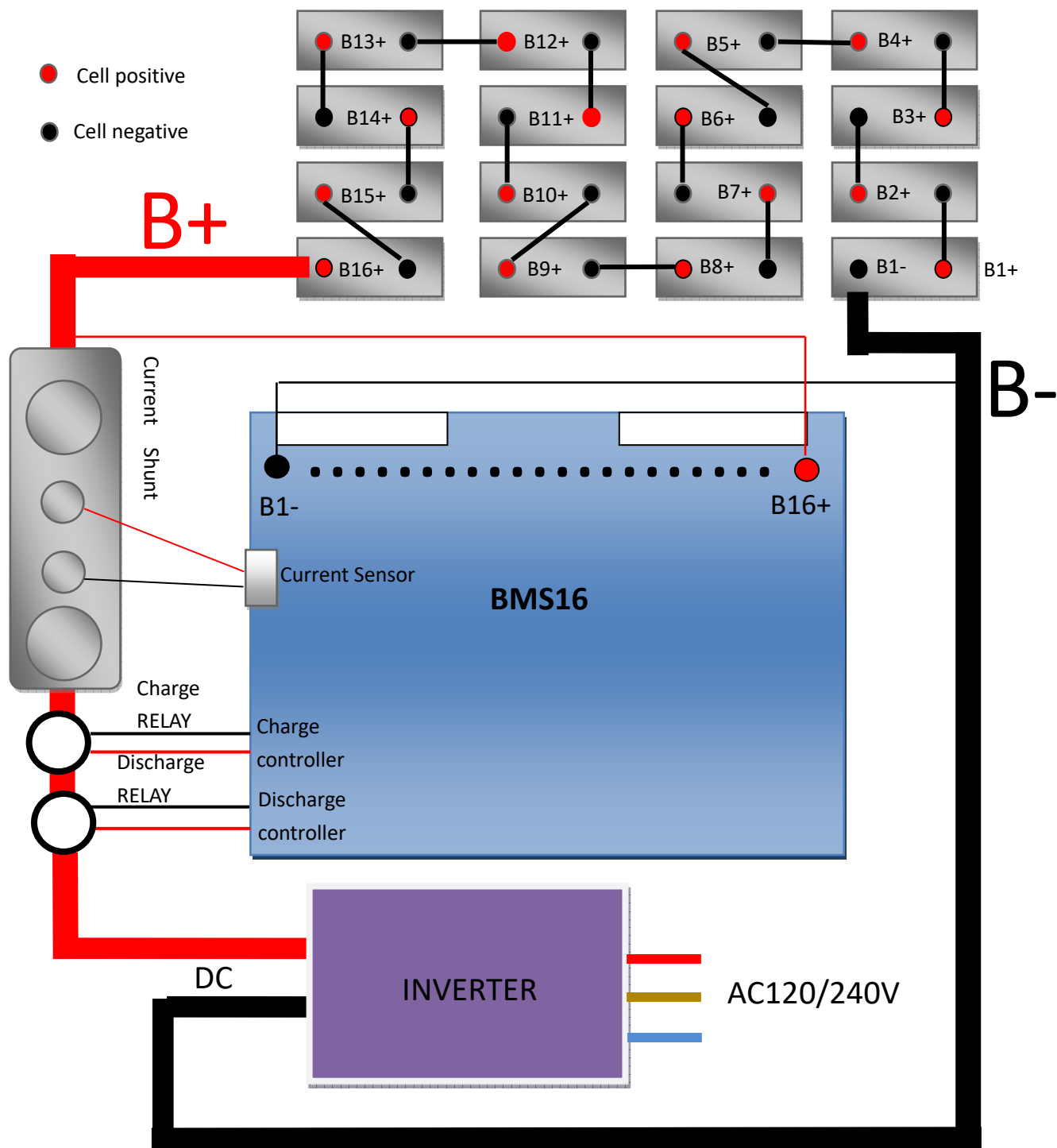
Heavy RED wires are positive of battery pack (B+/B16+), charger and load such as motor, and heavy black wire is negative of battery pack(B-/B1-), charger and load.

## Warning

Before connect the relay to charge or discharge controller, please confirm the coil of relay voltage. The BMS16 controller will output 12V to power the coil, and total current for charge and discharge relay don't be larger than 2.5A.



If charge and discharge use one port, the charge relay and discharge relay can be connected in series, but the charge relay must be with enough rated current that is larger than maximal discharge current.



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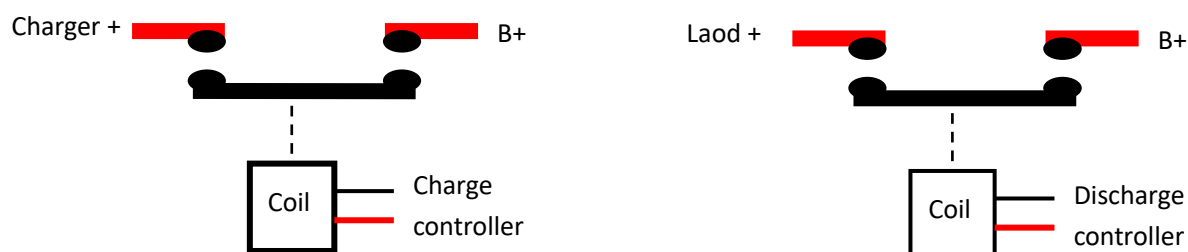
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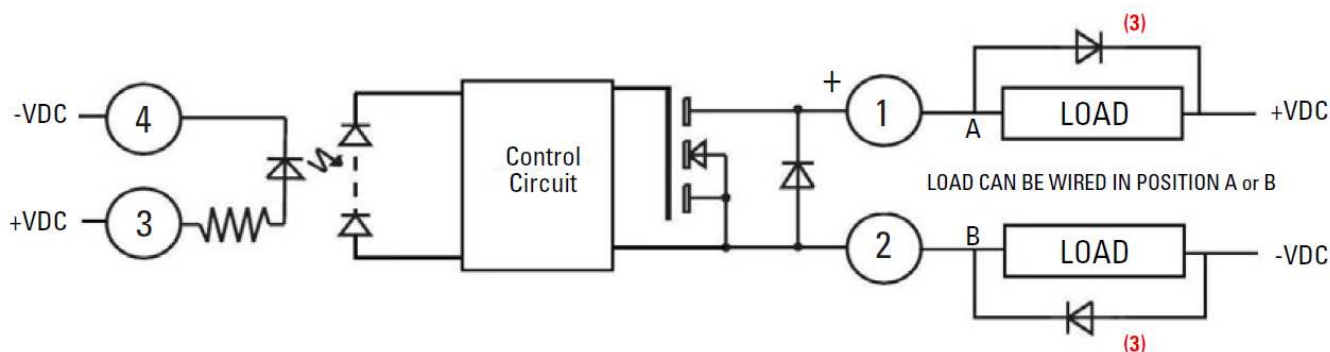
## Charge relay and discharge relay lectotype for BMS16

BMS16 can output 12V 3A 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 rated current should be over 1.2 times of real charge or discharge current. If discharge current is 100A, 120A relay for discharge is suitable.
2. If BMS16 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 BMS16.



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.



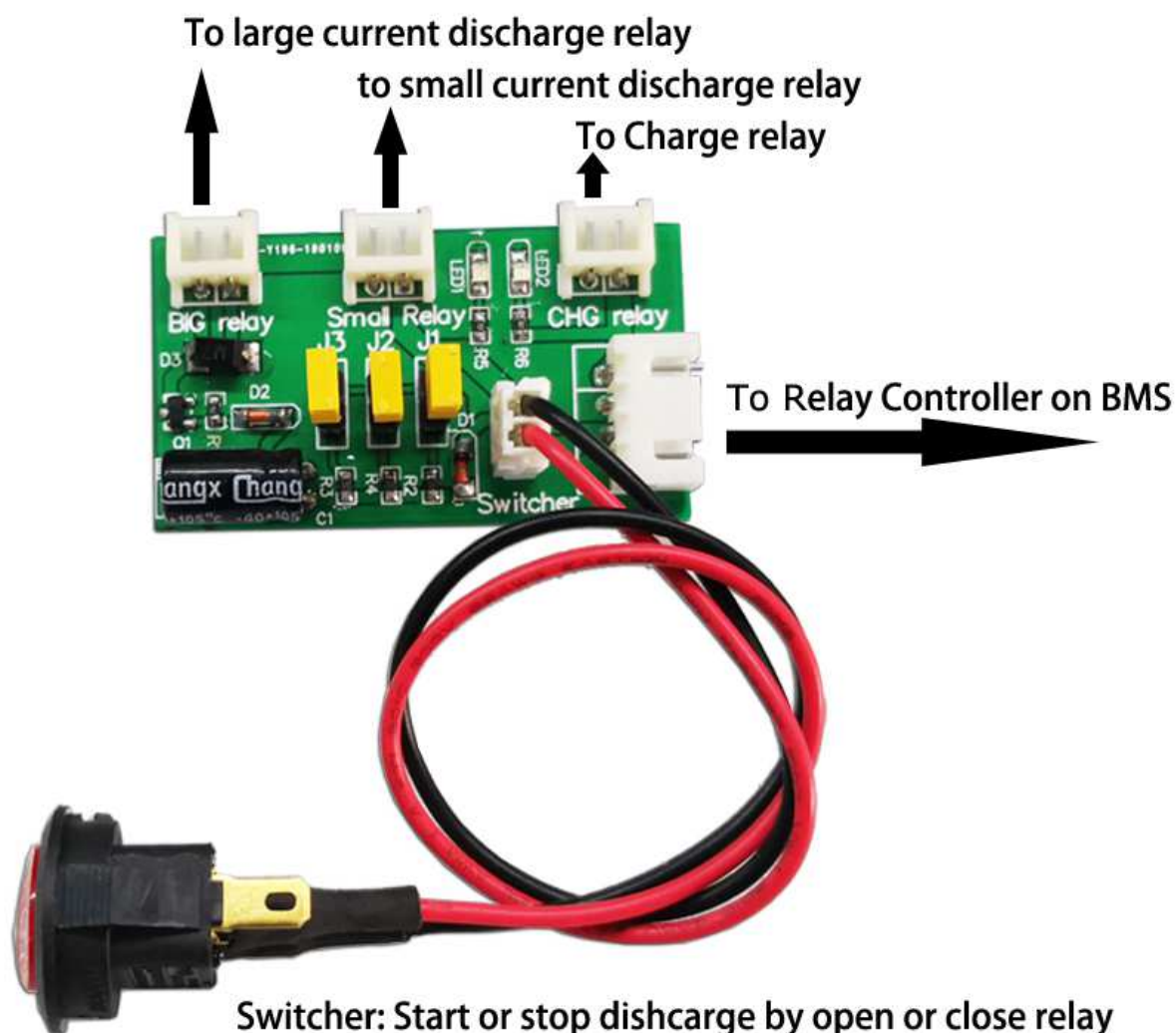
## Optional accessories

- 12V 100A, 200A 400A, 600A and 800A relay

Rated Operating voltage	12V – 500V DC				
Continuous (Carry) Current, Typical	<b>100A</b>	<b>200A</b>	<b>400A</b>	<b>600A</b>	<b>800A</b>
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	2 Kg



## 2. Relay delay time board



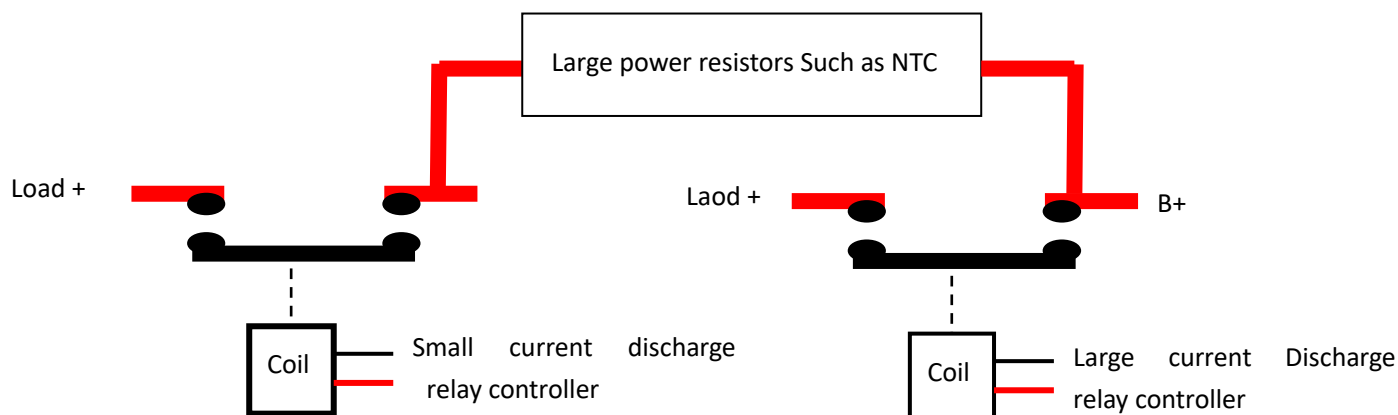
When battery start to discharge and power the motor, the surge current is very large, in order to restrain the current, CHARGER designed the special board, it can fit with CHARGER BMS8T, BMS16, BMS16T and BMS24T and so on.

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 chose by delay time and load current.

Before finish all connections, please power off the switcher (LED 1 is off). On the board, there are two BLUE led indicators, when charge relay closed, the LED 2 is on, otherwise it is off, when discharge relay closed, the LED 1 is on.

Finish all connection and setup, when ready to go, please close all other switchers on other device first, finally power on the switcher on the board, LED 1 is ON, small current relay closed immediately, after setup delay time, the large current relay closed. The battery will discharge normally.

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 BMS16

MODEL	DESCRIPTION	COMMENTS
BMS16T	16S BMS with 1.2A balancer	600A maximal
BMS8T	8S BMS with 1.2A balancer	600A maximal
BMS24T	24S BMS with 1.2A balancer	600A maximal

## Version History

Version	description
V1.0	100A continuous charge and discharge , 300A maximal
V2.0	300A continuous charge and discharge , 600A maximal





## Frequent questions

### 1. Charge or discharge relay/DC contactor don't be open or closed

- a) Confirm relay coil driven voltage, it must be 12V.
- b) Confirm relay coil consume power or current, don't be over 1A for each relay
- c) Without alarm the charge and discharge relay controller voltage is 12V,
- d) When any alarm events happen, the charge and discharge relay controller voltage is 0V,
- e) Without any warnings, the relay always closed

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

- a) Check 9pin balance wire connection is good.
- b) Measure actual cell voltage on BMS balance port.
- c) 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.
- d) Or send back to us and calibrate the cell voltage again.

### 3. Charge or discharge current display is not stable or wrong

- a) Check charge current or discharge current ripple, especially on inverter.
- b) Add low-pass filter on current sensor
- c) Calibrate current again

### 4. Cell voltage difference drop slow during balance

- a) Setup balance in storage is ON
- b) Setup balance in charge is ON
- c) Setup lower balance start voltage
- d) Confirm the BMS main unit blue case is warm, if yes, means the balance is in working.
- e) 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. If only 10 ohm or less, please return back to us for repair.
- f) For over 50Ah battery, the balance time is longer
- g) 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. Change lower voltage cell in discharge or higher voltage cell in charge is suggested.

### 5. STOP button freeze

- a) When current displayed is zero, that is to say, the battery don't be charged or discharged, press STOP button make the BMS enter into sleep mode to save battery energy. At other situations, the STOP button is disable.
- b) If stop charge or discharge, please operate on charger or motor.



## Warranty and Service

Chargery Power Co., Ltd. as manufacture of power system warrants its BMS16 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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