



# BMS16T

for 2S-16S LiPo/Li-ion, LiFe & LiTO

Low power consumption

High accuracy

2.8" TFT LCD display

Programmable

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## Chargery BMS16T

Battery Management System for 2S-16S LiPo/Li-ion, LiFe & LiTO

Low power consumption, High accuracy, 2.8" TFT LCD display, Programmable

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## Owners Manual

V 4.1

Main Unit Software Version 4.0

LCD Unit Software Version 4.01





Thank you for choosing the Chargery BMS16T as your Battery Management System. This versatile BMS is designed to be suitable for Electric Vehicles and mobile / fixed Energy Storage Systems providing extensive flexibility for your specific application.

Please read the ENTIRE instruction manual to become familiar with the features and functions and capabilities of the device before operating. Please see Video References for additional installation & operational tips.

**Overview:**

The Chargery BMS16T is designed especially for LiPo, LiFe and LiTo battery packs applied to Energy Storage Systems and Electrical Vehicles 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), with the information displayed on the TFT color LCD screen. It has an Internal balancing function to balance cells to maintain optimal operations of the battery pack being managed.

Feel 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.

**Jason Wang**

Edited by Steve\_S from <https://diysolarforum.com> .

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## Safety Notes

Please read the entire manual completely before using, to ensure safe and efficient use.

1. Ensure the BMS program and settings match your battery pack, otherwise the battery may be damaged and a dangerous situation may arise, especially for Lithium based batteries, which may catch fire.
2. Use the Battery Cell Manufacturers specifications and information when configuring your BMS.
3. For Energy Storage System and Electric Vehicle applications, there are many different requirements, please adjust those key parameters carefully for your application, or contact us for more details.
4. Do not allow water, moisture, metal wires or other conductive materials to come in contact the device.
5. Never charge or discharge any battery having evidence of leaking, expansion/swelling, damaged outer cover or case, color-change or distortion.
6. Do not try to charge "non-rechargeable" dry cells.
7. Do not mix batteries of different types, different capacities or from different manufacturers, all cells used should be of matching specifications.
8. Do not exceed the battery manufacturer's suggested maximum charge and discharge rates.
9. Carefully follow the battery pack manufacturer's recommendations and safety advice.



## Warning

1. The Current shunt must not make contact with any metal including the BMS case
2. The BMS case should not be in direct contact to any metal
3. Current shunt must connected to the Battery Pack Negative !
4. Prevent BMS from vibrations and shaking
5. Ensure the BMS case does not make contact with battery wiring in any way.

## Copyright

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## Specifications

1. Battery range: 2S-16S LiPo & LiFe, LTO battery pack on BMS16T
2. Accurate scope of the cell voltage: -5mV/+5mV on BMS16T
3. Cell Voltage display range: 0.10~4.99V
4. The voltage of external power: 13-60V, 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: 124×95×30 (L×W×T, mm) or 4.88×3.74×1.18 (L×W×T, inch)
9. Main module weight: 365g 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
12. Warning LED: 11000mCd, @ 2.0V, 20mA
13. Warning beeper: 85dB @ 12V, 25mA
14. Package: AL alloy case

## 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



## Version History

Software Version of LCD unit	Description
V3.0	Released first time
V3.01	debug a mistake on display
V3.02	adjusted Maximum cell difference can be set up to 1000mV
V3.03	Add low temperature cutoff
V4.0	Add WH setup
	Add AH display
	Add Balancing indicator
V4.01	Simplify current calibration,
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
V4.0	Add cell internal resistance measurement
	Add cell internal resistance send tout
	Optimize SOC calculation

## Update / Change log

1. Added RS232 port, allowing for external devices to read out the data from the BMS. See Additional information [Supplemental: Reference Documents & Video links](#)
2. Improved cell voltage detection accuracy
3. Added over current protection during balancing
4. Added low temperature protection(on LCD unit V3.03)
5. Add WH setup that is used for SOC calculation (on V4.0)
6. Add balancing indicator
7. Add cell impedance measurement and send out to R232.
8. Add WH, AH send out to RS232
9. Add cooling fan connector (on hardware V3.2), optional cooling fan can speed up balancing, fan speed is adjusted automatically (on program V4.0)
10. Optimized SOC accuracy, new approaches are voltage based and coulomb counting, consideration the cell impedance at the same time. Please setup accurate battery capacity (AH) and battery power (Wh) on Program setup menu before using the BMS.
11. Added current, AH and WH, SOC interface, it is easy to read charge or discharge current, capacity, power and state of Capacity of battery pack on one interface.
12. Relay controller use 12V 3A large current regulator from 8S battery pack. It can drive larger current mechanical and state solid relays.
13. If using external adapter, the BMS can support 2S-8S battery, the external voltage range is 15-30V.
14. The BMS uses one Current Shunt to detect Charge & Discharge current per battery pack. The BMS controls Charge & Discharge relays separately



1.2A balance

600A max. charge/discharge



## Order information

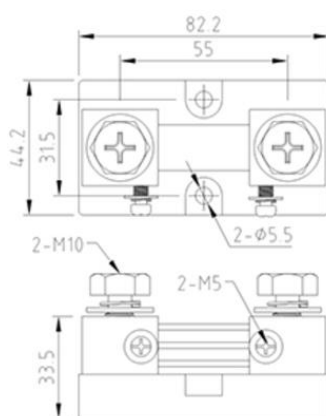
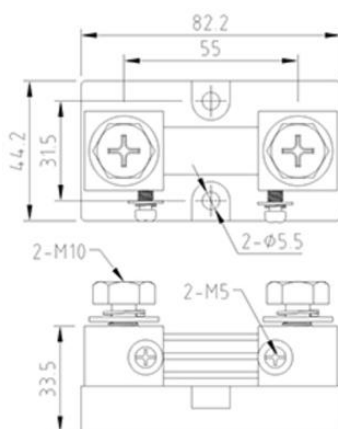
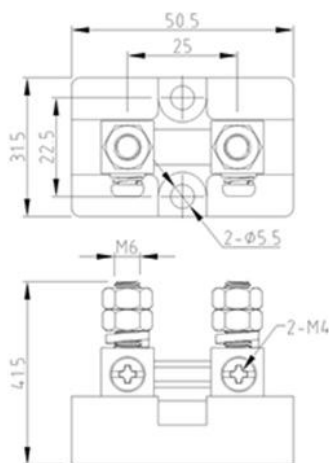
Model	Description	Accessories
BMS16T(BMS16Pro)-100	100A charge and discharge	100A shunt, and standard accessories
BMS16T(BMS16Pro)-300	300A charge and discharge	300A shunt, and standard accessories
BMS16T(BMS16Pro)-600	600A charge and discharge	600A shunt, and standard accessories

## Standard accessories

USB data cable: Update main unit and LCD unit	Cell Balance wire: connect cell to BMS balance port, 600mm	DCC/Relay controller wire: cut off charge /discharge , 600mm.
		
Temperature sensor: 600mm, monitor battery temperature.	Warning LED, 300mm	Warning Beeper, 300mm
		
Current sensor wire, 600mm, monitor charge /discharge current	Communication wire (4.5 meters), connect main unit to LCD unit	COM3 Data line: connect to external device, send out all data
		

## Current Shunt

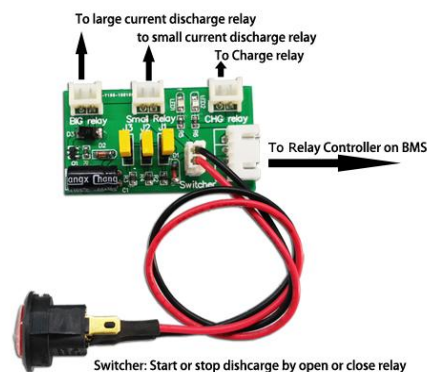
A single shunt is used for the BMS16T, it is delivered with BMS and other standard accessories. The BMS16T detects the charge and discharge currents using the same shunt. All supplied shunts are voltage and current calibrated prior to delivery. If you exchange the shunt, 75mV or less is recommended, and need calibrate again.



## Optional accessories

### Relay delay time board

It is only used with a mechanical relay and/or DC contactor without surge current suppressing circuit.



### DC Contactor

Relay delay time board

CHARGER DCC has 4 models: **DCC-100HB** :12V 100A ,  
**DCC-200HB**: 12V 200A, **DCC-300HB**: 12V 300A, and **DCC-600HB**: 12V 600A

### Notes

- The DCC is used for cut off charge or discharge when any cell voltage reach settings to prevent any cell from damage and possibly fire.
- If without DCC, BMS will only warn by Beeper sound and LED flash.
- **One** DCC can be used in a Common port such as a Solar system, instead of **two** SSR's or relays.
- The Relay Delay Time board is to avoid a surge current when start to charge or discharge. If using a CHARGER DCC, the delay board is not required, because it has a Built-in the surge suppressing circuit. For other SSR or mechanical relay, please consider the surge current seriously and make a suitable plan.





## Cold pressing copper tube terminal

When you order the DCC, the tube terminal and bolts will be delivered with DCC.



DCC model	DCC-100HB	DCC-200HB	DCC-300HB	DCC-600HB
Terminal model	10-6	25-6	50-8	50-8



## Operational Description

The BMS16T includes a Main Unit and a Display Module. Once the hardware installation is completed and ready, power on the BMS16T to finish setting up all of the parameters using the Display Module. The BMS16T will use the saved settings even if the Display Module is disconnected from the Main Unit. Removing the Display Module disables the data display, beeper and warning LED but the BMS will still function properly and can cut off charge / discharge when any set condition requires it. You can connect an external device such as a computer to the COM3 port on the Main Unit to receive all RS232 data. To modify the parameters in setup, please reconnect the Display Module, no data can be written to the BMS from an external application at this time.

The BMS16T can be used with any lithium battery charger, when any cell is over charged, the BMS16T will open the charge relay to cut off charge, if used with a CHARGER power charger, the charge control is handled by connecting the CHARGER power charger to the BMS16T on COM1, when any cell reach OVP, the charge current will decrease automatically to prevent any cell damage. This feature can save charge relay cost and shorten charge time.

More information on the RS232 Data Interface can be found in [Supplemental: Reference Documents & Video links](#)

Special NOTE: The RS232 output is wired in a Cross Over fashion. Refer to RS232 Document for pin out. This can be wired to any type of adapter being used, such as RS232, RJ-11, RJ-45. Pin outs must be observed accordingly.

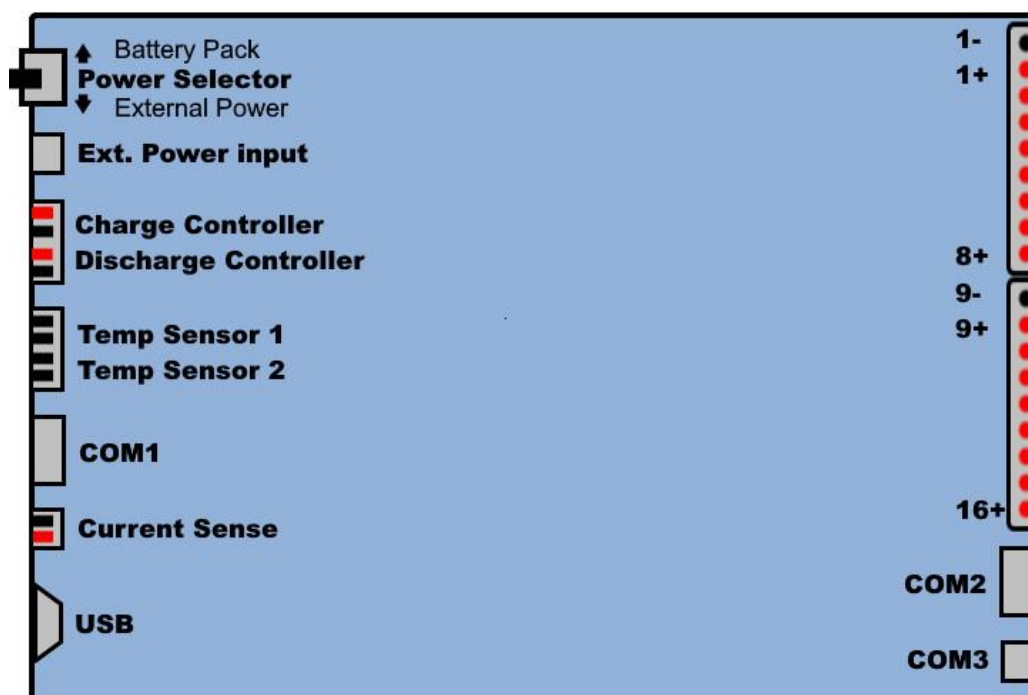


## Special Features

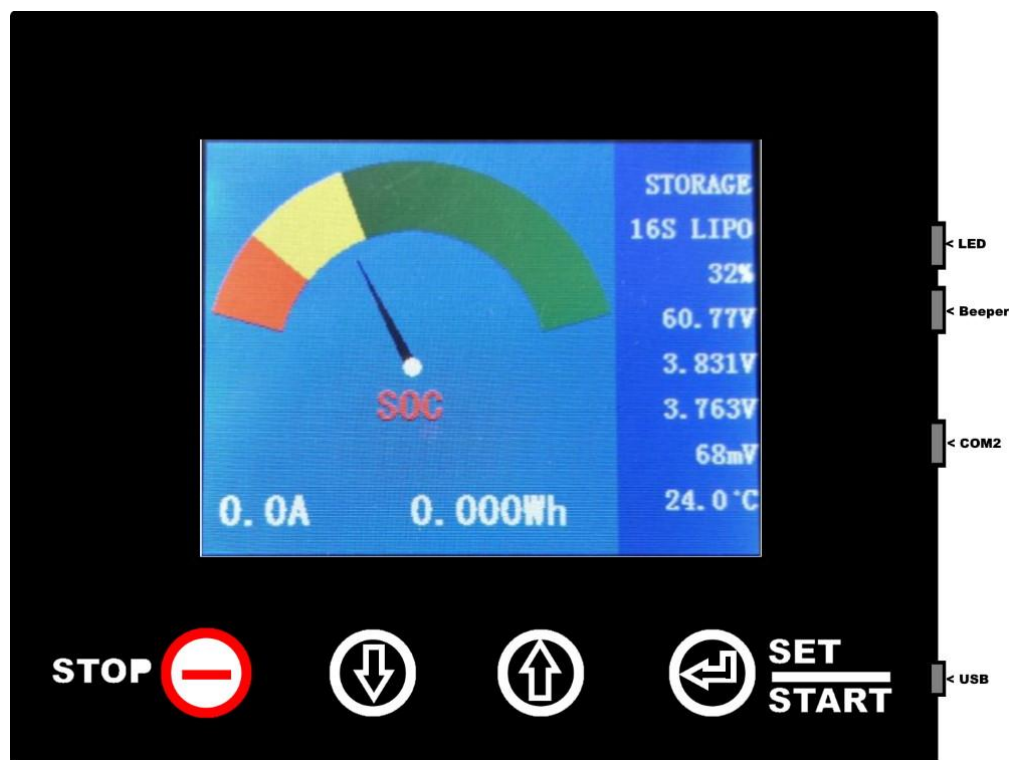
1. The BMS16T uses advanced ADC measurement technology, high accuracy, high voltage and high current detection circuit. The maximum voltage measurements tolerance is within 5mV at up to 8S LiPo battery (34V)
2. Supports regenerative braking, during braking operation it can charge the battery pack and the discharge power (Wh) will increase in response to the braking power.
3. Charge/discharge current up to **600A**. Larger current support can be custom ordered.
4. **1.2A** per cell balance current is very useful for large capacity battery pack, this feature can restore all cell voltage balance in the shortest time. Over temperature protection ensures the system safety during balancing.
5. BMS16T calculates and displays the charge and discharge power (Wh), generally the battery rated power is rated voltage multiplied by rated battery capacity.
6. TFT LCD screen provides rich information including current, voltage, power, capacity, battery status, SOC and temperature and so on.
7. BMS16T features maximum safety protections, within the range parameters that can be setup, BMS16T will alarm and cutoff charge or discharge according to users' setup, out of range parameters and triggered absolute maximum settings BMS16T will force cutoff charge / discharge to protect the battery.
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 the cells or an external power supply.
10. Detect cell count at any time, and compare with the count detected when switched on first time. If inconsistent, the device will alarm and cutoff charge or discharge according to user setup, this is a safety feature is if a cell becomes loose.
11. Sound alarm and LED alarm will be triggered if any warning events occur, it will wait several seconds, then disconnect charge / discharge if required. The delay time can be programmed.
12. The Charge and Discharge relays are controlled independently.
13. Two temperature sensors monitor battery temperature for different positions on the pack.
14. Supports upgrading the firmware program by USB port.
15. BMS16T provide users the maximum flexibility, key parameters can be programmed.
16. BMS16T displays battery SOC as a dial gauge. Cell count, battery pack voltage and battery gauge (%) temperature is displayed simultaneously.
17. In case the battery pack is not to be charged / discharged and put into **storage mode**, Press **STOP** button enter into Sleep Mode to save energy consumption, Charge / Discharge are disabled and the LCD back light is turned 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 activate.

## Interface

### BMS16T Main Module



### BMS16T Display Module



Power Selector	<b>Battery pack</b> to power the BMS. the battery pack must be 8S to 16S LiFe or LiPo or LiTO. <b>External power</b> supply, BMS16T supports 2S to 16S LiPo, LiFe or LiTo battery pack. The external input supply <b>Voltage</b> range is 13V to 60V @ 3A.
External power port	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, connected to relay / DC contactor. will "OPEN" the relay by releasing the coil power when any cell voltage is <u>OVER</u> setup values. Otherwise the BMS16T will output <b>12V</b> power the coil to close the relay when everything is within programmed settings. The relay must be a "Normally Open" type.
Discharge controller	Discharge controller, connected to relay / DC contactor. will "OPEN" the relay by releasing the coil power when any cell voltage is UNDER setup values. Otherwise the BMS16T will output <b>12V</b> power the coil to close the relay when everything is within programmed settings. The relay must be a "Normally Open" type.
COM1	The COM1 port (black connector) is connected to external device such as Charger. If connect to Chargery charger, BMS16T can control charge current to shorten charge time
COM2	The COM2 (gray connector) port is connected BMS main unit to display module by gray spring wire
COM3	Output RS232 level on the port, any external device can read out all data from BMS16T
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 <sup>1)</sup>	Connect to high light LED, the LED will flash when any warning event happened
Beeper <sup>1)</sup>	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 other cells to socket 2, such as 8S + 2S for 10S and 8S + 5S for 13S

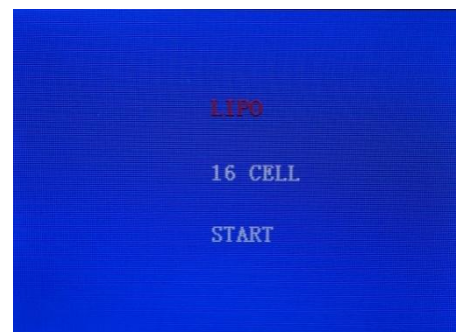
Note:

- 1) On the BMS display module



## Hardware Setup

1. Prepare the BMS wiring harness by attaching ring terminals on the ends. Isolate any leads which will not be used to prevent accidental contact.
2. Attach the leads to the cells and install temperature sensors on pack.
3. Connect Beeper, LED, to the Display Module.
4. Ensure the BMS Main Module power switch is OFF.
5. Connect the shunt, current sensor wire, relays, relay controller wires and Temperature Sensors to BMS16T Main Module.
6. Connect battery wires to BMS16T, **ensure correct cell polarity**.  
See the "Typical Connections" diagrams starting on page 42.
7. Connect the Main Module to Display Module using the COM2 port
8. Turn on BMS by moving the Power Selector to turn on the device.
9. BMS16T will initialize the beeper and LED, beeper will sound one time, then displays BMS16T and version, the battery type and cell count interface is displayed. Three battery types LiPo, LiFe and LTO can be selected. Cell count range is 2S to 8S, the cell count will be identified automatically when the battery pack connect to the BMS16T.



## Warning

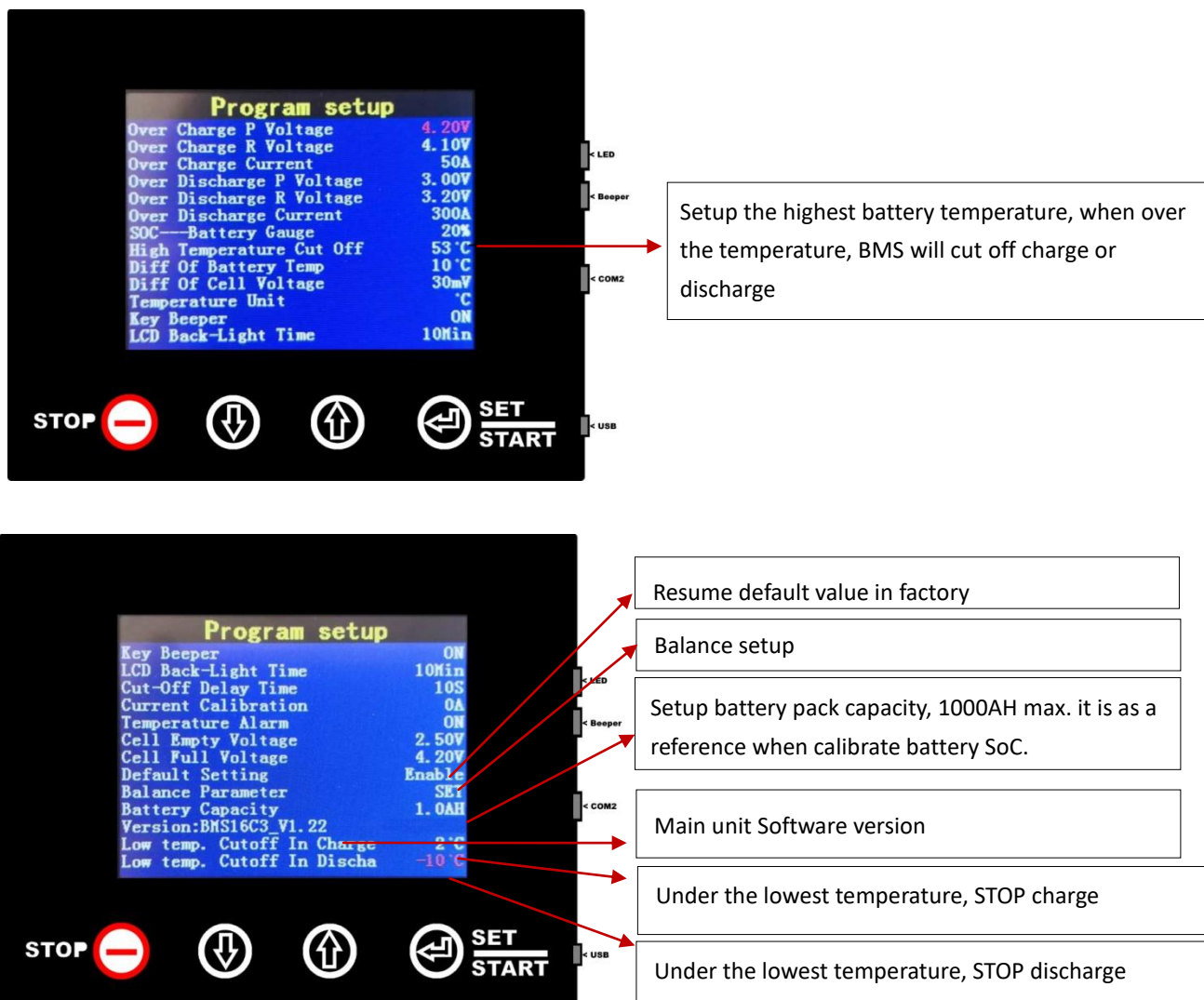
1. The Current shunt must not make contact with any metal including the BMS case
2. The BMS case should not be in direct contact to any metal
3. Current shunt must connected to the Battery Pack Negative !
4. Prevent BMS from vibrations and shaking
5. Ensure the BMS case does not make contact with battery wiring in any way.

## Absolute maximum or Minimum ratings *(Always refer to Manufacturer specifications)*

Maximum cell voltage	LiPo	4.35V	Larger than the absolute maximum voltage, BMS16T will force charge cut off
	LiFe	3.90V	
	LiTO	2.80V	
Minimum cell voltage	LiPo	2.50V	Less than the absolute minimum voltage, BMS16T will force discharge to cut off
	LiFe	2.00V	
	LiTO	1.50V	
Battery temperature	LiPo LiFe LiTO	1 °C - 80 °C	Over / Under temperature, BMS16T will cutoff the charge and discharge

**Next Step is to configure the Software.**

## Software Configuration



**Program setup**

Over Charge P Voltage	4.20V
Over Charge R Voltage	4.10V
Over Charge Current	50A
Over Discharge P Voltage	3.00V
Over Discharge R Voltage	3.20V
Over Discharge Current	300A
SOC—Battery Gauge	20%
High Temperature Cut Off	53°C
Diff Of Battery Temp	10°C
Diff Of Cell Voltage	30mV
Temperature Unit	°C
Key Beeper	ON
LCD Back-Light Time	10Min

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

**Program setup**

Key Beeper	ON
LCD Back-Light Time	10Min
Cut-Off Delay Time	10S
Current Calibration	0A
Temperature Alarm	ON
Cell Empty Voltage	2.50V
Cell Full Voltage	4.20V
Default Setting	Enable
Balance Parameter	SET
Battery Capacity	1.0AH
Version: BMS16C3_V1.22	
Low temp. Cutoff In Charge	2°C
Low temp. Cutoff In Discha	-10°C

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, STOP charge

Under the lowest temperature, STOP discharge



## Warning

When setting up parameters, the "current calibration" shouldn't be modified, otherwise the current reading will be wrong.

### INSTRUCTIONS on Navigating Menu

- Press **SET/START** button for 3 seconds enter into Program Setup interface.
- Press **UP** or **DOWN** button to select the item, press **SET/START** quickly to make the value flash, and press **UP** or **DOWN** to change the value. Press **SET/START** button quickly to confirm the change. After finishing all of the setup, press **SET/START** for 3 seconds to save & quit the setup menu.
- When you quit setup mode, BMS16T will save all the parameters till next change.



## Parameters Setting----Configuration Values

**NOTE: Please keep the default setup values unless your application requires special settings.**

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 <sup>(1)</sup>		1	10	999	1	min
Cut-Off Delay Time <sup>(2)</sup>		0	10	60	1	Sec's
Current Calibration <sup>(3)</sup>						SET
Current in Storage			0			A
Current in Charge		0	20	100	1	A
Current in Discharge		0	-20	-100	1	A
Temperature Alarm <sup>(4)</sup>		ON		OFF		
Cell Empty Voltage <sup>(5)</sup>		1.50	2.50	4.34	0.01	V
Cell Full Voltage <sup>(5)</sup>		1.51	4.20	4.35	0.01	V
Default settings Choose Enable and Press SET/START restores factory defaults						
Balance Parameter setup: Press SET/START to setup and press for 3 seconds to quit setup						
Balance Start Voltage <sup>(6)</sup>	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 <sup>(7)</sup>			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 <sup>(8)</sup> in Storage	ON means Balance start during storage, OFF disable.					

Parameters	Min.	Type	Max.	Step	unit
Battery Capacity AH <sup>(9)</sup>	1	1	1000	1	AH
Battery Power WH <sup>(11)</sup>	1	1000	99999	1	WH
Low temp. cutoff in charge	-20	2	20	1	°C
Low temp. cutoff in discharge	-20	-10	20	1	°C
Version:BMS16C3_v4.0 <sup>(10)</sup>					

## NOTES:

- Always on** means the LCD back-light will be ON forever.
- NO** means BMS16T will not cut off charge or discharge but alarm by LED flash and Beeper Sound.  
**Cut-Off Delay Time** is very important and different for different battery capacities and applications, please carefully verify and use proper settings for your application. For EV's, you can select **NO** to control the EV manually, **NOT** controlled by the BMS16T, but when the cell voltage and/or temperature trigger the absolute maximum or minimum settings, the BMS16T will force the cut off to Charge / Discharge to protect the battery and prevent damage and the possibility of fire or explosion.
- Current Calibration** is not recommended unless you are using a different shunt. Voltage and current is calibrated before delivery for the supplied shunt.
- Temperature Alarm OFF** means Battery and Difference of battery Temperature is disabled.
- 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
- Battery start voltage**, when minimum cell voltage over the setup value, the balancing will start automatically
- Balance Stop Diff Voltage**, Setup the minimum cell difference, when the difference of the cell voltage under setup value is reached, balancing is stopped automatically
- Balance switcher**, default Balance is OFF,
  - If balance "in storage" setup is 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. **For EV's, balance "in storage" OFF is suggested. For storage systems, ON is recommended.**
  - If balance "in charge" setup is ON, balance will start during charge
  - If balance "in discharge" setup is ON, balance will start during discharge
  - Balance current is 1.2A max. per cell,
- Battery Capacity AH**, Setup accurate battery capacity, **See the cell specification / datasheet.** Continuous charge-discharge cycles will decrease capacity over time. Usually once the battery pack reaches 70% of the original capacity, the pack is typically decommissioned and replaced.
- Main Unit software version
- Battery Power WH**, Setup accurate battery power, the measurement unit is in WH (Watt Hours). If you do not have the values on the battery label or data sheet, it can be calculated as shown below.

## WH=Rated battery voltage x battery capacity

One Li-on (NMC) cell, rated voltage is 3.6V, if capacity is 10AH, battery power is 36WH

One LiPO cell, rate voltage is 3.7V, if capacity is 10AH, battery power is 37WH

One LiFe cell, rate voltage is 3.25V, if capacity is 10AH, battery power is 32.5WH



One LiTO cell, rated voltage is 2.3V, if capacity is 10AH, battery power is 23WH

**LiFe Example:**

If four LiFe cell are connected in series, the rated battery voltage will be 13V with the cells at 3.25V,

If each cell capacity is 280AH, the total battery power is 3640WH @ 3.25V per cell.

4 cells X 3.25 volts = 13.0V. 13.0V x 280AH = 3640WH

4 cells x 3.65 volts = 14.6V 14.6V X 280AH = 4088WH

**About AH and WH**

AH is rated battery capacity, it is most important parameter and must be written in the battery or cell data or manual. At the same time the AH depends on a special testing conditions, AH is discharge current multiply discharge time. If discharge current is 10A and discharge time is 1 hour, the battery rated capacity is 10AH, during discharging, the discharge current must be constant.

Generally, the testing condition includes discharge current, discharge terminal voltage and ambient temperature.

For 280AH LiFePO4 battery, means the battery can be discharged at 280A, when the battery voltage drop to 2.5V, the discharge time is 60min at least.

As far as WH, it is battery voltage x AH, but the battery is not stable during charge or discharge, so the WH is not stable and change with voltage going up or down.

There are four voltage parameters for any chemical battery:

**Rated voltage** is most stable, and marked with battery label, generally it is the voltage of discharge platform. At this voltage battery has most of capacity, or at this voltage, the discharge time is longer than at other voltage.

**Charge terminal voltage**, it is the highest voltage, over this voltage, if continue to charge, battery is not safe.

**Discharge terminal voltage**, it is the lowest voltage, under this voltage, if continue to discharge, battery is no safe too.

**OCV** is Open Circuit Voltage, measure battery voltage accurate must be done without charge or discharge, otherwise it is not accurate. Because battery impedance affect the voltage measurement.

BMS realize many functions based on accurate cell voltage measurement.

During battery discharge, at rated voltage, the discharge time is longer than at other voltage, so we calculate wh based on rated voltage. If wh calculate based on other voltage, the WH will be lower or higher, it is bad.

Some battery label has WH and AH, if without WH, WH calculation based on AH x battery rated voltage is suggested, Ah and rated voltage must be found in battery datasheet.

## Operating guideline

### Installation video:

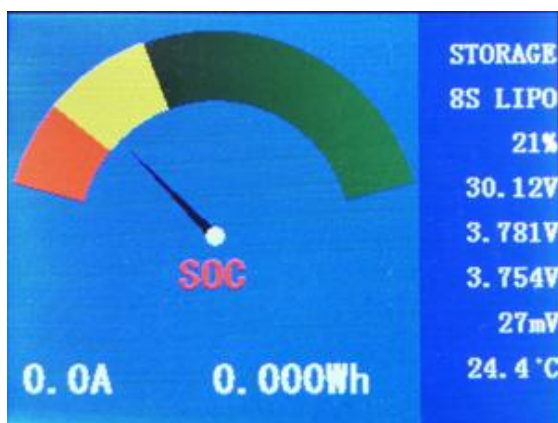
[http://chargery.com/Video/BMS24T\\_C10325\\_operation\\_instructions.mp4](http://chargery.com/Video/BMS24T_C10325_operation_instructions.mp4)

### INSTRUCTIONS on Navigating Menu

- Press **SET/START** button for 3 seconds enter into Program Setup interface.
- Press UP/DOWN button to select the item, press **SET/START** quickly to make the value flash, and press **UP/DOWN** to change the value. When done, press **SET/START** **button quickly to confirm the change. (stop blinking)**. After finishing all of the setup, press **SET/START** **for 3 seconds to save & quit the setup menu.**
- When you quit setup mode, BMS16T will save all the parameters until the next change

With all the hardware setup completed, Turn on the BMS by moving the power selector Switch

- BMS16T will initialize the beeper and LED, beeper will sound one time, then displays BMS16T and version, the battery type and cell count interface is displayed. Three battery types LiPo, LiFe and LTO can be selected. Cell count range is 2S to 16S, the cell count will be identified automatically when the battery pack connect to the BMS16T. Press **DOWN** / **UP** button to choose the item and press **SET/START** until the selection blinks, then press **DOWN** / **UP** button to modify, finally press **SET/START** button to run the BMS16T or wait for 8 seconds start automatically. After started, battery type and cell count will not be changed unless the BMS is powered off. Each cell voltage and other data are displayed correctly. If the cell voltage is not displayed correctly, please check the battery connections.
- Press **SET/START** button for 3 seconds enter into Program Setup interface, modify **Over Charge Current (50A default)** and **Over Discharge Current (300A default)** according to your application. If Balancing is needed during Charge or Discharge, please modify the Balance settings in the Program Menu. The balance function is disabled by default.
- SOC—battery gauge dashboard will be displayed first, as following. Press **UP/DOWN** button alter Configuration Interface. **SOC need to be calibrated first time, See the "SOC Calibration" on page 25.**



Status: STORAGE or CHARGE or DISCHARGE <sup>(1)</sup>

Cell count and battery type

SOC—battery gauge, and 00% display

Battery pack voltage

Highest cell voltage

Lowest cell voltage

Difference between cell voltage

Battery temperature

Charge or discharge  
current

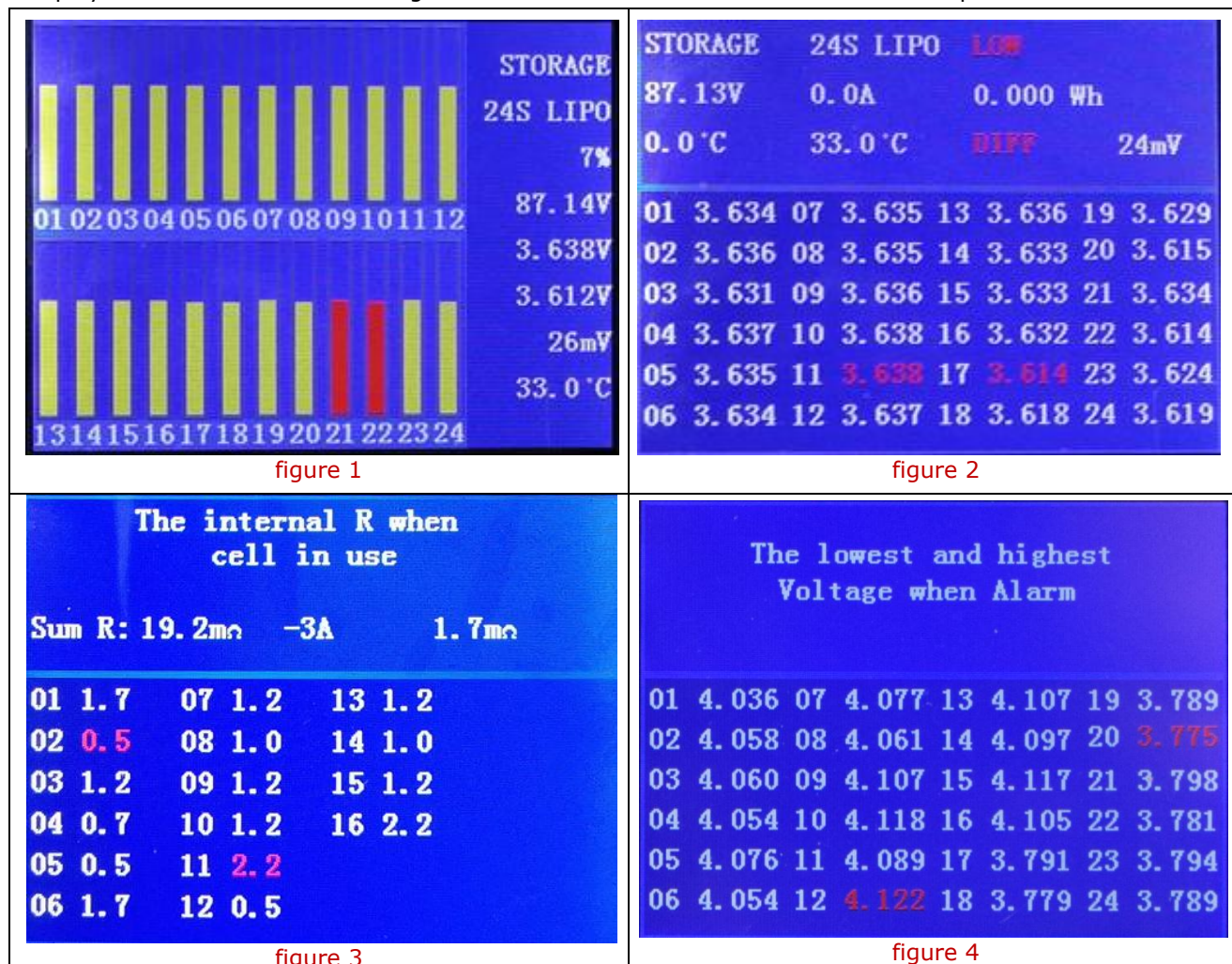
Charge or discharge  
power

### Notes

When charge or discharge current less than 1.0A, battery status will be STORAGE.



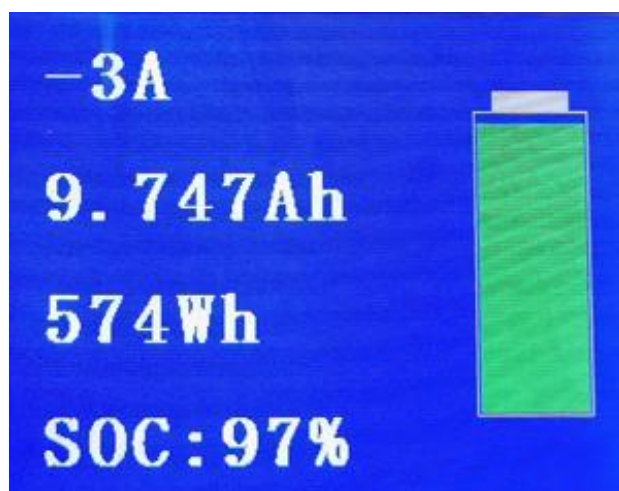
4. The following interface figure 1 is the cell voltage bar graph, the highest and the lowest cell voltage is displayed in RED column. The images below are taken from a BMS24T as an example.



5. The right corner interface figure 2 displays all of the information including all cell voltage. The highest and the lowest cell voltage is displayed in RED text. The difference of cell voltage and the difference of battery temperature is also displayed.

When any warning events are triggered, the BMS16T will go to the interface and display error information. Such as if the battery connection has broken down and the cell count is wrong an ERROR will be displayed in turn. If the cell voltage is over the setup value, the cell voltage and HIGH will be displayed in turn.

6. When charge or discharge, BMS will measure each cell internal resistance. See above figure 3.
7. This right figure displays charge or discharge current, charged or discharged power in Wh, Capacity in AH and SoC. When the SoC less than 30%, it is displayed in yellow. When under setup values, the BMS will cut off discharge.
8. When any warning events are triggered, Press UP or DOWN, you can check which cell triggered the warning events (over charge or over discharge), the voltage will be recorded till next warning. See figure 4.



**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 yellow bar is displayed means the cell is in balancing. See "Balancing Indicator" on page 28.
- COM2 is to connect to charger if you have CHARGERY charger, COM3 is to connect to external device.





## SOC Calibration

The program calculates SOC according to the power charged or discharged from battery. Users need to setup **battery power (WH)** and **battery capacity (AH)** when turning on the BMS for the first time. After charging to Maximum voltage or discharge to minimum voltage, BMS will complete the SOC calibration and display accurate SOC. The details are as below.

**WH** = (Cell Voltage X AH rating) IE: 4 cells X 3.25 volts = 13.0V. 13.0V x 280AH = 3640WH

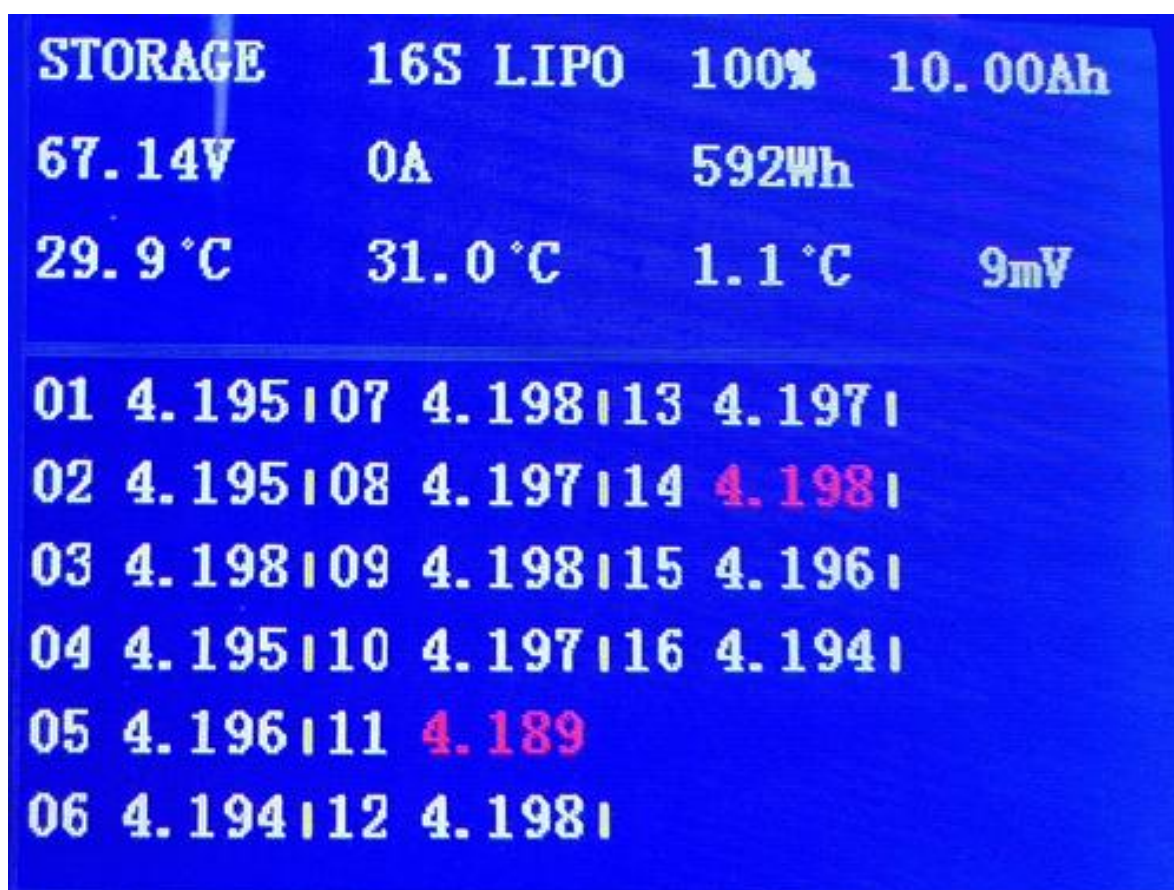
1. Connect all cells and accessories.
2. Turn on BMS, choose battery type, cell count is automatically identified by the BMS, press START or waiting for 8 seconds, BMS will start and display all cell voltages.
3. Press START **for 3 seconds** to enter setup configuration screen.
4. Continue to setup **"over charge protection(P) voltage"** to Maximum value according to cell datasheet. Generally it is 4.20V for LiPo, 4.15V for Li-ion, 3.65V for LiFe, 2.70V for LiTo battery.
5. Continue to setup **"over discharge protection (P) voltage"** to minimum value according to cell datasheet. Generally it is 2.75V for LiPo, 2.50V for Li-ion, 2.5V for LiFe, 1.50V for LiTo battery.
6. Continue to setup **battery AH and WH** according to battery datasheet. WH can be calculated based on the formula above or setup according to cell datasheet.
7. Continue to setup **"Low SOC cut off"** to 0. The setting is used for SOC calibration while discharging.
8. Continue to setup **"over charge current"** and **"over discharge current"** according to your particular application requirements.
9. Others can be setup later, but make sure battery can be charged or discharged normally.
10. Press START for 3 seconds, quit Program Setup, LCD display SOC, WH and AH, SOC is estimated based on battery voltage. WH and AH is calculated according to WH and AH settings. Take a 16S 10AH LiPo battery as a sample, If SOC estimated is 20%, AH setting is 10AH, WH setting is 592WH (**3.7v x 16 x 10AH=592WH**), the WH reading will be 118.4WH, and AH reading will be 2 AH.
11. Start to charge, with the charging time increased, the SOC, AH and WH will increase, till the cell average voltage reach 4.2V (it is over charge protection voltage setting), the SOC will display 100%, AH reading is 10AH, WH reading is 592WH. Actual power charged may be not 592WH, it is normal, the power (WH) difference is caused by SOC tolerance based on voltage. The BMS calibrated the difference and display accurate SOC.
12. Or start to discharge, with the discharging time increased, the SOC, AH and WH will decrease, till the cell average voltage reach 2.75V (it is over discharge protection voltage setting), the SOC will display 0%, AH reading is 0AH, WH reading is 0WH. Actual power discharged may be not 0WH, it is normal, the power (WH) difference is caused by SOC tolerance based on voltage. The BMS calibrated the difference and display accurate SOC.
13. Stop charging or discharging, the BMS will display accurate WH, AH and SOC, when starting to discharge or charge again, the BMS will display actual power charged or discharged. It will be very accurate.

### Notes:

1. In SOC calibration, or in first charging or discharging, **"over charge protection(P) voltage"** and **"over discharge protection(P) voltage"** setting are very important, it must be maximum cell voltage and minimum cell voltage separately. The voltage setting can make sure the WH and AH reading after calibration are accurate.
2. When you turn off BMS, the actual SOC, WH and AH will be saved, and displayed when you turn on BMS. This feature avoids re-calibrating SOC.
3. As Charge and Discharge cycles increase, the battery capacity will be decreased, that is to say, the actual

battery capacity will reduce over time. You may find that the SOC is not 100% when the battery is fully charged (each cell voltage reaches maximum value), such as 90%. This means battery WH or AH is only 90% of the original setting. When this occurs, you can setup new WH and AH, if the original is 100wh, you can change it to 90WH, then the BMS will update SOC display to 100%.

4. Finished SOC calibration, the voltage can be set again according to your specific application. Such as you can set the "over charge protection (P) voltage" to 4.0V (LiPo), and "over discharge protection (P) voltage" (LiPo) to 3.3V, means the battery SOC will be used from 10% to 90%. This will extended the battery pack life-cycle and make the system safer in general.



## Balancer

The BMS16T can restore balanced cell voltage status in the shortest time, it is based on a 1.2A balancing current per cell, with balancing accuracy of 8mV. Balancing can be operated in Storage, Charge, Discharge or in ALL modes, the feature can be configured in the program setup menu. The balance function is disabled by default. After the BMS display is connected and configured with the cell voltages, reenter into program setup menu to enable balance.

Although the balancing current per cell is larger than some other brand BMS', the Chargery BMS16T uses temperature protection prevent the BMS from overheating and has over current protection for each cell.

In certain conditions, cell voltage difference drop is very slow, it seems that it won'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 the BMS is balancing cell voltage, the balance current is 1.2A max. meaning the high voltage cell discharge will be 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 until the difference reaches the "balance stop diff voltage" setting.

The higher the battery capacity and the more cell difference voltage there is, the balancing time will be longer. The battery discharge platform voltage is storage voltage, so when the average cell voltage is just cell storage voltage, the difference drops very slow, and the balance time seems longer, or looks like the BMS won't balance or stop balancing.

Comparing balance and cell capacity/impedance, the cell capacity/impedance is more important. With battery discharge and charge cycle increasing, the cell capacity and impedance will worsen slowly. Take a 100Ah battery for example, 5% difference on capacity, means 5Ah is needed to be balanced, if 1A balancing, it will 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 even 10h.

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

RECOMMENDATION: After 50 or 100 cycles, it is essential to test battery capacity, and measure each cell impedance to identify which cell is has the highest impedance. A High Impedance cell has a lower capacity and will determine the total battery capacity and battery life and even driving distance, if used in an EV application.



## Balancing Indicator

From firmware v4.0, the BMS has a yellow indicator, when the BMS is balancing cell voltage in Storage, Charging or Discharging. The "yellow bar" will be displayed after cell voltage reading, when cell are not in balancing mode, the yellow bar will be not displayed. Example below.

<p><b>DISCHARGE 16S LIPO 96% 9.651Ah</b></p> <p>66.05V -3A 569Wh</p> <p>28.9 °C 29.8 °C 0.9 °C 11mV</p> <p>01 4.126 07 4.129 13 4.128  </p> <p>02 4.129 08 4.131 14 <b>4.131</b></p> <p>03 4.130 09 4.128 15 4.129</p> <p>04 4.131 10 4.128 16 4.127</p> <p>05 4.130 11 <b>4.120</b></p> <p>06 4.121 12 4.130  </p>	<p><b>CHARGE 16S LIPO 93% 9.405Ah</b></p> <p>66.60V 9A 555Wh</p> <p>28.9 °C 29.7 °C 0.8 °C 16mV</p> <p>01 4.172 07 4.161 13 4.160</p> <p>02 4.161 08 4.161 14 4.158</p> <p>03 <b>4.157</b> 09 4.160 15 4.159</p> <p>04 4.158 10 4.165 16 4.169  </p> <p>05 4.160 11 4.171  </p> <p>06 <b>4.173</b> 12 4.157</p>
Balancing in Discharge, cell 5 and cell 12 are in balancing.	Balancing in Charge, cell 1,6,10,11 and cell 16 are in balancing.
<p><b>STORAGE 16S LIPO 94% 9.427Ah</b></p> <p>66.03V 0A 557Wh</p> <p>29.3 °C 30.0 °C 0.7 °C 6mV</p> <p>01 4.129   07 4.127   13 4.128  </p> <p>02 4.128   08 4.125   14 4.126  </p> <p>03 4.127   09 4.123   15 4.129  </p> <p>04 4.126   10 4.128   16 <b>4.129</b>  </p> <p>05 <b>4.123</b>   11 4.125</p> <p>06 4.126   12 4.126  </p>	
Balancing in Storage, except cell 11, other cells are in balancing.	

## Cell internal resistance (Impedance) test

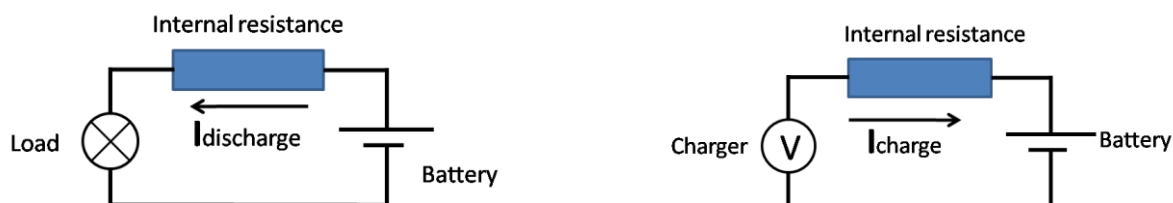
Internal resistance of an energy storage device, such as a battery, is an importance parameter that determines their power performance. For commercial products, the manufacturers usually provide two types of internal resistance, i.e. dc internal resistance and ac internal resistance. For ac resistance, typically the parameter is measured at 1 kHz frequency, namely  $R_s$  at 1 kHz. For dc resistance, there has been no standard regarding the method of measurement.

For a battery the internal resistance is dependent on many factors, such as conductivity of electrolyte, electrode material, and current collectors. The Ohmic internal resistance should be distinguished from the influence of electrode processes, such as voltage changes due to electrochemical double layer charge/discharge and faradaic reactions (polarization in the battery). Ideally internal resistance should be measured by instantaneous voltage change after a current pulse or interruption. However when it comes to practical measurements, time resolution regarding to how the dc resistance from iR drop is determined has become an issue.

With firmware v4.0, the BMS features a cell internal resistance measurement. When battery start to charge or start to discharge, BMS measure each cell internal resistance within 1 second, the total battery resistance and difference of cell resistance are being displayed on one interface.

The measurement time and charge or discharge current affects the resistance. The shorter the time and the higher current, results in higher accuracy, so the internal resistance will be updated when charging or discharging occurs again.

Generally, the new cell internal resistance is lower than the same cell that has been used for several cycles. With the internal resistance increased, the battery power/capacity will decrease.

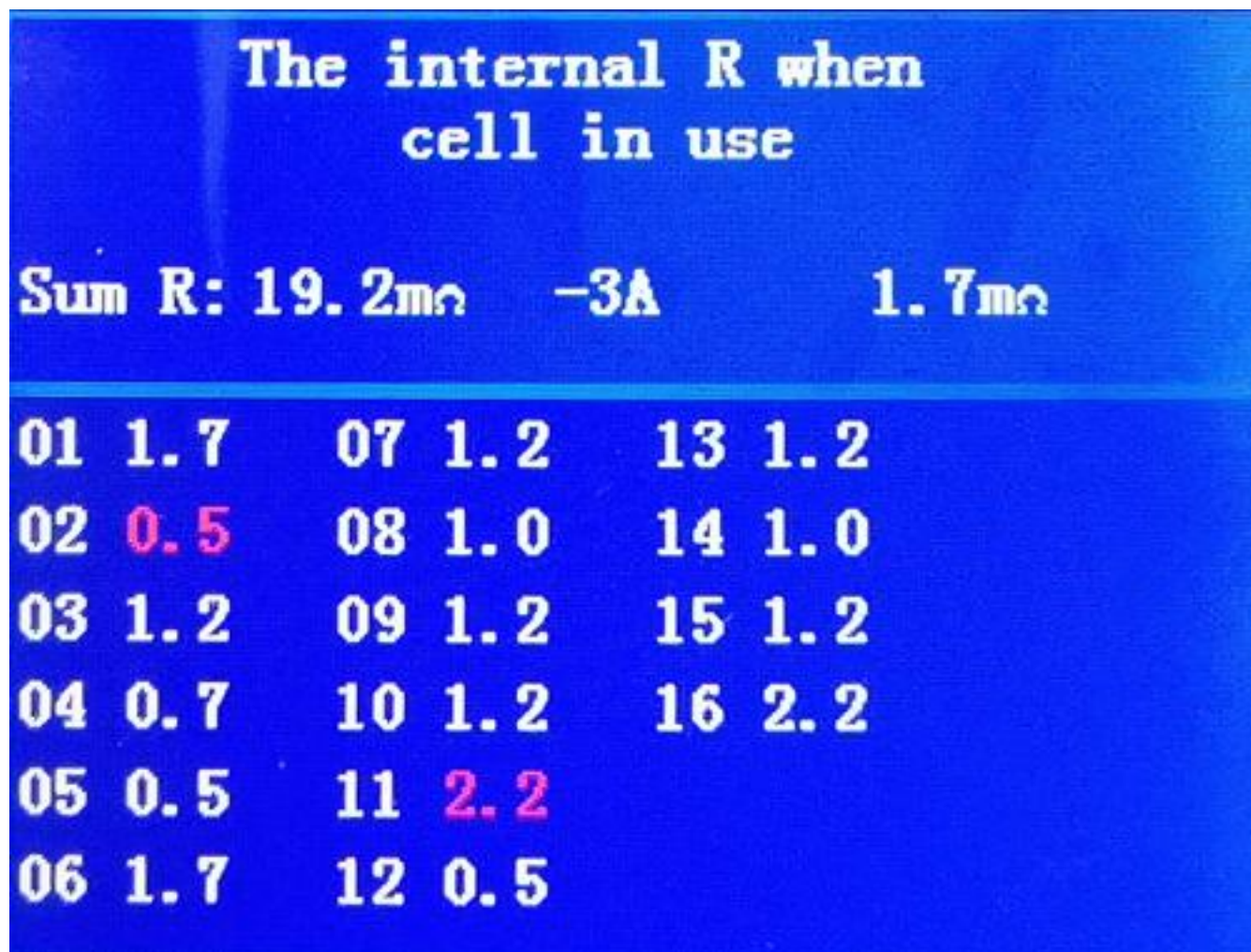


When battery is in discharging, the voltage of load is battery voltage minus discharge current x cell internal resistance,  **$V_{load} = V_{battery} - I_{discharge} \times R$** , **R is battery internal resistance**

If R is 10mohm, when  $I_{discharge}$  is 100A, the IR drop will be 1V. for any cell in series, if the cell voltage is 4.0V, means the cell voltage is only 3.0V when discharge at 100A. the cell have to be exchanged or abandoned.

When battery is in charging, the formula is  **$V_{charger} = V_{battery} + I_{charge} \times R$** , **R is battery internal resistance**, for any cells in series, all cells have same charge current, so the cell with higher R will be charged fully first. and will cause imbalanced cell voltage.

Although cell internal resistance measured by BMS may be not accurate, it is still very useful to sort out all cells and then find "good" or "bad" cell. Ideally, each cell in series should have same internal resistance, if the difference of cell internal resistance is very large, the higher resistance cell must be "bad", and caused large cell voltage difference, then shorten the total battery life.



#### EXAMPLE:

One 16S LiPo battery pack is in discharging at 3A, BMS measured all cell internal resistance. The total battery resistance is 19.2mohm, and the difference of each cell resistance is 1.7mohm.

All cell internal resistance, total battery internal resistance, cell internal resistance difference and the current when measure internal resistance are sent out.

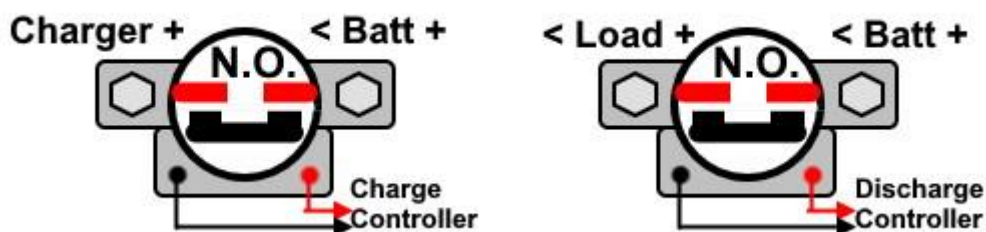
You can record the cell internal resistance, and compare new cell internal resistance with the cell used for several months, then you can find which cell has the highest internal resistance.



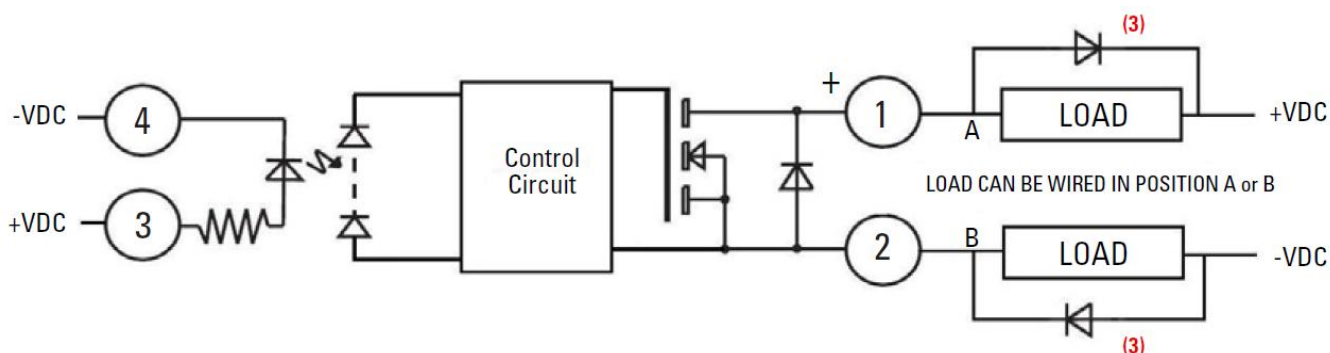
## Charge and discharge relay lectotype for BMS16T

The BMS16T can output 12V/3A to power the charge and discharge DCC/relay/SSR that is used for cut off charge or discharge when any cell voltage reach settings. The relay coil drive voltage must be 12V and the total current for charge and discharge relays cannot exceed 2.5A.

1. Relay DC rated current (Amp Capacity) should be **1.2 times over** the actual charge / discharge current. If the discharge current is 100A, a 120A relay for discharge is suitable.
2. If the BMS16T is powered by external power supply, the external voltage should be 15-30V which can output at least 3A to drive the relay and power the BMS16T.
3. Generally the mechanical relay is bi-directional, can be installed on the battery positive or negative, the driven coil is isolated with large current terminal (main contactor). Connection is as below picture.



4. For Solid State Relays, installing adequate Heats Sinks for the rated load current is very important, please pay close attention to the wiring connections. Special Note: Some SSR's (Solid State Relays) are Uni-directional, others are Bi-directional, be aware of these differences plan and purchase accordingly. If it is isolated, the SSR can be installed on the battery positive or negative, if is not isolated, the SSR must be installed on the battery negative.



5. Chargery DCC (DC contactor) can be fit with Chargery BMS, it is designed special for the BMS.

## Chargery DC Contactor Specifications

Chargery DC Contactor is designed special fit with Chargery BMS.

1. One DCC can be used in common port, and get both charge & discharge signal, When any cell is over charged, or over discharged or DCC over temperature, the DCC will be open and stop charging or discharging.
2. Built-in surge suppressing circuit, do not need install relay delay time board.
3. Over temperature protection and with intelligent cooling fan.

DC Contactor (DCC) model	DCC-100HB	DCC-200HB	DCC-300HB	DCC-600HB
Driving voltage	12V			
Holding current (Avg.) at 12V	9mA	11mA	11mA	11mA
Rated Operating Voltage	100V <sub>ischar</sub>			
Continuous (Carry) Current, Typical	100A	200A	300A	600A
Maximum current, at 85°C for 2 seconds	200A	300A	500A	1000A
Maximum Contact voltage drop at 100A	200mV	136mV	80mV	40mV
Fan start Temperature		41°C	41°C	41°C
Over temperature protection: Turn off temperature		90°C	90°C	90°C
Current mode	bi-directional			
Size(L*W*H, mm)	105*55*40	105*64*55	105*90*55	142*105*55
Weight(Kg)	0.3	0.45	0.7	1.2
Operating Ambient Temperature	-40 to +85 °C			
Cold pressing copper tube terminal	10-6	25-6	50-8	
Screws	M6*16		M8*20	
Wire Area(mm <sup>2</sup> ) requirements	18	30	50	70

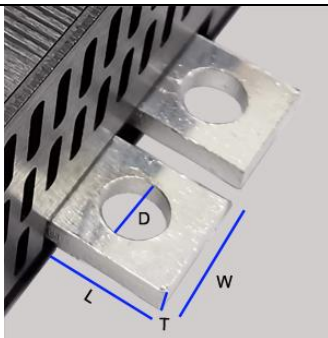








<b>Status</b> Indicator	Red LED is ON at DCC closed, and OFF at DCC open.
<b>Power</b> Indicator	Turn on Switcher, red LED is ON, if off, means BMS cut off charge and discharge, such as low temperature protection is trigger, or don't connect temperature sensor to BMS.

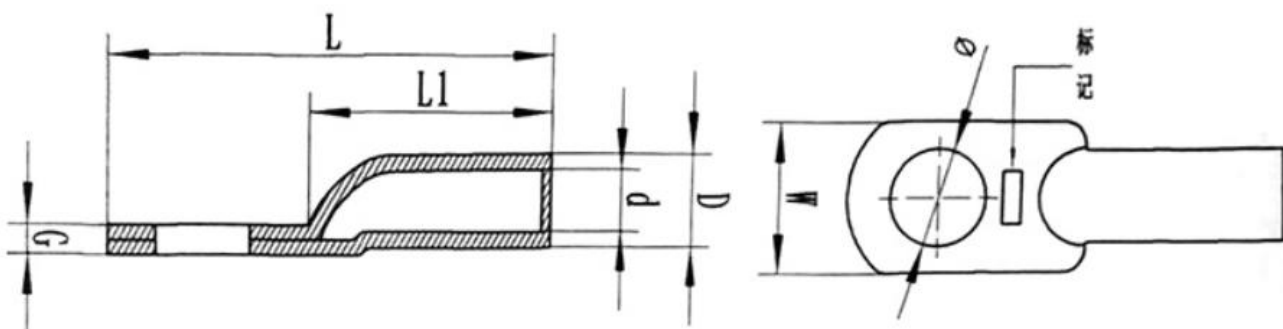


## Chargery DCC installatio details.

**Warning: when install Lugs, both lugs don't be short circuit or touch the DCC case at the same time.**

	DCC MODEL /Terminal size	L/mm	W/mm	T/mm	D/mm	Bolt Size
	DCC-100HB	15	18	3	7	M6 - 1/4
	DCC-200HB	15	18	3	7	M6 - 1/4
	DCC-300HB	20	18	5	9	M8 - 5/16
	DCC-600HB	20	18	5	9	M8 - 5/16
						
DCC-100HB, 100A		DCC-200HB, 200A				
						
DCC-300HB, 300A		DCC-600HB, 600A				
						
DCC-600HB, 600A		BMS8T is connected to DCC-600HB				

## Cold pressing copper tube terminal Specifications



DCC model	DCC-100HB	DCC-200HB	DCC-300HB	DCC-600HB
Terminal Model	10-6	25-6	50-8	
D±0.2mm	8	10	13	
d±0.2mm	5.6	7.3	10	
<b>G±0.3mm</b>	<b>2.5</b>	<b>2.8</b>	<b>3</b>	
L±1.5mm	38	45	54	
L1±1mm	21	25	30	
W±1mm	12	14	19	
φ ±0.5mm	6.5	6.5	8.5	
Cable AWG	AWG5 (16.8mm <sup>2</sup> )	AWG2 (33.6mm <sup>2</sup> )	AWG1/0 = 0 (53.5mm <sup>2</sup> )	AWG2/0 = 00 (67.5mm <sup>2</sup> )



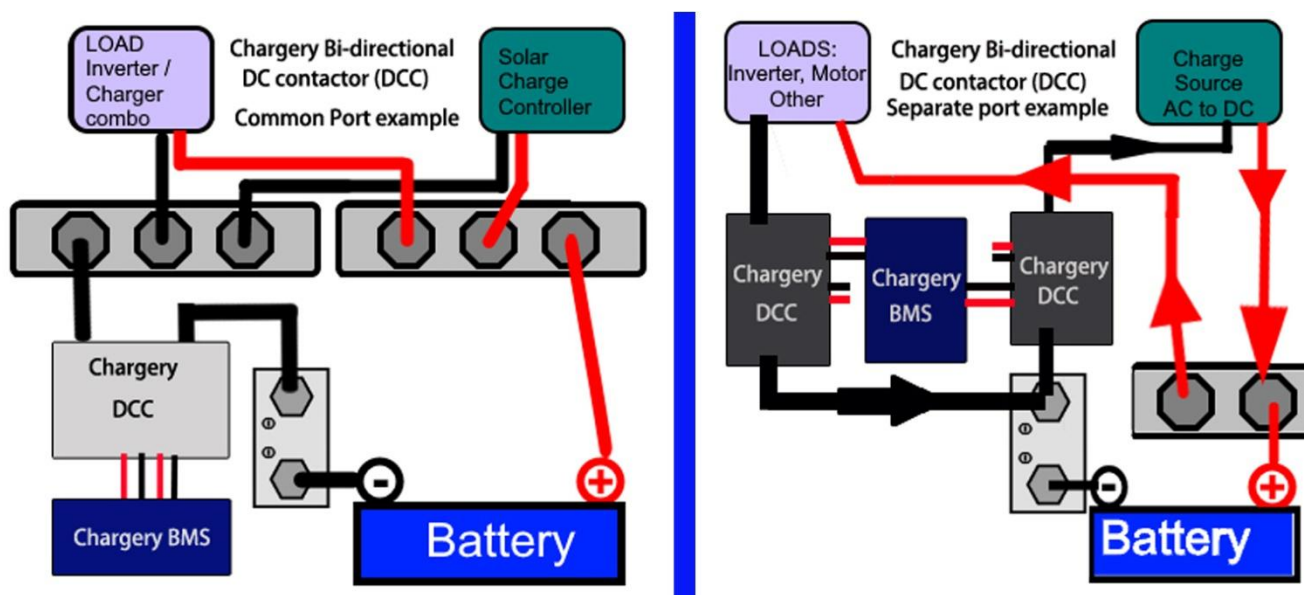
## Chargery DC Contactor (DCC) configuration in Common and Separate Port

CHARGERY DCC should be installed on the battery negative. It has the following advantage:

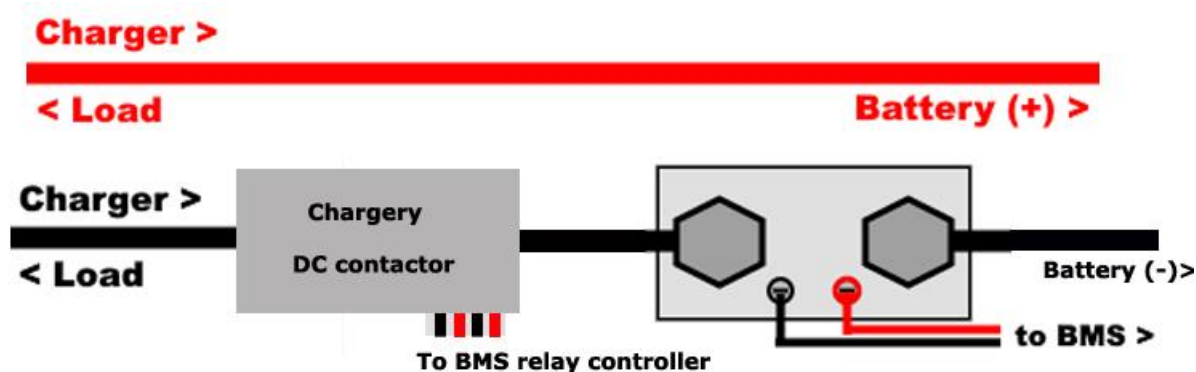
- Lower holding current (under 11mA for 600A DC Contactor), save more battery energy.
- Bi-directional allows it to be used in common port and separate port configurations.
- Nothing extra is needed to have both charge and discharge control signals to control one DCC in common port application.
- The Relay Delay Time Board Even is not needed to avoid surge current, as it is built-in.

Compare with SSR (Solid State Relay), the Chargery DCC is bi-directional and can handle up to 600A current at 100V DC. **ONE** Chargery bi-directional DCC can be used in common port, and receive both HV and LV cut off signal. If not using the Chargery DCC, you would require two SSR's or two relays, which would increase power consumption and have a higher cost.

The Chargery DCC installation diagram is as below.



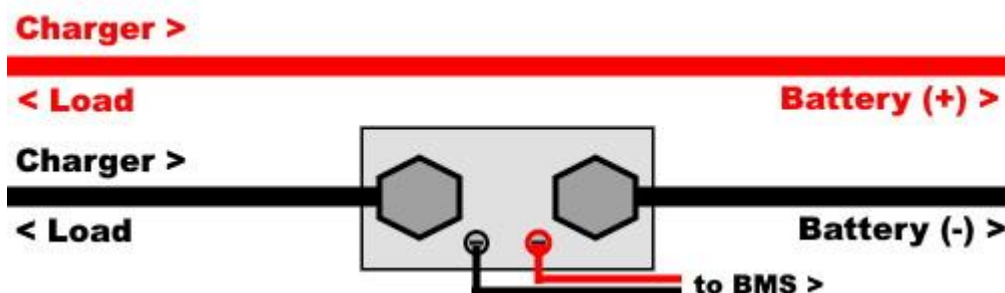
### Chargery DCC , shunt, charger and LOAD installation diagram (common port)



## Current Calibration (Shunt)

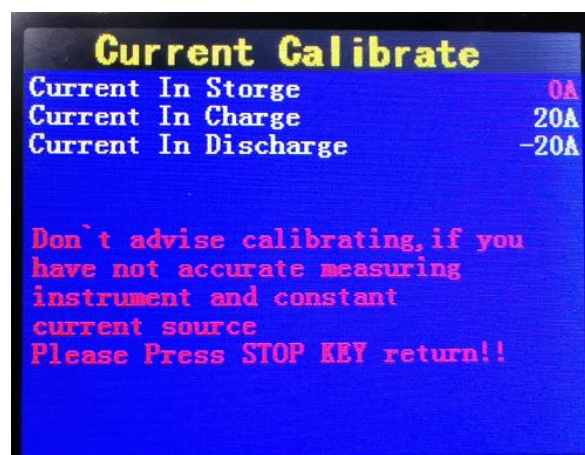
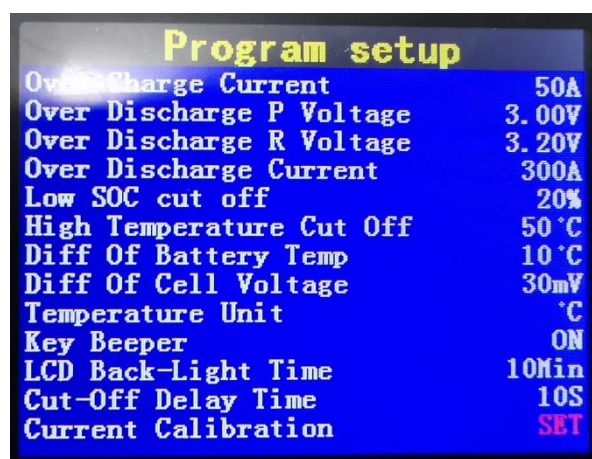
Current calibration is only required if you change the Shunt from the one supplied by Chargery which are calibrated at the factory. Use shunts which are 75mv or lower only.

Press **SET/START** for 3 seconds to enter into Program Setup and find the Current Calibration, you can calibrate the current to improve the measurement accuracy. If using a new current shunt, the current must be calibrated again to ensure accuracy. The current shunt should be installed as shown below.



Turn off charge and discharge, choose "Current Calibration SET" and press START enter into Calibration submenu as right picture,

- ZERO the shunt:** choose first line "Current In Storage" press **SET/START** button make the 0A blink, quickly press **SET/START** button to finish 0A calibration.
- CALIBRATE Charge Current:** choose second line "Current In Charge", Press **SET/START** make the current blink, Quickly press **UP/DOWN** increase the current to the new value (up to 100A, it must be less than current shunt, it is better to make it equal to your charging 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 value.
- CALIBRATE Discharge Current:** choose third line "Current In Discharge", Press **SET/START** make the current blink, Quickly press **UP/DOWN** decrease the calibration current to new value (up to -100A, it must be less than current shunt, it is better to make it equal to your demand current (load), the key is the current must be accurate) turn on the load and discharge battery at the current, 3 seconds later, press **SET/START** save the discharge calibration value.
- Turn off the load, quickly press **STOP** quit calibration, and press **SET/START** button for 3 seconds quit Program Setup and current calibration is finished.



If calibration is not needed, please press STOP button quit directly.

During calibrating, the charge current and discharge current must be stable and accurate, and must be as



same as current calibration setting. If charge current setting is 30A (on Program setup, current calibration submenu, the setting is 30A, as right picture), the actual charge current must be 30A that must be measured by high accuracy current meter and confirm it is 30A NOT 29.8A or 30.1A. if it is 30.1A, BMS will make the 30.1A as 30A reference, so the current reading will not be accurate.

When calibrating **charge current**, the charger must work on CC (constant current) mode. So the current can keeps stable basically.

When calibrating **discharge current**, the load must be drawn at a constant current from battery, but this is very difficult to do, because discharge current depend on the load applied. If using an electric load, and set the discharge current such as 30A on CC mode, the electric load can make the discharge current at 30A and keep it there so it won't change.

If you cannot make the battery discharge at a constant current, but you can charge the battery at constant current, when calibrating **discharge current**, you can swap current sensor wire (slim red and black wire) on the shunt, then turn on charger, and charge the battery at "Current In discharge" settings, Such as -20A or -30A. Don't forget switch the wires back on the shunt after finishing the discharge current calibration. Remember, RED wire toward the Battery Pack terminal.

Current calibration is not suggested. We calibrate shunt and current before delivery. You only need to re-calibrate if you change shunts from the ones supplied by Chargery.

If the current is not accurate, the WH and AH will not be accurate. SOC reading will also be wrong.

## Firmware Upgrades via USB Port

### Warning:

1. BMS main unit and LCD display module have **different firmware file**, and must be updated separately.
2. There is a USB port on the Main unit and LCD unit separately for updating.
3. Don't turn off BMS during updating
4. If loading the wrong firmware, the BMS may be damaged and won't resume operations.
5. Generally the USB driver is not needed for the BMS8T, 16T and 24T. If it is needed, please install USB driver on PC from the Chargery downloads.
6. Main unit V4.0 cannot communicate with a lower version LCD, such as V3.03, it means, when press START button on LCD unit, the BMS WON'T start.

### Update operations

Before update, please down load update tool software, new firmware for BMS main unit and LCD unit. Generally windows PC can identify BMS and communicate with BMS successfully as right image (COM3)

If the below image or others with yellow mark is showed up in device manager, please install USB driver on pc.



1. Please down load [BMS16T, 16T and 24T USB driver for window PC](#)
2. Please down load update tool on <http://www.chargery.com/uploadFiles/Update Tool V1.03.zip>, it is for BMS16T v3.0, BMS16T v3.0 and BMS24T v3.0 (new hardware with COM3 communication port),
3. Please down load the latest firmware according to your BMS model, including main unit firmware and LCD unit firmware, take as BMS16T-300 as sample, the correct link is [BMS16T-300 main unit v4.0](#) and [BMS16T LCD module V4.0](#)  
All files are here <http://chargery.com/update.asp>,
4. Install USB driver if need,
  - a) Turn on BMS, connect BMS to PC,



- b) If above image with yellow mark is showed in device manager, please run the USB driver. If don't show it, please check the USB data cable and BMS turned on or not.
- c) After running USB driver, when right image showed, please press INSTALL button, continue to install the driver.
- d) When Installation finished, installation finished menu will be pop up.
- e) Check the device manager, USB-SERIAL CH340 (COMx) will be listed in Ports(COM&LPT) list.

## Update BMS main unit

1. Connect PC to BMS by USB data cable and turn on BMS, the LCD display module do not need connect to main unit. If connect LCD to main unit, the update information will not be showed on LCD.
2. On PC "device manager" find the correct COM port, as above image, it is COM3.
3. Unzip the update tool software, and run the software, choose correct COM port, See right image, choose COM3
4. Click **OPEN** button lock the port please.
5. Click **Open File** button load the firmware file. The file should be .hex file. Such as **BMS16C3\_V4.00\_APP.hex**. "C3" means 300A model. See right image.
6. Click **Update** button start to update, the update progress bar will be showed on PC,
7. Finish installation, the complete information will be displayed on PC.



## Continue to update LCD unit

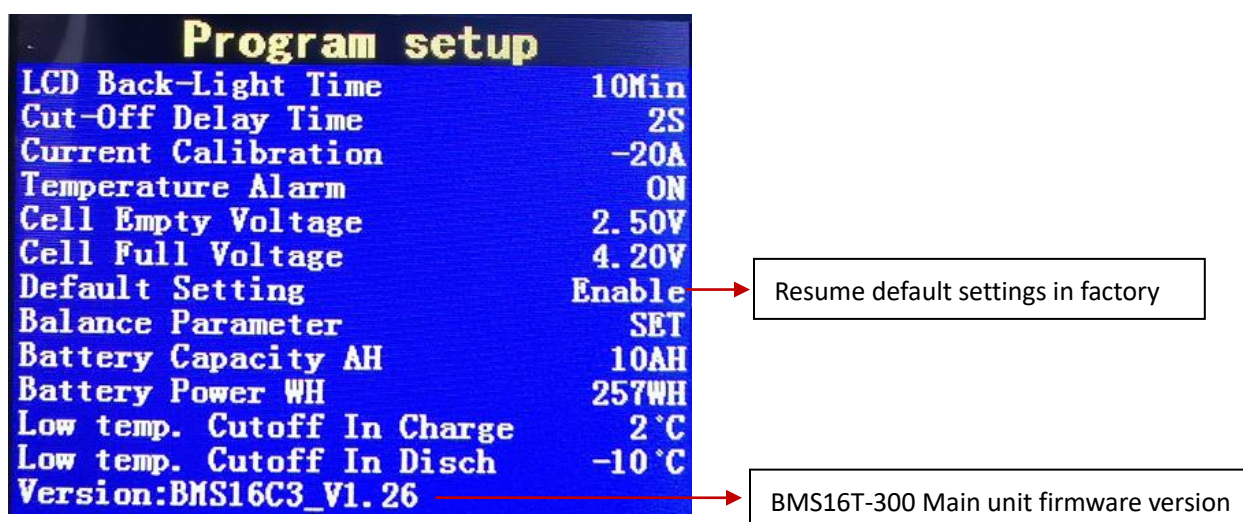
1. Connect LCD unit to main unit and connect LCD unit to PC by usb data cable.
2. Click **Close** button unlock the port, then click **Open** button lock the port on update tool software
3. Click **Open File** button load the firmware file. The file should be .hex file. Such as **BMS16T\_V4.00\_APP.hex**, it is for BMS16T LCD model.
4. Click **Update** button start to update, the update progress bar will be on PC and LCD, update complete

information will be displayed on PC.

Finish update, the BMS will start automatically. You can find the main unit version on the bottom line of program setup interface, when power on BMS, you can find the LCD module version on the first interface.

#### NOTES:

- If display "update time over", or don't display any COM port, please run update tool software again, the software version must be V1.03.
- The update tools current only supports Windows.
- After BMS main unit and LCD unit updated to V4.0, please enter into program setup interface and press UP or DOWN **choose Default Settings, then choose Enable press START button, resume all parameters settings as default.** As below.



Program setup	
LCD Back-Light Time	10Min
Cut-Off Delay Time	2S
Current Calibration	-20A
Temperature Alarm	ON
Cell Empty Voltage	2.50V
Cell Full Voltage	4.20V
Default Setting	Enable
Balance Parameter	SET
Battery Capacity AH	10AH
Battery Power WH	257WH
Low temp. Cutoff In Charge	2 °C
Low temp. Cutoff In Disch	-10 °C
Version: BMS16C3_V1.26	

Resume default settings in factory

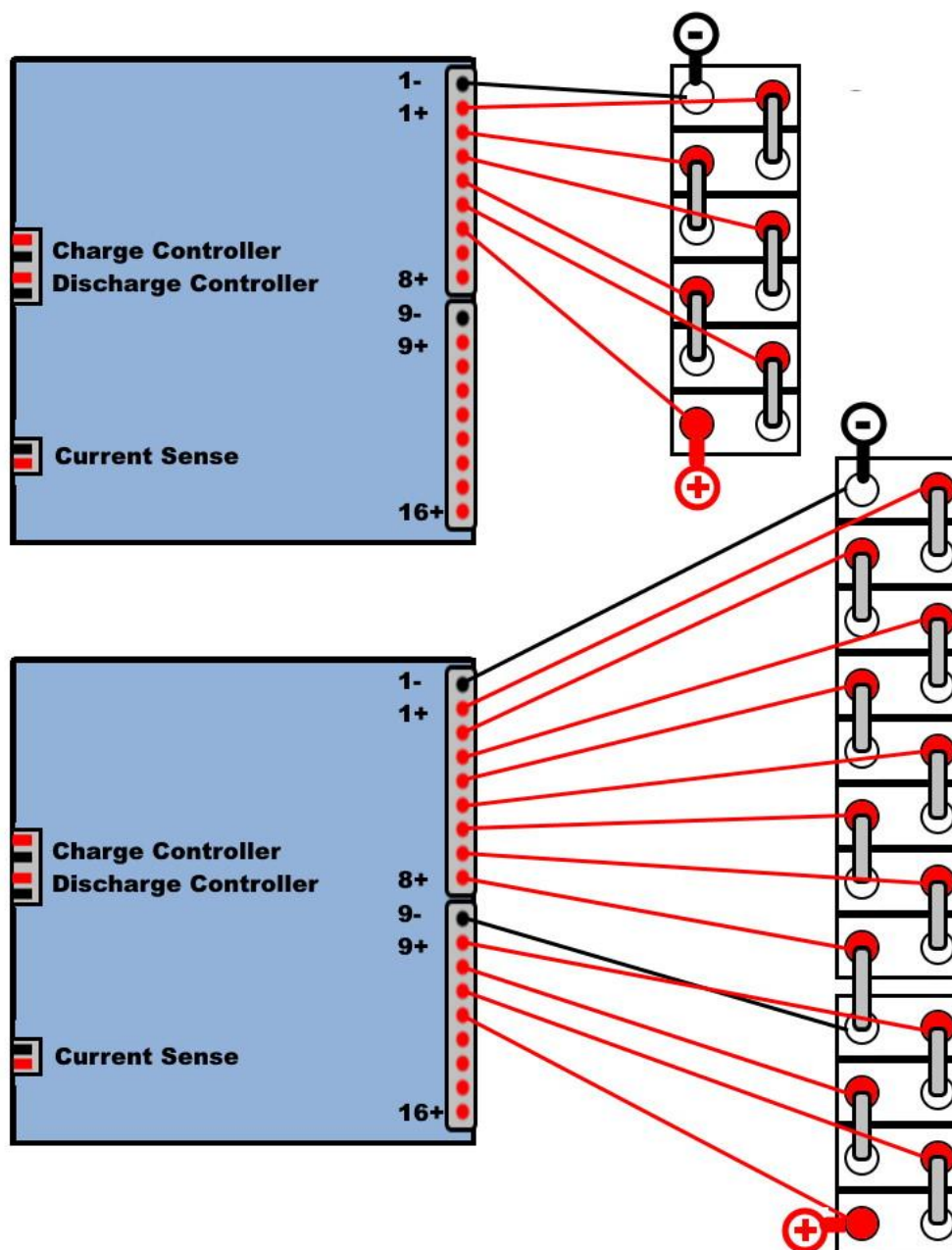
BMS16T-300 Main unit firmware version

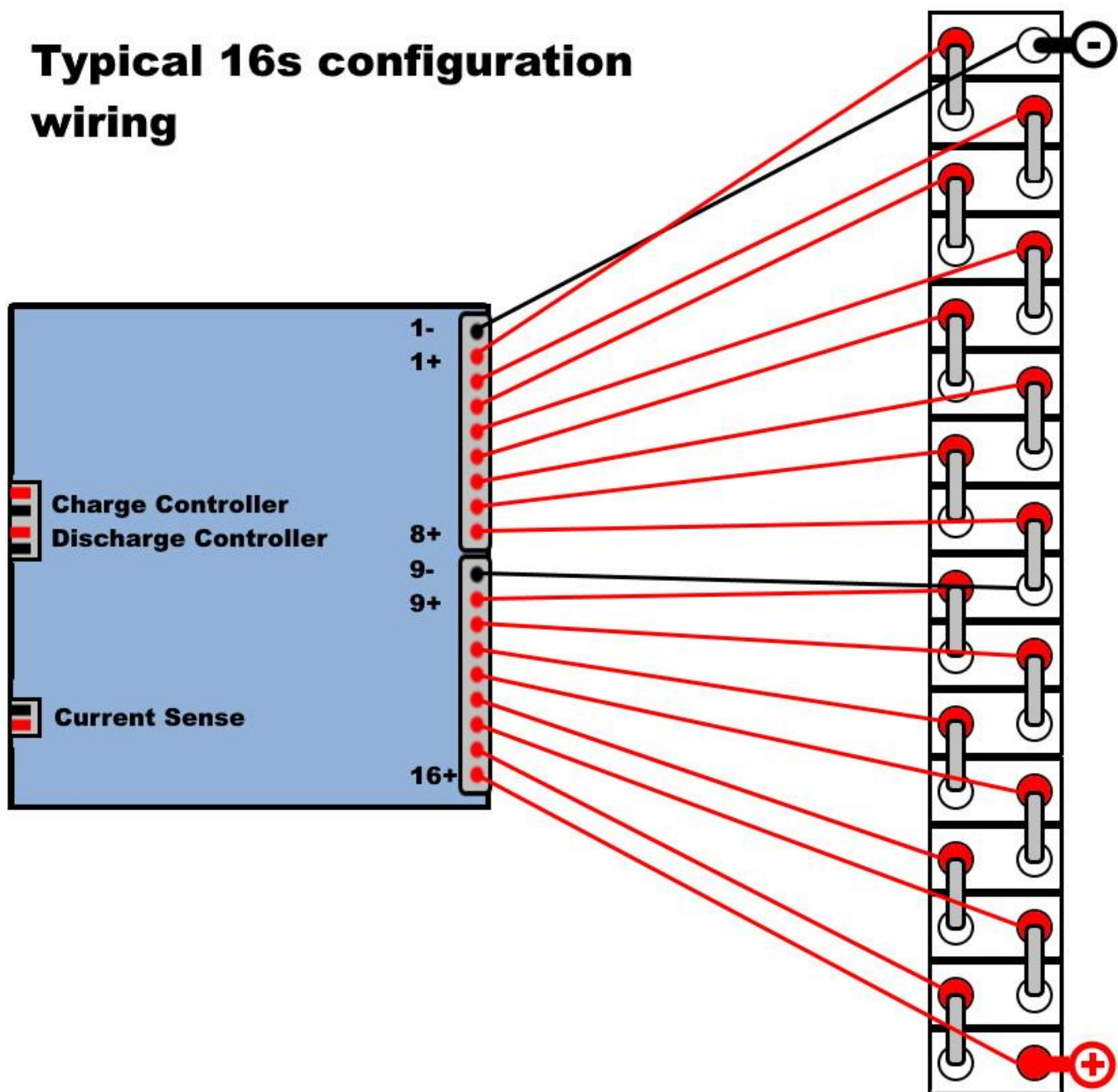


## Typical Cell Connections

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

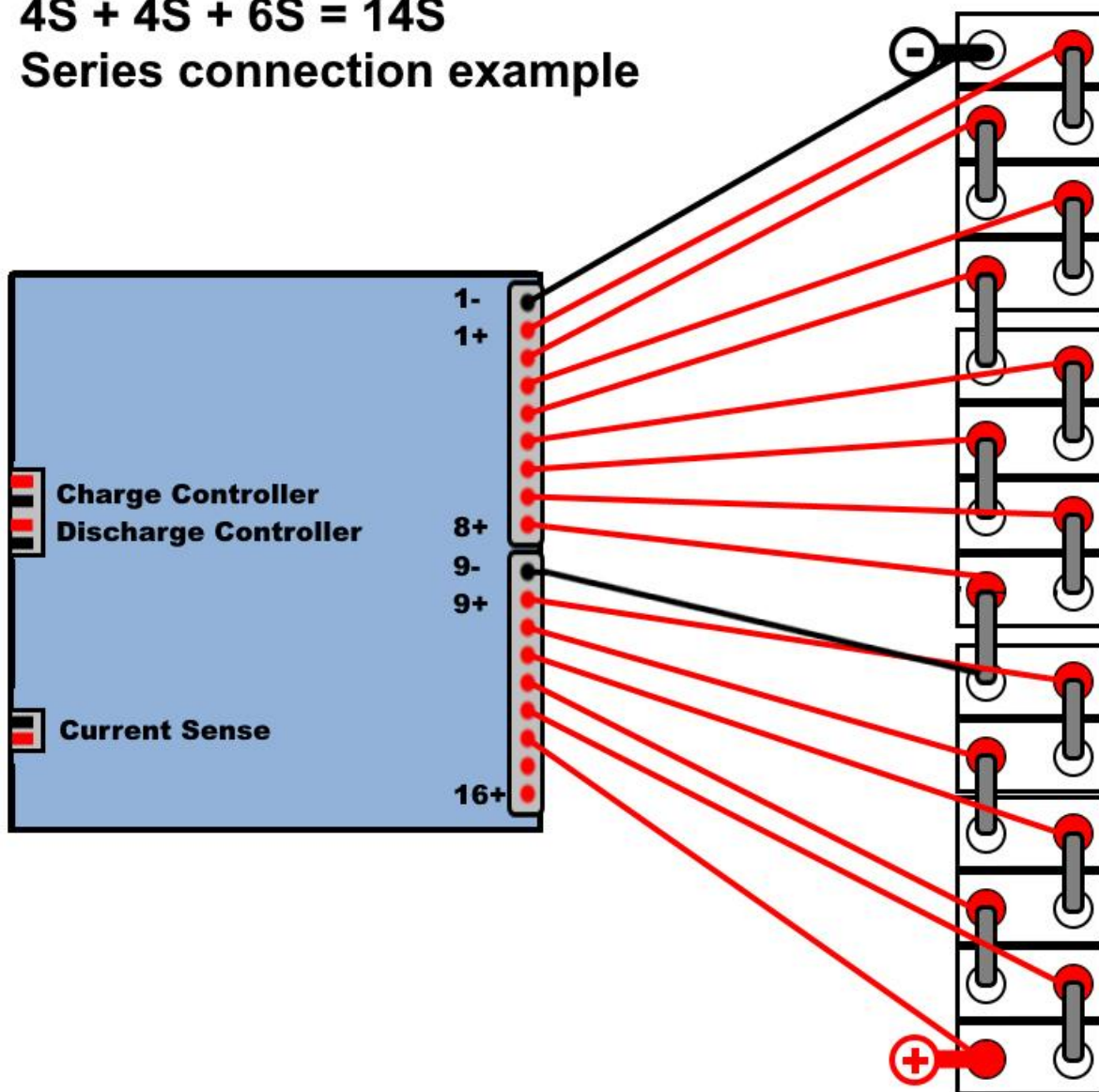
1. 2S-8S battery connected to the socket 1 directly, but external power supply is required.
2. For 7S or less configuration allows for external to power the BMS. The BMS requires 13-60 VDC @ 3A.
3. Connect 8S to socket 1 and remaining cells connect to socket 2 separately. See the 12S battery example shown below:



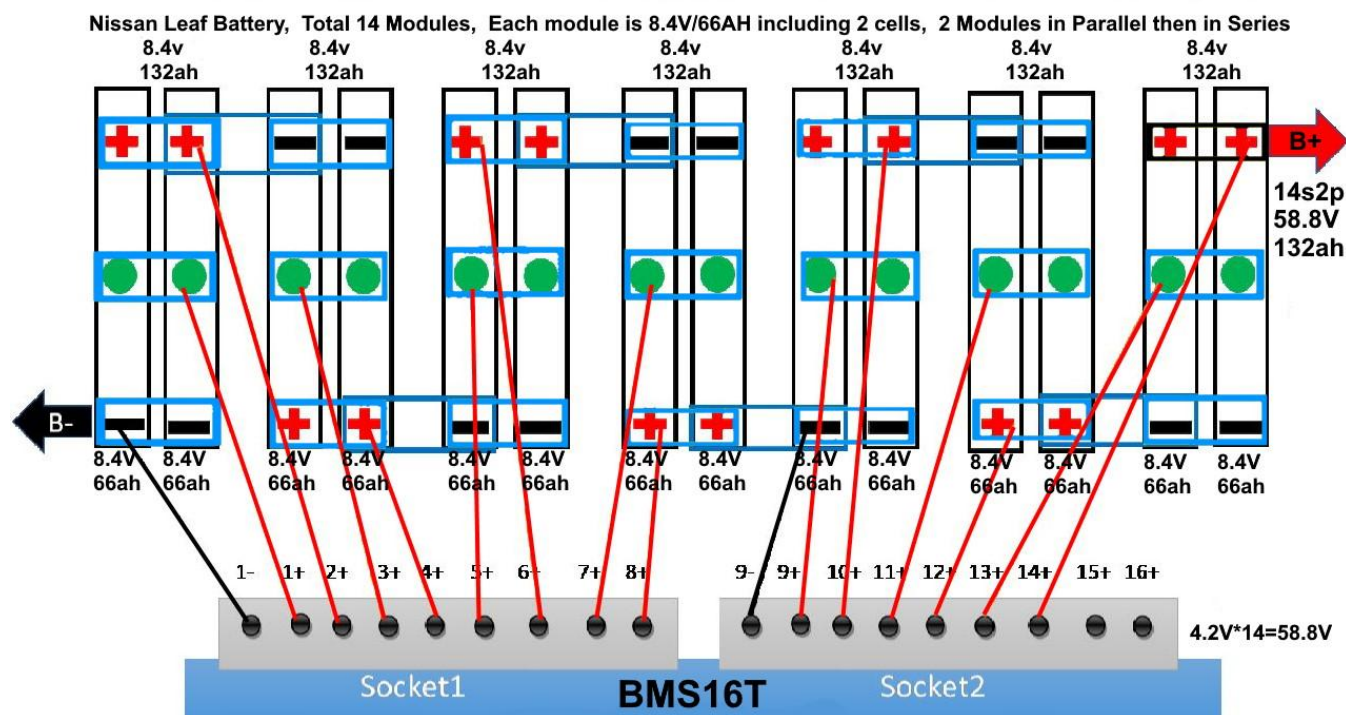
**Typical 16S configuration****Typical 16s configuration wiring**

4s + 4s + 6S with single BMS16T configuration example.

**4S + 4S + 6S = 14S**  
**Series connection example**



## Nissan Leaf battery 2P14S with BMS16T configuration example





## Separate Port Configuration example—with Chargery DCC

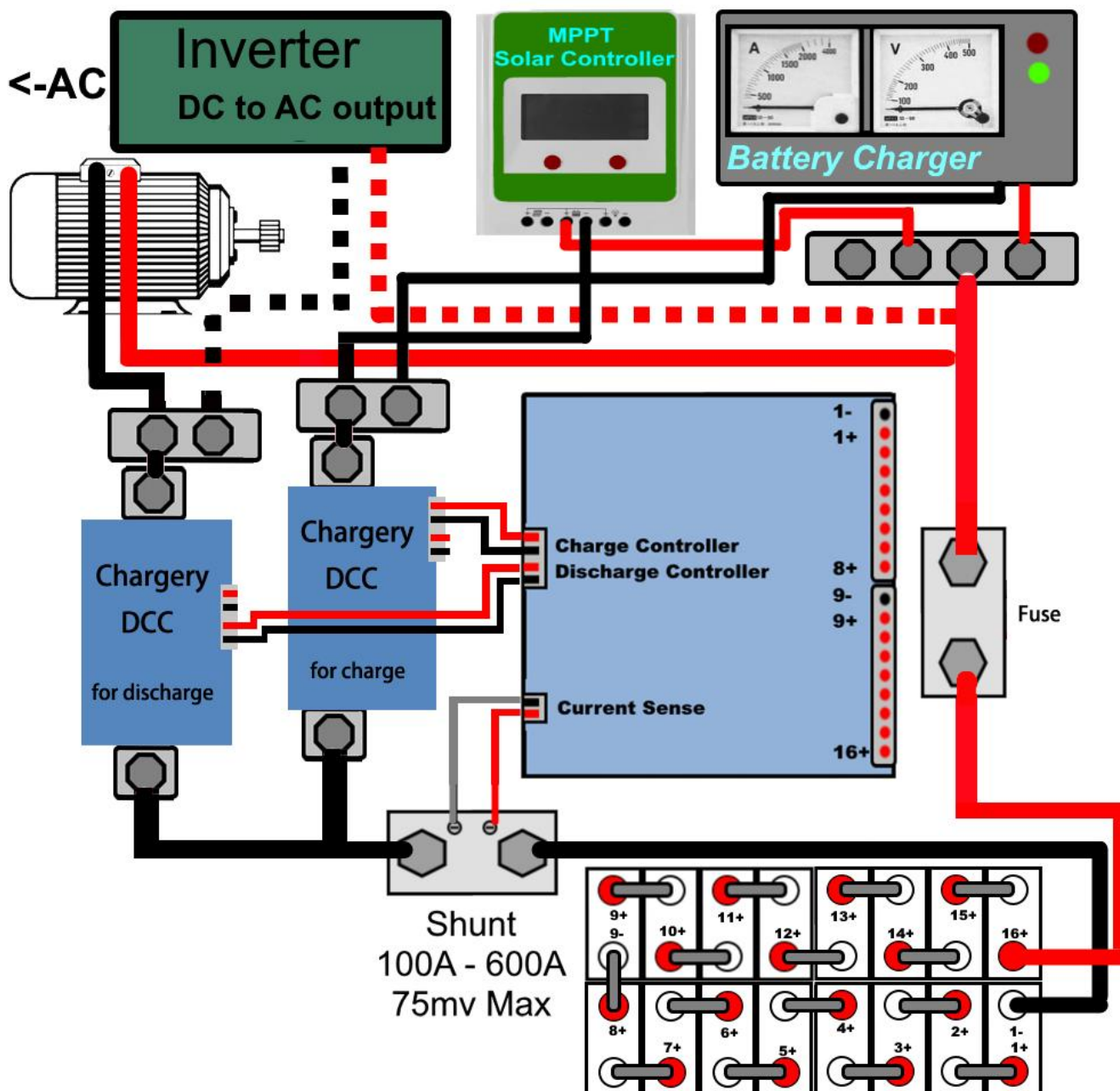
Chargery DCC can connect to BMS16T directly, do not need install delay time board or others.

The Charge DCC should be 1.25 times the maximum amperage provided by the charging devices.

The Discharge Relay should be 1.25 times the maximum amperage draw expected.

Example:  $(2000W \div 12V = 166A \times 1.25 = 208A)$   $(2000W \div 24V = 83.3A \times 1.25 = 105A)$

**NOTE !** Fuses, DC Breakers are not shown. Please use Best Practices and install appropriate fuses and breakers according to local codes and other guidelines.



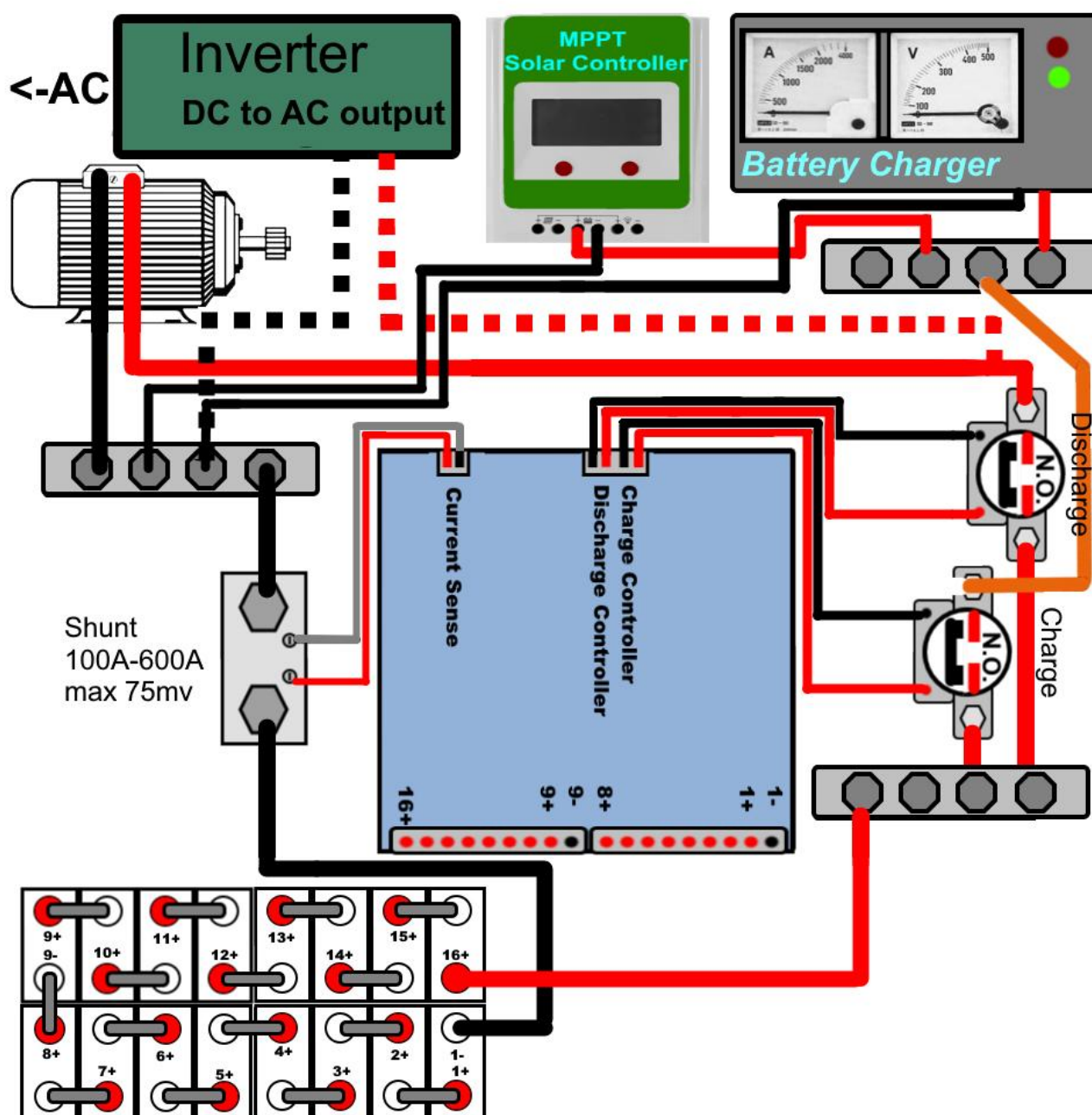


## Separate Port Configuration example—with Mechanical relay.

Before connecting the relay's for charge or discharge control, please confirm the coil relay voltage is correct for the voltage being used. The BMS16T controller outputs 12V to power the coil and the total current for charge and discharge relay's cannot be larger than 2.5A. In this configuration, the Charge Relay should be 1.25 times the maximum amperage provided by the charging devices. The Discharge Relay should be 1.25 times the maximum amperage draw expected.

Example:  $(2000W \div 12V = 166A \times 1.25 = 208A)$   $(2000W \div 24V = 83.3A \times 1.25 = 105A)$

**NOTE !** Fuses, DC Breakers are not shown. Please use Best Practices and install appropriate fuses and breakers according to local codes and other guidelines.

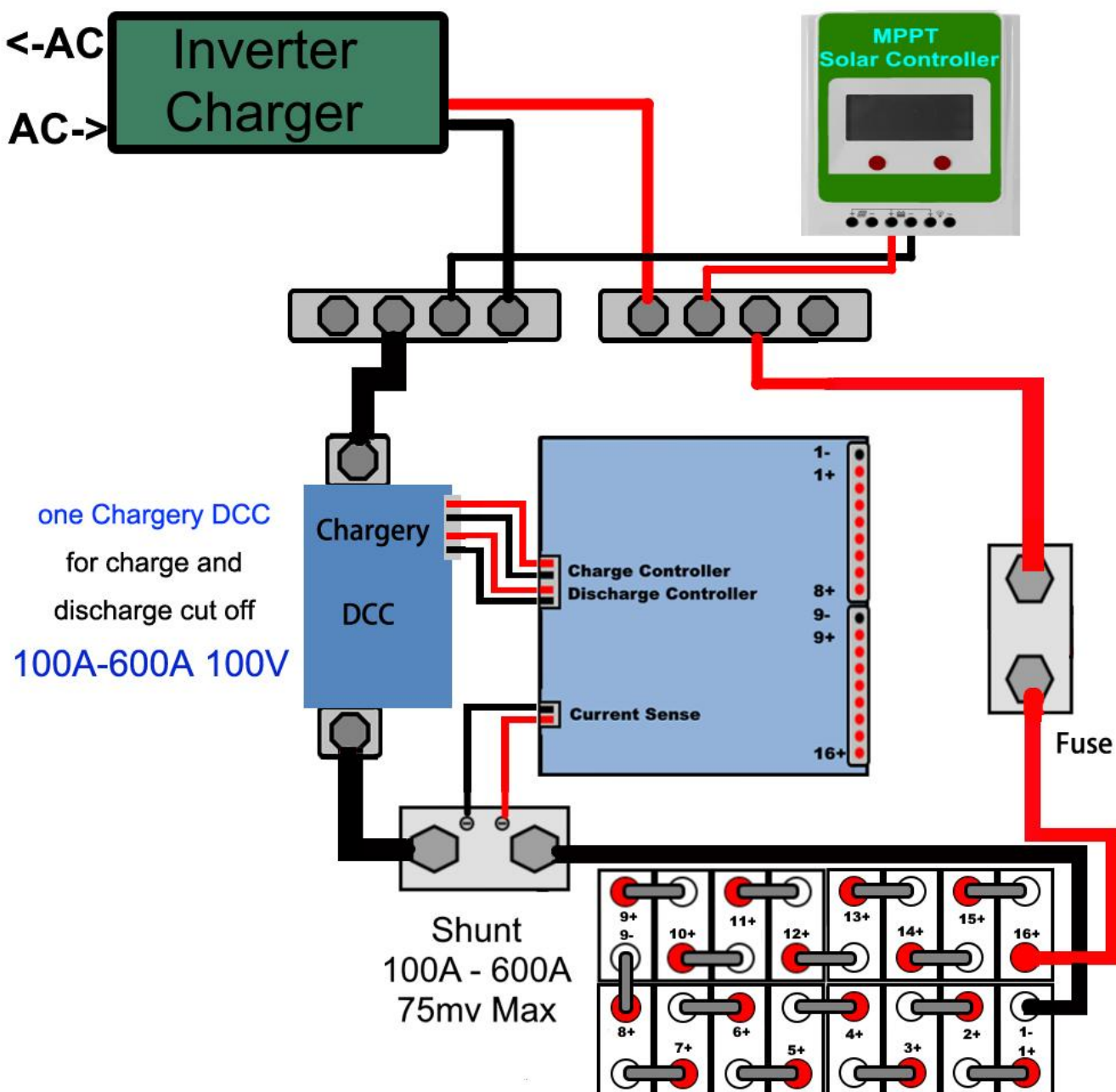


### ATTENTION !

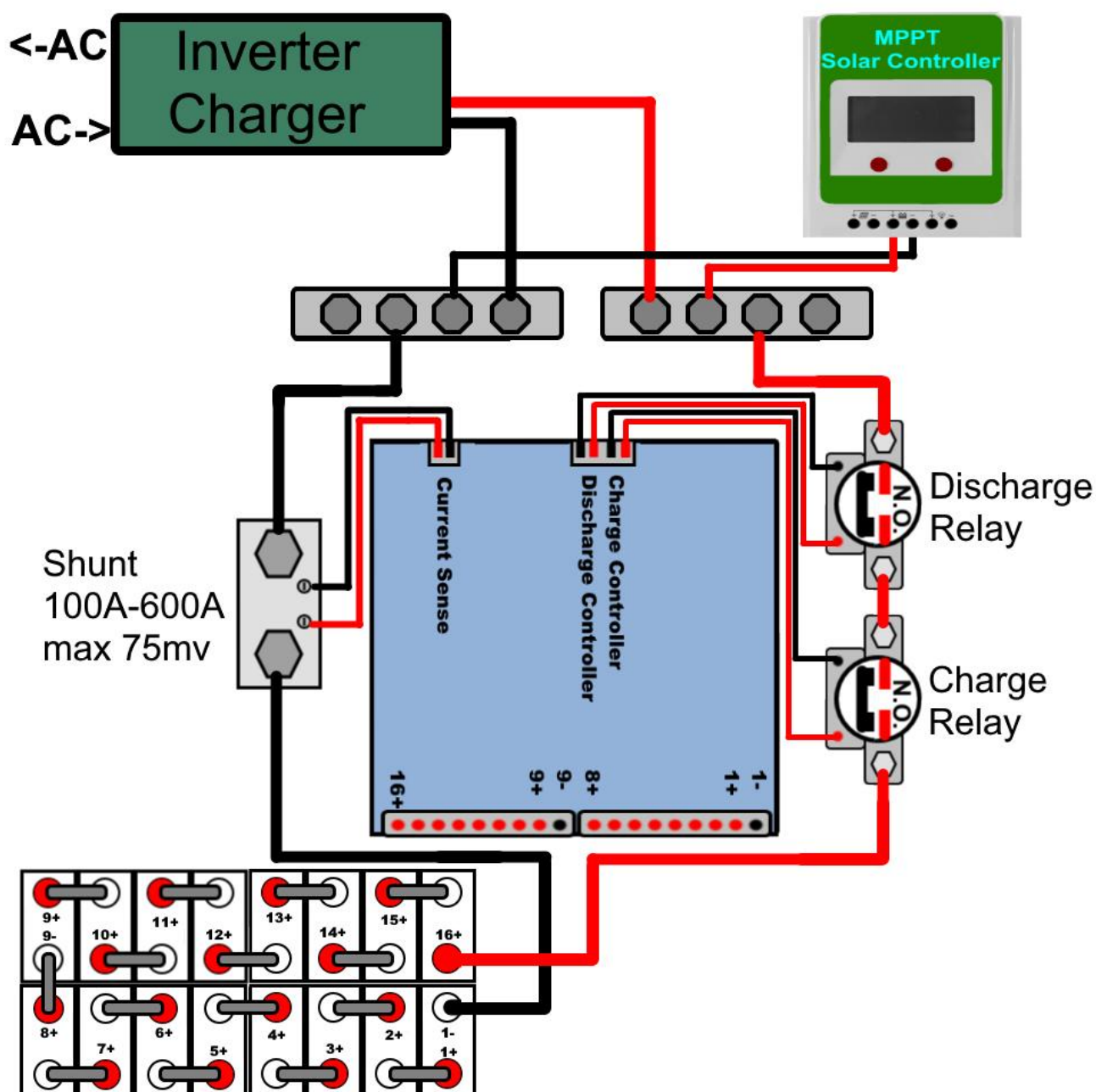
The relay on above Configuration is bi-directional or uni-directional SSR/mechanical relay. But SSR must be isolated.

## Common Port Configuration example—with Chargery DCC

On this configuration, both Charge & Discharge cut off is realized by one Charger DC contactor, and do not need install relay delay time board. 100A – 600A 100V bi-directional DCC is available, only 11mA power consumption from battery when it is turned on.



## Common Port Configuration example—with Mechanical relay.



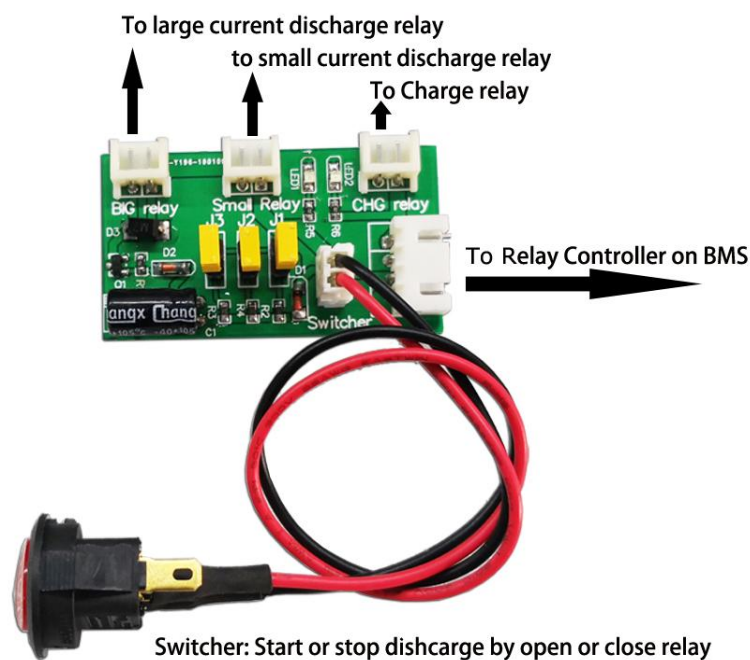
This configuration requires that both Charge & Discharge Relay's are capable of handling equal amperage.

Example:  $(2000W \div 12V = 166A \times 1.25 = 208A)$   $(2000W \div 24V = 83.3A \times 1.25 = 105A)$

### ATTENTION !

- Fuses, DC Breakers are not shown. Please use Best Practices and install appropriate fuses and breakers according to local codes and other guidelines.
- The relay on above Configuration is bi-directional or uni-directional SSR/mechanical relay. But must be isolated.

## Relay Delay Time Board (optional accessory)



If using a CHARGER DCC, this board is not needed.

When a Motor and many Inverters are started, the initial surge is very large. In order to restrict the current surge, CHARGER designed this special delay board, it can work with CHARGER BMS16T, BMS16, BMS16T and BMS24T and so on.

The board receives the relay signal from the BMS, the Charge Relay and Small Current Discharge Relay will be closed without a delay. But the Large Current Discharge Relay will be closed after a delay time. When the Large Current Relay is closed, the Small Current Relay will open automatically according to the below jumper connections diagram below:

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

1. Short circuit ALL jumpers: J1, J2 and J3, the delay time = 2 seconds,
2. Short circuit ONE of 3 jumpers: J1, or J2 or J3, the delay time = 6 seconds.
3. Short circuit TWO of 3 jumpers: J1 and J2, or J2 and J3, or J1 and J3, the delay time = 3 seconds.

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

**Before completing connections:** please power off the switcher (LED 1 is off). On the board, there are two BLUE LED indicators, when the Charge relay is closed, 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.

The large NTC Power Resistors must be chosen by delay time and load current.

**Surge Power Rating:** During start up, certain loads require a considerably higher surge of power for a short duration (lasting from tens of milliseconds to few seconds) as compared to their Maximum Continuous Running Power Rating. The inverter Continuous Power Rating should be higher than the surge power rating of these devices. 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 winding's draw a very heavy surge of starting current (Amperes) called "Locked Rotor Amperes"(LRA) due to low DC resistance of the winding's. For example, in motor driven loads like Air-conditioning and Refrigeration Compressors and 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 winding's and the current draw reduces proportionately till it draws the running FLA/ Maximum Continuous Running Power Rating at the rated RPM.

**Example:** If the motor's rated current is 100A, the surge current may be up to 1000A, it is over the maximum Discharge Current of Battery, so a power resistor is needed to restrict the current to 100A for example, therefore you will 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 depends on delay time desired. 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. It is recommended to consult your Inverter or Motor documents and supplier information before testing the Small Relay and Power Resistor.

Complete all connections and configuration setup, check and confirm all settings are ok, when ready to go. Please close all other switcher's on other devices, finally turn on the switcher on the board and the battery will start to charge or discharge.

12V: The resistor value should be over 0.24 OHM

24V: The resistor value should be over 0.24 OHM

48V: The resistor value should be over 0.48 OHM

----



## Relay Delay Board Implementation Examples:

If using a CHARGERY DCC, the delay board is not needed (connection diagram is on page 47).

The Small Relay in this example is a simple automotive "Make & Break relay". The simplest and most common form of relay. The circuit between terminals 30 and 87 is Closed "on" when energized and Open "off" when de-energized, this is known as NO (Normally Open). Terminals 85 and 86 actuate the relay. Suggested to use a 12VDC / 10A or greater relay.

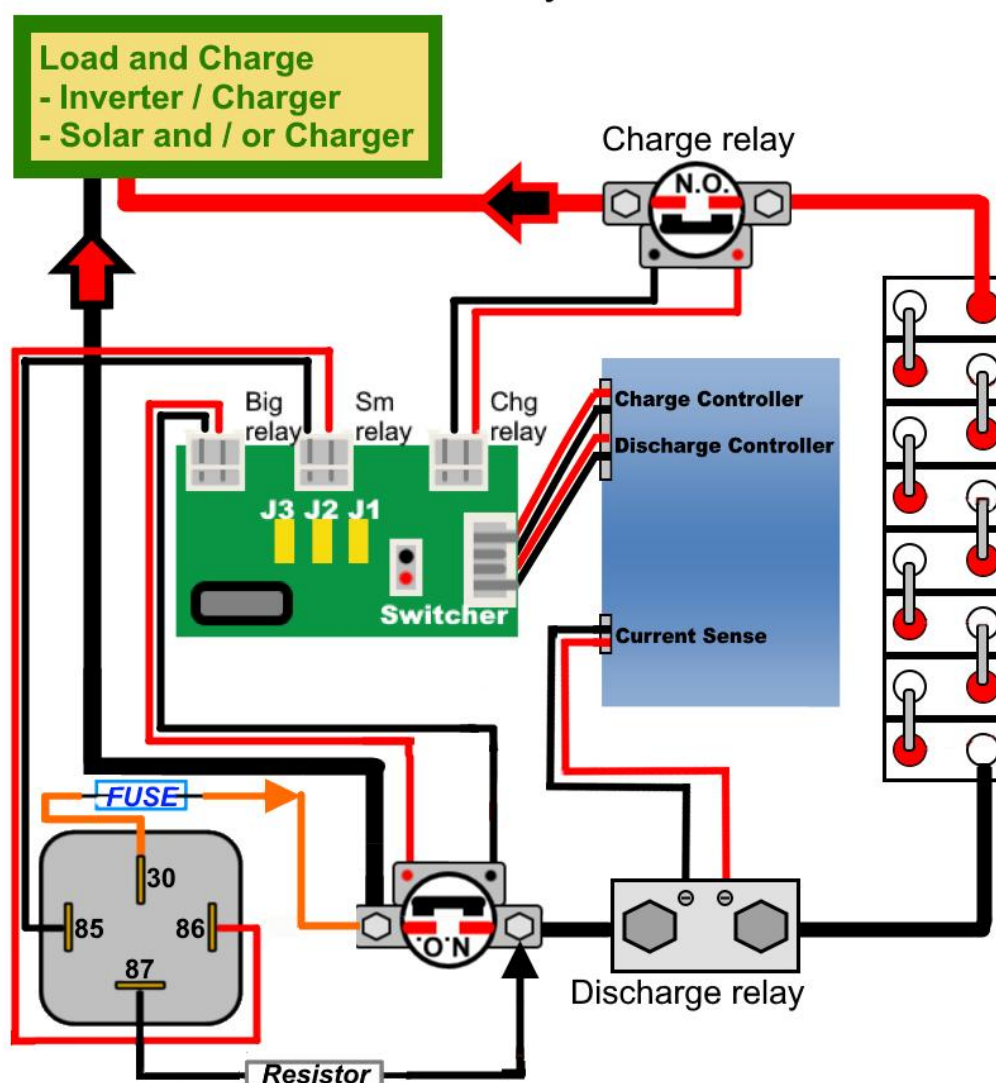
In this configuration, both the Charge and Discharge relays must be of equal Amperage rating as they share the common lines between the Motor / Inverter and battery.

For example: 24V/4000W Inverter will draw  $(4000W \div 24VDC = 166.66A) \times 1.25 = 208.3A$

Note a Low Frequency Inverter is capable of 3X the wattage (12,000W) for momentary surge.

The relays in this case should be sized 200A or greater.

### Common port configuration example for Delay Board



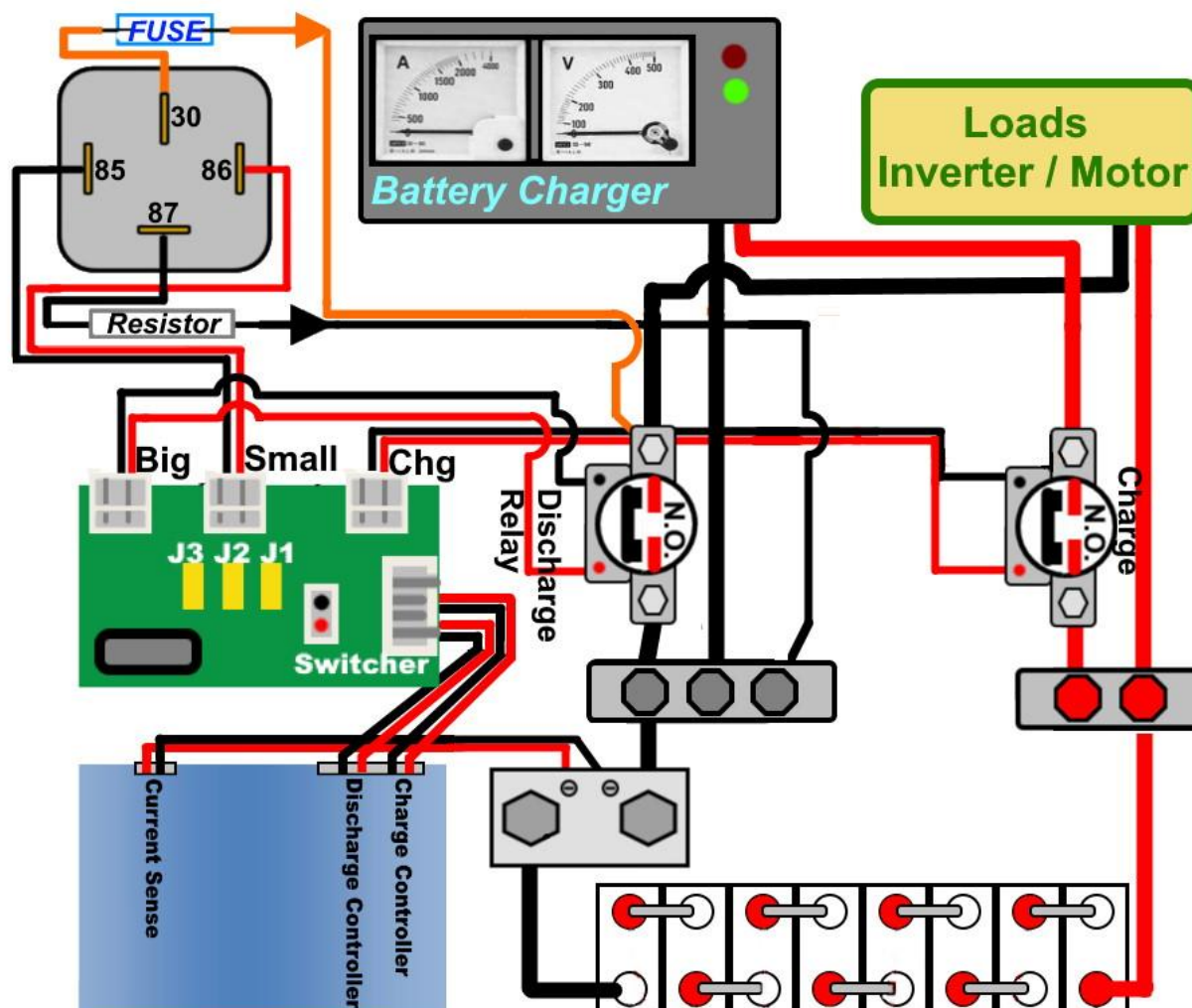
#### ATTENTION !

- The relay on above Configuration is bi-directional or uni-directional SSR/mechanical relay. But must be isolated.

## Relay Delay Board Implementation Examples con't.

If use CHARGERY DCC, do not need install the board (connection diagram is on page 45).

### Separate port configuration example for Delay Board



#### ATTENTION !

- The charge relay on above Configuration is bi-directional or uni-directional SSR/mechanical relay. But must be isolated.

The Small Relay in this example is a simple automotive "Make & Break relay". The simplest and most common form of relay. The circuit between terminals 30 and 87 is Closed "on" when energized and Open "off" when de-energized, this is known as NO (Normally Open). Terminals 85 and 86 actuate the relay. Suggested to use a 12VDC / 10A or greater relay.

In this configuration, the Discharge relay must be sized to the maximum Amperage anticipated x 1.25.

For example: 24V/4000W Inverter will draw  $(4000W \div 24VDC = 166.66A) \times 1.25 = 208.3A$

But a Low Frequency Inverter is capable of 3X the wattage (12,000W) for momentary surge.

The Charge relay must be rated for the Maximum Amperage that the charge sources (combined if multiple charge sources) can output to the battery. For example a Solar Charge Controller at 75A, and an AC Charger at 50A equals a max input potential of  $125A \times 1.25 = 156A$ , so a relay of 150A an up would be suitable.

## Related parts

The following device is related with BMS16T

MODEL	DESCRIPTION	COMMENTS
BMS16	For 2S-16S, without cell balancer	300A charge/discharge
BMS16T	For 2S-16S, 1.2A balance current per cell	600A max. charge/discharge
BMS24T	For 2S-24S, 1.2A balance current per cell	600A max. charge/discharge
C3060	AC charger for 1S-8S battery pack	1-60A charge, 1500W max.
C10325	AC charger for 4S-24S battery pack	1-25A charge, 1500W max.



1.2A balance

600A max. charge/discharge

## Total solution on E-Vehicle application

If using the Chargery charger, the charge relay can be ignored, BMS16T can communicate with charger, when any cell is over charged, BMS will send a signal to charger, the charger will decrease charge current till the cell voltage within safe values. If using another brand of charger, BMS16T only OPEN the Charge relay, if the charge current is too high, such as over 10A, the relay will open and close repeatedly. The relay life cycle will be shortened and charge time will be longer.

The Chargery Charger and BMS can save a relay cost and shorten the charge time.



The BMS on above picture is BMS24T, it is as a sample, the connection is as same as BMS16T and BMS16T

### 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.



## Supplemental: Solid State Relay supplemental information

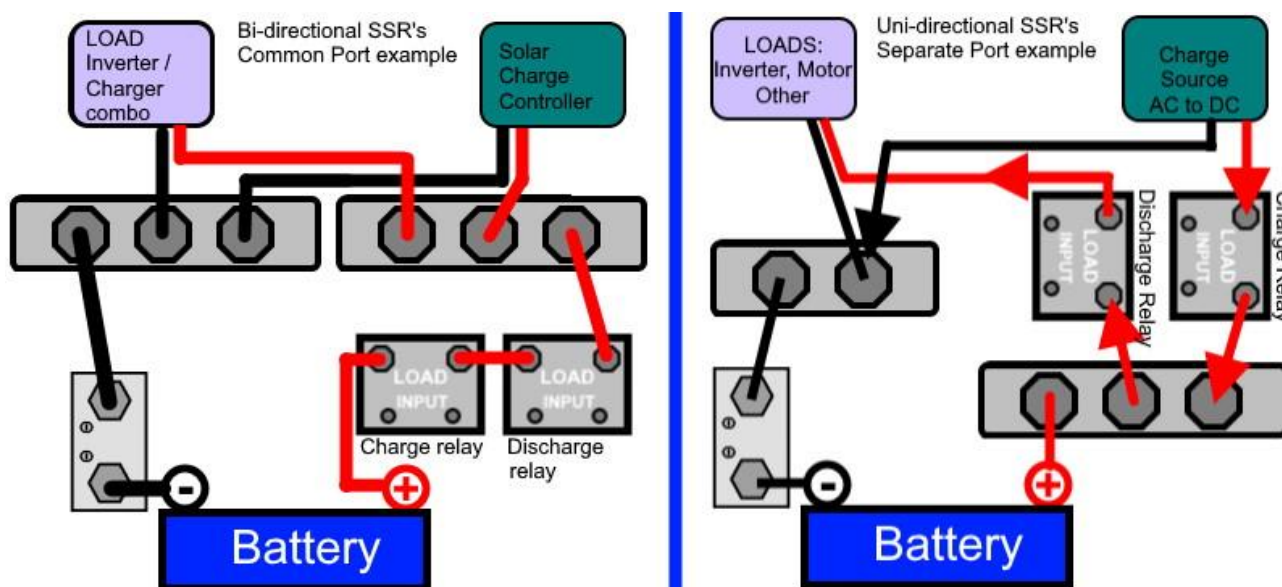
Because SSR's vary by manufacturer, carefully plan your configuration to accommodate your "specific application" and how to best implement the relays for your needs. Bi-directional relays are the most flexible and the least complicated to work with. Uni-directional relays can be used within a common-port configuration as well. Simple examples are shown below.

The separate Port example is shown, could also use a busbar between the Charge Relay and Charge Source if there is more than one charge source available.

If more than one Battery Pack, each with their own BMS exists, the current sensing Shunt must be on the battery side of the Shunt, as each separate BMS will read the current to and from that particular battery pack. Remember that these relays must be sized at least 1.20 to 1.25 times the maximum anticipated Amperage throughput that is expected. Relays capable handling more amperage than expected will not cause any issues. Example: If you know you will never exceed 100A Load Draw or Charge then you can safely use 120A to 125A rated relays, you may choose to use 200A relays without concern.

If you wish to monitor the "complete battery bank" consisting of multiple battery packs, then a shunt will be required between the NEG busbar and the actual Load such as an Inverter / Charger.

**CAUTION NOTE:** If you are using a Common Port configuration, ensure that "both" relays are equally matched, as the highest throughput current is the determining factor and if a relay is installed that cannot handle the maximum Amperage that could pass through it, it will fail and possibly result in damage.



### ATTENTION !

- The relay on above Configuration is bi-directional or uni-directional SSR/mechanical relay. But must be isolated. If it is not isolated, please install it on battery negative, connect between Load inverter/charger negative and current shunt.
- If use CHARGERY DCC, one DCC is enough for the Common Port application (connection diagram is on page 47)

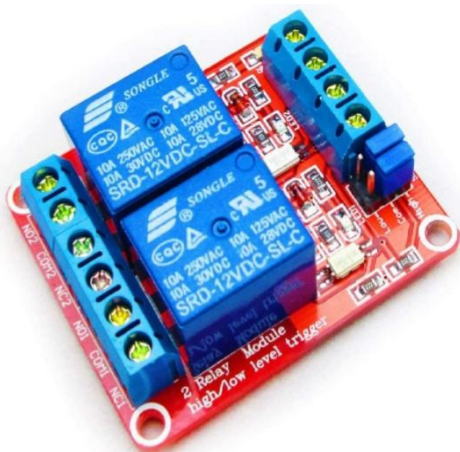


## Supplemental: Single Relay with 2 channel Opti-Coupler

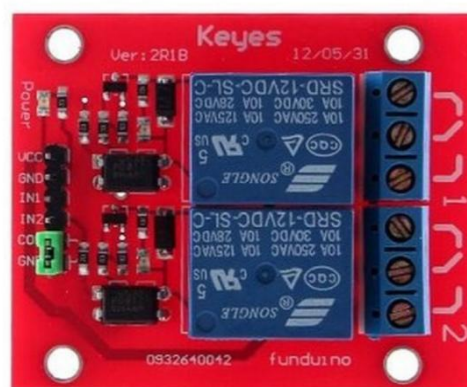
Quite often, the "need" for two relays is unnecessary and can use more power than needed. Fortunately by using a 2 Channel Opti-Coupler board, it can accept the two Relay Signals from the BMS but actuate only one Relay. This is often practical in a Common Port configuration where charging & discharging is done through a common DC Bus. Note that the Relay / Contactor chosen MUST be capable of handling the highest Amperage load that will pass through it.

Components Required:

- DC 12V 2 Channel Relay Module with Isolated Optocoupler " Triggered by DC 12V" NOT 5.5V or 3.0V
- Support minimum of 5A, 10A is typical.
- 12VDC Power Source. Can be from Battery or a Step-down converter if battery pack is above 12VDC, Two Example Coupler Boards: (used for Arduino & Raspberry Pi etc, there are many brands / versions)



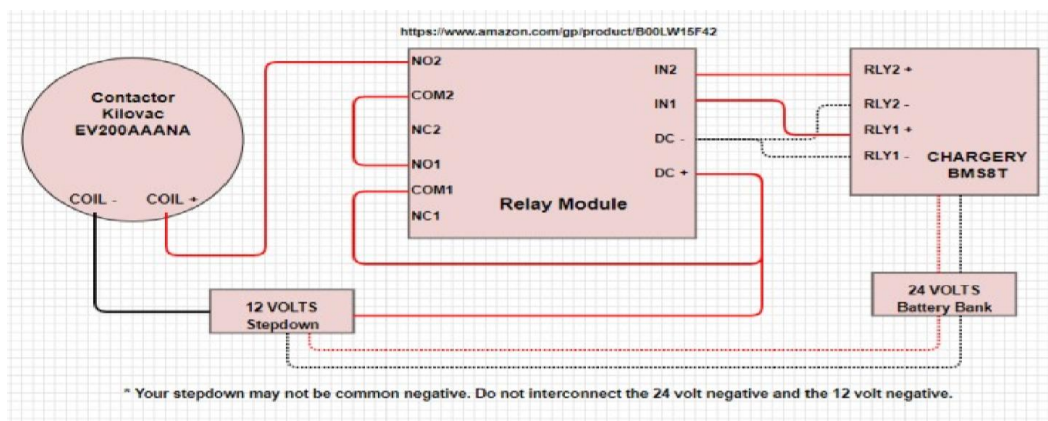
HiLetGo 3-01-0342



Keyes 2R1B

Wiring the board:

For two contactors run 12v+ through NO1/COM1 and NO2/COM2 separately to each coil+. 12V is provided from either 12V battery or Step Down converter. Caution: If using converter, do not connect (-) from the battery but from the converter only.



Thanks to user "Onemorebattery" from Diysolarforum.com.

Chargery DCC solved the problem, one DCC uses in a Common Port configuration, and does not need the relay board. Detailed connection is on page 47.

## Supplemental: Equipment Voltage Calibration

Various components such as Solar Charger Controllers, Inverter/Chargers need to "know" the precise voltages being dealt with in regards to the batteries, with Lithium Based batteries, accurate voltage sensing is essential. This is not a difficult process to do but as equipment varies a great deal on how they are configured and what options they have, you will have to refer to the manuals for your particular equipment.

**! You will require an accurate DVOM (Digital Volt Ohm Meter) or DMM (Digital Multi-Meter) to accomplish this task.**

### Simple Steps:

*Do this when there is no charging from the Solar Charge Controller, best time to do this is just after sundown, so that there is no solar activity.*

1. Ensure your batteries are charged and "at rest", meaning no loads or charging for 1 hour.
2. The Solar Charge Controller, Inverter/Charger must connected and ON. As well, if you have a Buck Converter / Step Down converter have that on BUT WITH NO LOAD being supplied to devices.
3. First, take a Voltage Reading at the Battery Terminal (if only one pack) or at BUS Terminals if multiple packs in parallel. Test "after" the BMS but before the Relays as the BMS is on the "battery side". NOTE the Voltage as ##.## volts (IE 28.92vdc or 14.86vdc)
4. Next, measure the Voltage at the Inverter/Charger DC Input Terminals and again note it.
5. Next measure the voltage at the Solar Charge Controller "Battery Terminals" (not the solar input terminals) NB: The Solar Charge Controller should not be getting any sun, no input. NOTE the Voltage seen at the Battery Terminals of the Controller.
6. If you have an external AC to DC charger connected as well, check the voltage at the "terminals" of the charger and note them as well.

You will now see a difference in readings between the Batteries, the Solar Charge Controller & the Inverter Charger. This is the result of "deration", essentially the wire and every single connector in between adds a bit of loss through the whole circuit and this must be addressed. **! ALERT ! If the discrepancy is more than 1 Volt you may have other problems, such as a loose connection, poor crimps or damaged wire / components. This must be addressed first and once done, redo above readings.** The BATTERY reading (be it a single or a bank of packs) is the one that RULES and the remaining equipment must "match up" to be effective.

### Example using basic numbers to Keep It Simple:

Assume the Battery reads 24.0 VDC, the Solar Charge Controller reads 23.75 VDC and the Inverter/Charger reads 23.60 VDC.

**EXAMPLE:** If the desired CHARGING cutoff is 29.20 VDC, then the SCC would have to be corrected for the 0.25V shortfall in readings, so it would be programmed to cutoff at 29.45 VDC. The Inverter Charger "Charge cutoff" would then also have to be corrected to 29.60 VDC to compensate for the 0.40 VDC difference.

### LOW Volt Disconnect

The Inverter will have it's own LVD (Low Voltage Disconnect) setting and this is extremely important. While 0.40V is not a big difference, it can be if you want to keep within a very specific range and with Lithium based batteries 0.40V at the bottom edge **can be significant !** So you would have to Correct the voltage the Inverter/Charger sees, so that it cuts off exactly at the voltage desired "at the battery terminal end". So IF you want the LVD to kick on when the cells reach 2.75VDC ea / 22.0 VDC for the

24V pack/bank, the LVD setting will have to be adjusted to 22.40. This way when the Inverter/Charger sees 22.40 Volts it cuts off as the actual batteries are at 22.0VDC.  $21.60 \text{ VDC} = 2.70\text{v per cell. (uncorrected)}$  \* REMEMBER, that below 2.80V per cell the voltage drops very fast as you in the "bottom 20%" of cell capacity. *Always defer to the particular battery chemistry data sheets from the Manufacturer for the cells you are using, they vary quite a bit.*

**Don't make the BMS do the work it shouldn't do.**

The BMS of course will cut off for High / Low Volt etc but this is not it's job, those are "safety" features to protect you batteries and are more or less the "fail safe mechanism", as such they should not be doing that work as a matter of normal operations. This is really the task of the Solar Charge Controller and Inverter/Charger to manage on an ongoing basis. Continually using the BMS to do this function can actually affect the BMS negatively and may even result in damage, it is not what they are designed to do.

## Supplemental: Reference Documents & Video links

1. **Updated Manuals, Firmware & Drivers:** <http://chargery.com/update.asp>

### PDF Documents:

2. **Communication Protocol V1.25 for BMS24T, BMS24T and BMS24T:** [Protocol 1.25 PDF](#)

### Videos:

3. **BMS installation video on installation with Nissan Leaf battery:**  
[http://www.chargery.com/Video/BMS24T\\_C10325\\_operation\\_instructions.mp4](http://www.chargery.com/Video/BMS24T_C10325_operation_instructions.mp4)
4. **Current calibration:**  
[How to calibrate Chargery BMS Shunt \(BMS24T, BMS24T, BMS24T\)](#)
5. **BMS current calibration by power supply**  
[https://www.youtube.com/watch?v=bCM\\_cau0TD0](https://www.youtube.com/watch?v=bCM_cau0TD0)
6. **Chargery BMS update**  
<https://www.youtube.com/watch?v=zsMADtoNi1c>
7. **Chargery BMS update firmware on Main & LCD modules to v4.0**  
<https://www.youtube.com/watch?v=4nrYUm1uhAs>
8. **Chargery BMS. Package and settings walk-trough.**  
<https://www.youtube.com/watch?v=7ggsGRL8VC0>
9. **Configure 16s LiFePo4 to 48V battery---Connecting balancing leads to battery and Capacity test.**  
[https://www.youtube.com/watch?v=ic\\_Ulh8DOLk](https://www.youtube.com/watch?v=ic_Ulh8DOLk)

## Supplemental: BMS power consumption

### 1. BMS power consumption when fit with **Mechanical Relay**

Battery voltage	Normal mode without Relay but LCD is on	Sleep mode without relay and LCD is off	Normal mode with 12V mechanical relay at different rated current and LCD is on			
			100A	200A	400A	600A
	BMS drain current from battery (mA)					
16V	120	40	500	850	1150	1425
24V	84.25	35	475	550	725	890
36V	65	50	325	365	485	587.5
48V	55	42.5	247.5	280	370	445
60V	48.75	29	207.5	230	302.5	365
67.2V	46	28.25	187.5	207.5	275	332.5

Mechanical relay power consumption at 12V driven voltage when it is closed.

12V 100A relay	12V 200A relay	12V 400A relay	12V 600A relay
0.75A	0.96A	1.24A	1.3A

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

- If the battery is not in use (exclude charging), please disconnect coil driven wire.
- If storage for over 1 month, please press STOP button place the BMS into Sleep Mode.
- If storage for over 3 months, please turn off the BMS directly. You may use the External / Internal power switch if using internal power.

### 2. BMS power consumption when fit with **Chargery DC Contactor**

Battery voltage	Normal mode without DCC but LCD is on	Sleep mode without DCC and LCD is off	Normal mode with 12V DCC at different rated current and LCD is on			
			100A	200A	300A	600A
	BMS drain current from battery (mA)					
16V	120	40	130	132	135	135
24V	84.25	35	92	93	95	95
36V	65	50	71	72	75	75
48V	55	42.5	60	63	65	65
60V	48.75	29	50	50	59	59
67.2V	46	28.25	47	48	55	55

Chargery DC Contactor power consumption at 12V driven voltage when it is closed.

DCC-100HB	DCC-200HB	DCC-300HB	DCC-600HB
9mA	11mA	11mA	11mA



## Frequent questions

### 1. Charge or Discharge relay/DC contactor won't open (disconnect) or close (connect)

- a) Confirm the relay coil driven voltage, it must be 12V.
- b) Confirm relay coil current requirement, it must not be over 1A for each relay or that the total current with two relays won't be over 2.6A
- c) Without alarm the charge and discharge relay controller voltage is 12V,
- d) When any alarm events occurs, 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 9 pin balance wire connections are good and secure.
- b) Measure actual cell voltage on the 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 (100K ohm or so).
- d) Or send back to us and calibrate the cell voltage again.

### 3. SOC is zero,

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

### 4. SOC is wrong

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

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

- a) The wire length from current shunt to battery negative should be as short as possible.
- b) Check charge current or discharge current ripple, especially on an inverter.
- c) Add low-pass filter on current sensor
- d) Update main unit to V1.21, do not need calibrate current.
- e) If shunt is replaced, or for other reasons you need to calibrate current, the calibration video is here <https://www.youtube.com/watch?v= LOJw83s18M>

### 6. 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, it 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 (100K ohm or so). If only 10 ohm or less, please return back to us for repair.
- f) For over 50Ah battery, the balance time is longer relative to battery size
- g) After discharge, check the cell voltage difference on LCD, if over 100mV even 200mV, it 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

- a) When current displayed is ZERO, that is to say, the battery is not charging or discharging, press STOP button to make the BMS enter into **sleep mode** to save battery energy.
- b) If you need wake up the BMS, please press UP, DOWN or START Button.

- c) The STOP button will NOT stop an Inverter while drawing power and will NOT stop charging if there is current from the Charger. Loads & Charger must be OFF to allow the BMS to enter into Sleep Mode.

#### 8. Show timeout during updating,

- Download the correct firmware according to product model and save to your PC, from <http://chargery.com/update.asp>
- Update tool software version must be v1.03 or greater. Always use the most current.
- Connect BMS main unit or LCD unit to the PC by using the provided USB cable.
- Turn on BMS main unit.
- Execute update tool software and lock the com port by click OPEN button.
- Click open file button and upload the correct firmware.
- Click update button finish update.

#### 9. Charging stops, the possible reasons are as below.

- Any cell voltage reaches "Over Charge Protection(P) Voltage" setting.
- The highest cell voltage is over "Over Charge Release(R) Voltage" setting.
- Charging current is over "Over charge current" setting.
- Battery temperature is over "high temperature cutoff" setting.
- Battery temperature is under "low temp cutoff in charge" setting.
- Battery temperature difference is over "diff of battery temp" setting.
- Charger stop charging,

#### 10. Discharging stops, the possible reasons are as below.

- Any cell voltage reaches "Over discharge Protection(P) Voltage " setting
- The lowest cell voltage is under "Over discharge Release(R) Voltage" setting.
- Discharging current is over "Over discharge current" setting.
- SOC under "SOC----battery gauge" setting.
- Cell voltage difference is over "Difference(Diff) of cell voltage" setting.
- Battery temperature is over "high temperature cutoff" setting.
- Battery temperature is under "low temp cutoff in discharge" setting.
- Battery temperature difference is over "diff of battery temp" setting.
- Others

#### 11. LCD back light is always ON, the possible reasons are as below.

Within "LCD Back-light time" setting

- There are any warning events happened
- Do any operations

## Warranty and Service

Chargery Power Co., Ltd. as manufacture of power system warrants its BMS16T 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 Vendor / 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 are NOT covered by warranty.



**Charging Expert**

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