



# User Manual

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BM3000 Battery Monitoring System

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# 1. Product Overview

## 1.1. Functions

BM3000 Battery Monitoring System(BMS) is a multi-channel online-automatic battery test and monitoring system, which is a newest generation of monitoring systems based on new research on battery characteristics of battery industry and new technologies of industrial electronic monitoring equipment. And compared to the conventional DC discharge performance test system for batteries, which have the following features:

- ✓ Process by AC test technology, further effectively reveals the battery performance characteristics and aging trends;
- ✓ Much smaller discharge current, no damage on battery;
- ✓ No effect on battery pack assembling and operation environment;
- ✓ Optical isolation technology and multiple level safety protection;
- ✓ Real-Time monitoring individual block impedance, voltage, temperature and current
- ✓ Automatic inspection, maintenance-free, high speed, reliable;
- ✓ Internal resistance can be reported every day or even every hour as needed;
- ✓ Diversified event management and alarm criteria for setting;
- ✓ Detailed historical data record for maintenance analysis of the facts;
- ✓ Ethernet network management is conducive to expansion and centralized monitoring;
- ✓ Optional wireless alarms, use of cell phones and other mobile devices for maintenance;
- ✓ Designed to allow IEEE1188 best practice
- ✓ MODBUS TCP/IP Protocol for communication
- ✓ The system have been properly tested and proved by CE certification.
- ✓ Provide battery management software for measure, record and report, can display the analysis graphs.

## 1.2. Range of Application

BM3000 Battery Monitoring system can monitor the standard of 2V, 6V, 12V battery, battery capacity is up to 3000Ah, battery total voltage can reach 48V,110V,220V, 400V and etc, it meets the requirements of most users.

BM3000 Battery Monitoring System is using advanced testing technology, test internal resistance of battery each day/week, can effectively reflect the performance of battery, comply with IEEE1188 Standard recommendations, therefor especially suitable for high reliability requirements of UPS Users such as data center, telecom base station, power plant, rapid transit railway, semiconductor,medicine, bank, securities,insurance and etc.

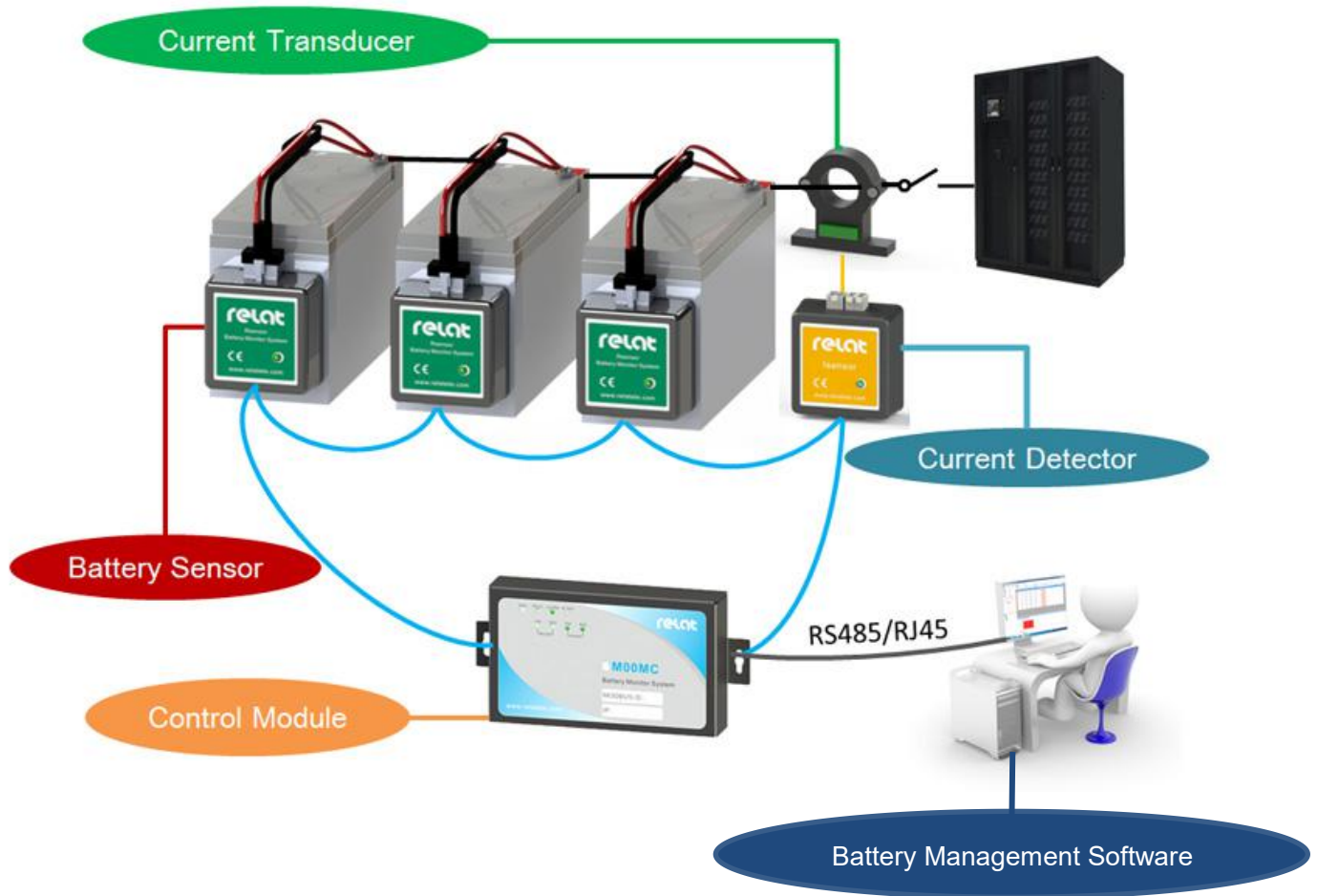
## 2. BMS System Description

BM3000 Monitoring system using modular level designed, which is easy for the installation and expansion.

BM3000 hardware composed with

- Control Module,
- Current Detector,
- Battery Sensor,
- Battery Management Software

System configuration as below:



Control Module is the brain of battery monitoring system, it management of battery sensor and current detector and process all the collecting battery data.

Battery Sensor is measuring individual battery voltage, internal resistance, temperature and transmit these data to control module via R-BUS port.

Current Detector is measuring battery string current and transmit the data to control module via R-BUS port.

Battery Management Software is installed at laptop or desktop, allows for remote viewing and data management of all connected battery monitoring systems. Report generation, graph and trending curves, detailed alarms can all be viewed on multiples of laptop or desktop on the same network.

## 2.1. General Specification

Table 1. BMS Specification List



Operating Specification	
Power Supply Range	DC12V
Power Supply Rating	Max.3.6 Watts
Operating Temperature	-5 °C to 50 °C (23°F ~ 122°F)
Operating Humidity	5% ~ 90%
General Specification	
Battery Type	VRLA,SLA,Vented and Nicad Battery
Nominal Battery Voltage	2V, 6V, 12V battery
Max. Connected Battery	254 blocks of battery
Max. Connected Strings	6 battery strings
Measurement Range	
Individual Battery Voltage	1.5V to 5V or 5V to 16V
Individual Battery Resistance	0.01mΩ to 40mΩ & 0.1mΩ to 80mΩ
Individual Battery Temperature	-10°C to 70°C (14°F ~ 158°F)
String Voltage	0 to 1500V
Ambient Temperature	-10°C to 70°C (14°F ~ 158°F)
String Current	0 to 1000A
Measuring Accuracy	
Individual Battery Voltage	± 0.2%
Individual Battery Resistance	2%
Individual Battery Temperature	±1°C
String Voltage	± 0.3%
String Current	± 1A
Ambient Temperature	±1°C

## 2.2. BMS Component List

Please check the BMS Component List below,

Table 2.BMS Component List

No.	Product Picture	Product Name	Description
1		Control Module BM00MC	Max connected with 254 block batteries and 6 battery strings.
2		Battery Sensor BM3KRS	One block battery require one R-Sensor
3		Current Detector BM00IS	One string batteries require one I-Sensor
4		Current Transducer 100A – 1000A	One string batteries require one current transducer
5		Battery Cable with temperature probe	Accessory of R-Sensor
6		R-bus Communication Cable	Accessory of R-Sensor and I-Sensor
7		Communication Cable of Current Transducer	Accessory of Current Transducer
8		Power Cable for Control Module	Accessory of BM00MC
9		Power Cable of I-Sensor	Accessory of I-Sensor

10		Kelvin Washer	One block battery require 2 PCS Kelvin Washer
11		RJ11 Connector	Fixed length of Telephone cable with RJ11 connector.

### 2.3. Control Module(BM00MC)

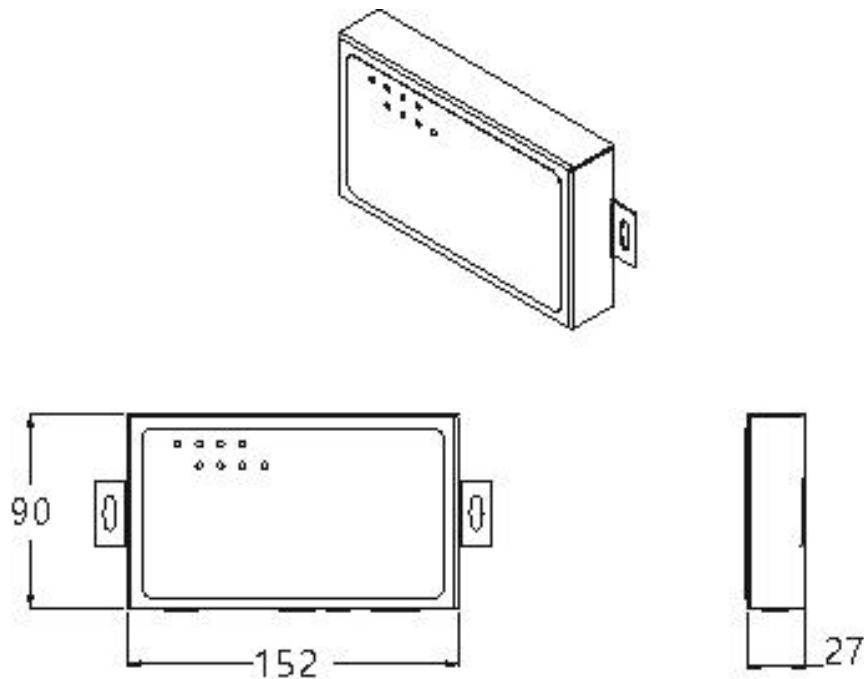
Control Module (BM00MC) is the core component of battery monitoring, allowed to wall mounting.

- Designed to receive transmitted signals from the Battery Sensor and Current Detector.
- Continuously monitors, analyzes, and uploads battery measurements to BMS software
- Provides RS-485 or Ethernet communication for remote monitoring.

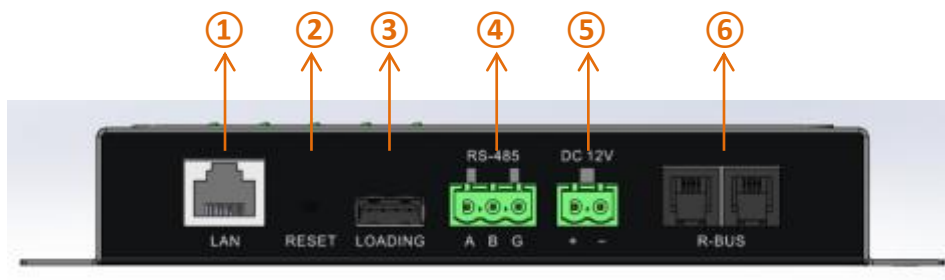
Table 3. Control Module (BM00MC) Specifications

Model	BM00MC
Operating Temperature	-5°C to 50 °C (23°F ~ 122°F)
Relative Humidity	5% ~ 90%
Operating Voltage	DC 12V±10%
Power Consumption	3.6 Watt
Communication Ports	Ethernet x 1 RS-485 x 2
Reserved Interface	USB x 1 (Loading firmware)
Monitoring Nodes/Battery	Maximum 254 nodes of batteries and 6 battery strings
Communication Protocol	Modbus
Dimensions (H x W x D)	90*152*27mm(3.54''x5.98''x1.06'')
Weight	420 g

Dimensional Drawing as below,



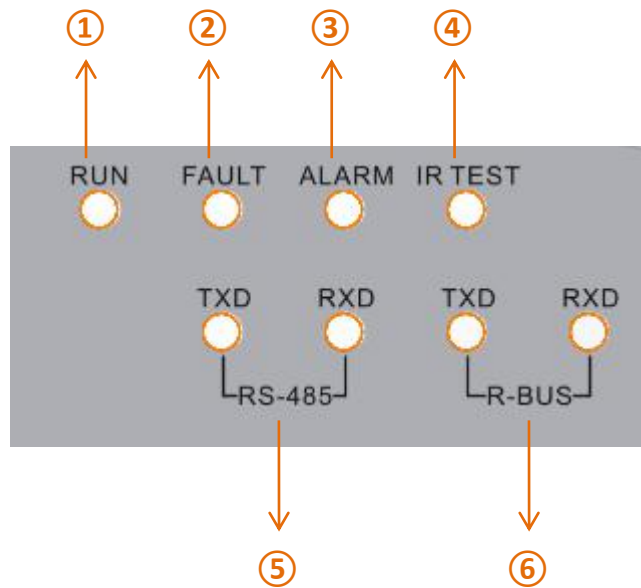
Interface Description



- ① **LAN** : Ethernet interface connect to computer or network switch, allow for web configuration or connecting to SCADA software via Modbus TCP. (Baud rate is 9600)
- ② **RESET**: Long press 5 seconds to reset the device IP address to 192.168.1.100
- ③ **Loading**: loading the firmware
- ④ **RS485**: RS485 interface connect with monitoring software, uploading battery data. (Baud rate is 9600)
- ⑤ **DC12 V Input**: DC12v Power Supply input
- ⑥ **Dual R-Bus Port** : Connect with R-sensors and I-Sensors in a link loop communication



LED Description



- ① **RUN:** If BM00MC control module is power on, the green light should be on.
- ② **FAULT:** Hardware detection indicator, if there’s any fault component, the red light should be on.
- ③ **ALARM:** Alarm indicator, if there’s any alarms, the red light should be on.
- ④ **IR TEST:** If the system is measuring the battery internal resistance, the blue light should be on. IR is short for internal resistance.
- ⑤ **RS485:** Communication indicator, the green blinking light should be on when there’s RS485 communication. The right LED is RXD means received data, left LED is TXD means transmit data.
- ⑥ **RBUS:** When control module is communicated with R-Sensors and I-Sensors, the green light should be on and blink. The right LED is RXD means received data, left LED is TXD means transmit data.

## 2.4. Battery Sensor(R-Sensor) BM3KRS

Battery sensor(R-Sensor) BM3KRS can measure the battery cell voltage, temperature and internal resistance, and transmit the measurement to the Control Module for analysis and storage.



Table 4. Battery Sensor BM3KRS Specifications

Model	BM3KRS-LV	BM3KRS-HV
Cell Voltage	2V/3.7V	6V/12V
Cell Voltage Measurement Range	1.5 - 5V	5 - 16V
Accuracy	±0.2% Full Scale	
Internal Resistance Measurement Range	0.01 - 40mΩ	0.1 - 80mΩ
Internal Resistance Repeat Accuracy	±2%	
Temperature Measurement Range	-10 - 70°C	
Accuracy	± 1 °C	
Operating Temperature	0 - 50°C	
Humidity	≤ 95%	
Power Consumption	< 0.4 W	
Isolation Characteristic	Input /Output > 4kV	
Communication Interface	RJ10	
Communication Protocol	R-bus	
Dimensions (H x W x D)	60x59x28mm	
Weight	50g	

Description,



- ① **Battery Cable Plug:** Place in battery cable and connect to battery positive and negative pole
- ② **RBUS Port:** Place in RBUS cable and connect to neighbouring sensors for communication
- ③ **RBUS Port:** Place in RBUS cable and connect to neighbouring sensors for communication
- ④ **Led indicator:** Run is Green, Alarm is Red.

## 2.5. Current Detector (I-Sensor) BM00IS

The Current Detector(I-Sensor) BM00IS could be connected to a current transformer to measure the battery string current, and transmit the data transmit the measurement to the Control Module for analysis and storage.

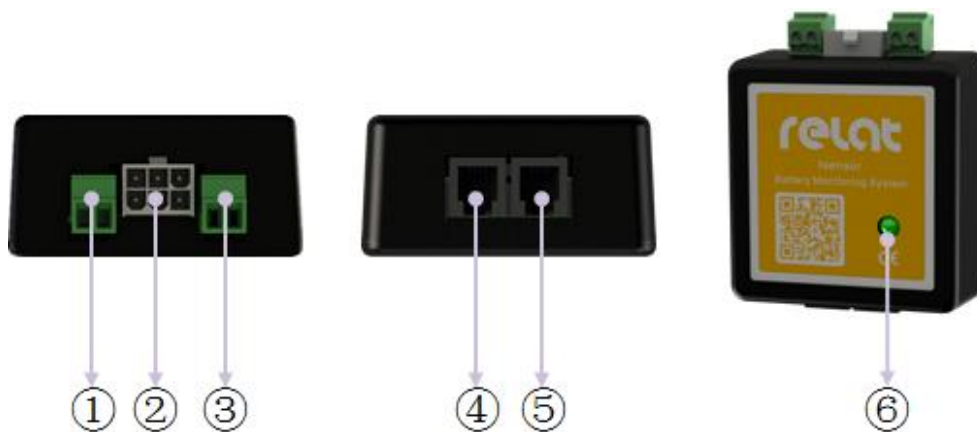


Table 5. Current Detector BM00IS Specifications

<b>Model</b>	<b>IS-100/200/300/400/1000</b>
<b>Current Measurement Range*</b>	0~100/200/300/400/1000A
<b>Accuracy</b>	±1% Full Scale
<b>Operating Temperature</b>	0-50°C
<b>Humidity</b>	≤ 95%
<b>Power Supply</b>	DC 24/48V
<b>Power Consumption</b>	< 1.6 W
<b>Communication Interface</b>	RJ10
<b>Communication Protocol</b>	R-bus
<b>Dimensions (H x W x D)</b>	60x59x28mm
<b>Weight</b>	56g

\*The current measurement range depend on the current transformer.

### Description,



- ① **DC12V Power Supply:** DC24 V power supply from controller or other current detector
- ② **CT Port:** Place in communication cable and connect to current transducer
- ③ **RBUS Port:** Place in RBUS cable and connect to neighbouring sensors for communication
- ④ **RBUS Port:** Place in RBUS cable and connect to neighbouring sensors for communication
- ⑤ **Led indicator:** Run is Blinking Green

## 3. Preparation for Installation

### 3.1. Preparation Work

Installation drawing and BMS layout should be completed before installation, all anticipating technician should familiar with all the installation procedure, make sure all component mounting position and the wiring methods. All the installation process should follow with the installation guide.

### 3.2. Resource from Client






Kindly check and confirm the following resource is ready,











- a. AC 100V/110V/220V/230V input power supply
- b. Assign the IP address for each set of control module
- c. Confirm the panel box of control module mounting position

### 3.3. Required Tools & Accessories

All required tools & accessories should be ready before installation.

Kindly find the tool list below,

Item	Tool	Picture	Description
1	Ratchet wrench		Loose or tight the battery terminal bolts and nuts, insulating treatment
2	Electric screwdriver		Loose or tight the battery terminal bolts and nuts, insulating treatment
3	Adjustable wrench		Mounting the panel box, insulating treatment
4	Multimeter		Measure voltage, current, and resistance. After MC annual verification.
5	Network cable tester		Verify the electrical connections in a RJ45/RJ11 network cable

6	Internal resistance tester		Measure battery internal resistance. After MC annual verification.
7	Current clamp		Measure the current, and check the UPS status. After MC annual verification.
8	Electrical outlets		Access AC power for installation jobs
9	Laptop		Testing and Commission
10	Diagonal pliers		Cutting wire
11	Needle-nose pliers		Used to bend, re-position and snip wire
12	Wire stripper		Used to strip the electrical insulation from electric wires.
13	Crimping Tool		Makes crimping RJ45/RJ11 network cables
14	Slot Head/Cross Head Screwdriver		Settle the control module,current transformer
15	AC Electric Voltage Detector		Electrical testing

Kindly find the accessory list below,

Item	Accessory	Description
1	RJ45/RJ11 Connector	Makes communication cable (Relat Supply)
2	2 pair/4 core telephone cable	Long communication cable between the control module and sensors.(Relat Supply)
3	Nylon cable tie	Tie the cable
4	Cable trunking	Cable wiring
5	Label for battery	Identify the number to all the battery (Relat Supply)
6	Insulating tape	Used to insulate electrical wires/battery terminal
7	Clean Rag	Clean battery surface and the battery rack

### 3.4. Checking the Product Package

Step 1, Appearance Inspection

Open the package, please check and confirm all the inner & outer packages and the components are intact, confirmed all packages are no damage, moisture and deformation.

Step 2, Quantity Inspection

Please check and confirm the quantity of the equipment, cables and accessories if in conformity with the product list!

### 3.5. Quick Installation Guide

Step 1, Cut off all the battery breaker from the battery bank to the UPS

Step 2, Cut off and segment the batteries connected in serial

Step 3, Stick all the battery labels on visible place of each cell/block

Step 4, Mounted all kelvin washers in accordance with specification

Step 5, Mounted all battery cable and make sure all red wires are post in positive terminal and blacks post in negative.

Step 6, Positioned all R-Sensors in accordance with specification

Step 7, Positioned all CT and I-Sensors in accordance with specification

Step 8, Mounted the communication cable from CT to I-Sensors and mounted their power cable in serial.

Step 9, Wall/Rack mounted all control module and the power supply in accordance with specification

Step 10, Mounted all fixed length communication cable to all R-Sensors and I-Sensors and connecting in serial.

Step 11, Handed make and mounted the fittest long distance communication cable from sensors to the control module

Step 12, Handed make and mounted the fittest long distance communication cable from different tier of the battery rack.

Step 13, Power on the Control module and inquiry and verify the reading of block voltage and temperature if correct.

Step 14, Manual performance An Internal Resistance Test and verify the reading of block impedance if correct.

Step 15, Revised the impedance high limit(the impedance reading plus 1.5 times )

Step 16, Save the Impedance Reference.

Step 17, Connected RJ45 cable from the control module to the Laptop computer and install the BMS Software.

## 4.Safety Information

Batteries are potentially dangerous, and proper precautions must be observed in handling and maintenance of batteries and monitoring systems. Maintenance shall be done only by personnel with knowledge of batteries and the monitoring system and trained in the safety precautions involved. Properly insulated tools and adequate personal protective equipment should be used when working with batteries.

The following precautions shall be observed when installing or servicing a battery:

- a) Prohibit smoking and open flames in the immediate vicinity of the battery.
- b) Avoid wearing metallic objects, such as jewelry.
- c) Keep the top of the battery clear of tools and other foreign objects.
- d) Provide unobstructed egress from the battery area.
- e) Verify that the battery area and/or cabinet ventilation is operable.
- f) Neutralize static buildup just before working on the battery by having personnel contact the nearest effectively grounded surface.

It is recommended that a battery disconnection means be used to isolate a battery from the system. If a battery disconnect is not provided, use extreme caution when removing the battery from the system. The entire string voltage will appear across any two open points when the string is disconnected from the system. Arcing will occur when the circuit is opened or closed if the charger/rectifier is not capable of supporting the existing loads. This also will occur if the battery voltage and the system voltage are not properly matched prior to the opening or closing action. For example, if the terminals are opened at the individual cell level while the string is connected to a load, lethal voltages may be present across the open circuit that is created by removing one side of the connection. Specialized training is required to perform work on live battery systems



**Electrical Hazard:** Risk of electric shock: battery cabinets contain potentially lethal voltages!  
A short-circuit can result in injury or death. Do not work alone.



**Caution:** Only qualified personnel, trained in battery operation and safety, may install the harnesses. Keep unauthorized personnel away from the batteries.



## 5. Installation Guide

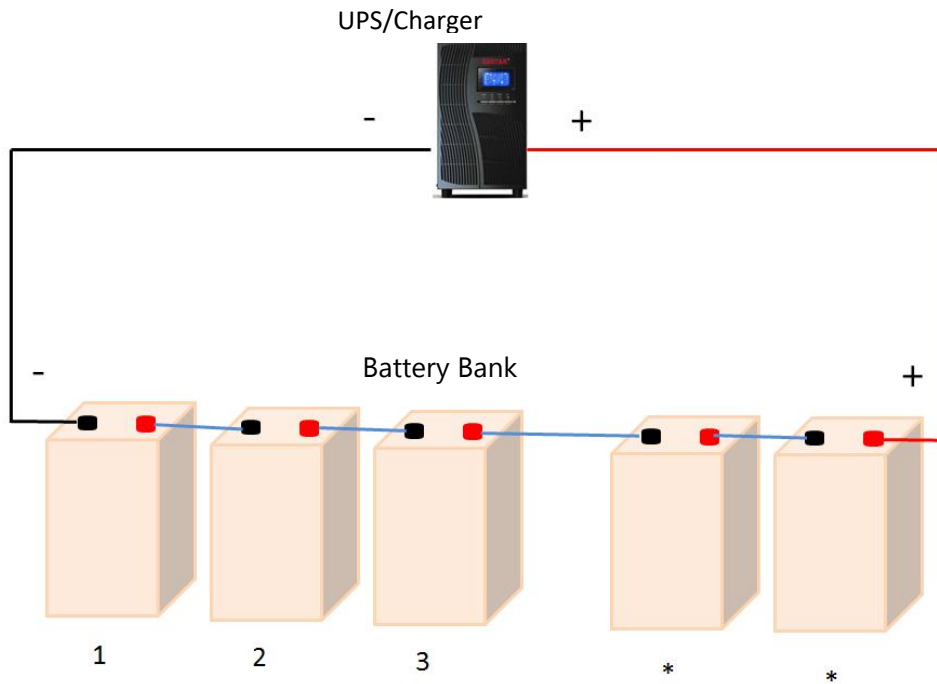
### 5.1. Personal Protective Equipment (PPE) requirements

The following personal protective equipment shall be available to personnel who perform battery maintenance work: goggles and face shields, acid-resistant gloves, protective aprons, portable or stationary water facilities for rinsing eyes and skin in case of contact with electrolyte, class C fire extinguisher, acid or alkaline neutralizer, and adequately insulated tools. Personnel shall wear protective equipment suitable for the voltage of the battery when installing or servicing a battery.



## 5.2. Step 1: Determine battery numbers

Designate a battery number for each battery in the system. Before connecting the Battery Sensor BM3KRS to the batteries, the batteries should be numbered and labeled correctly by using a label to paste on the surface of the battery where the labels are easy to be seen. The first battery, or, battery NO.1 must be the first one on the string negative terminal, the NO.2 is the battery following the NO.1 battery, and so on. The last battery is the one attached closest to the string positive terminal. The batteries should be numbered in accordance with this method.



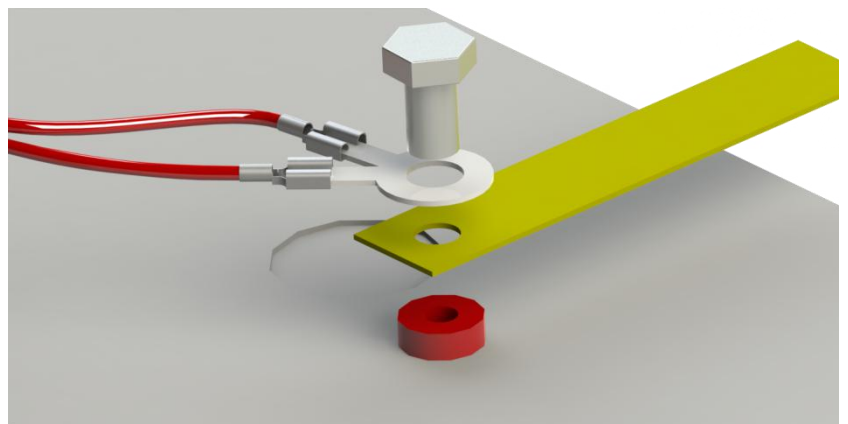
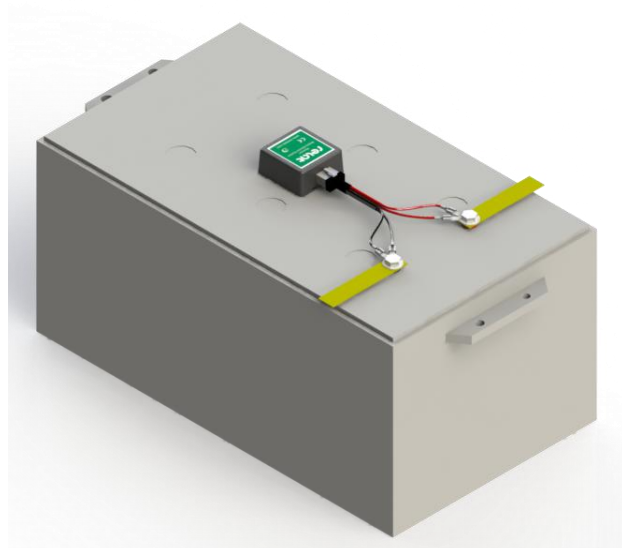
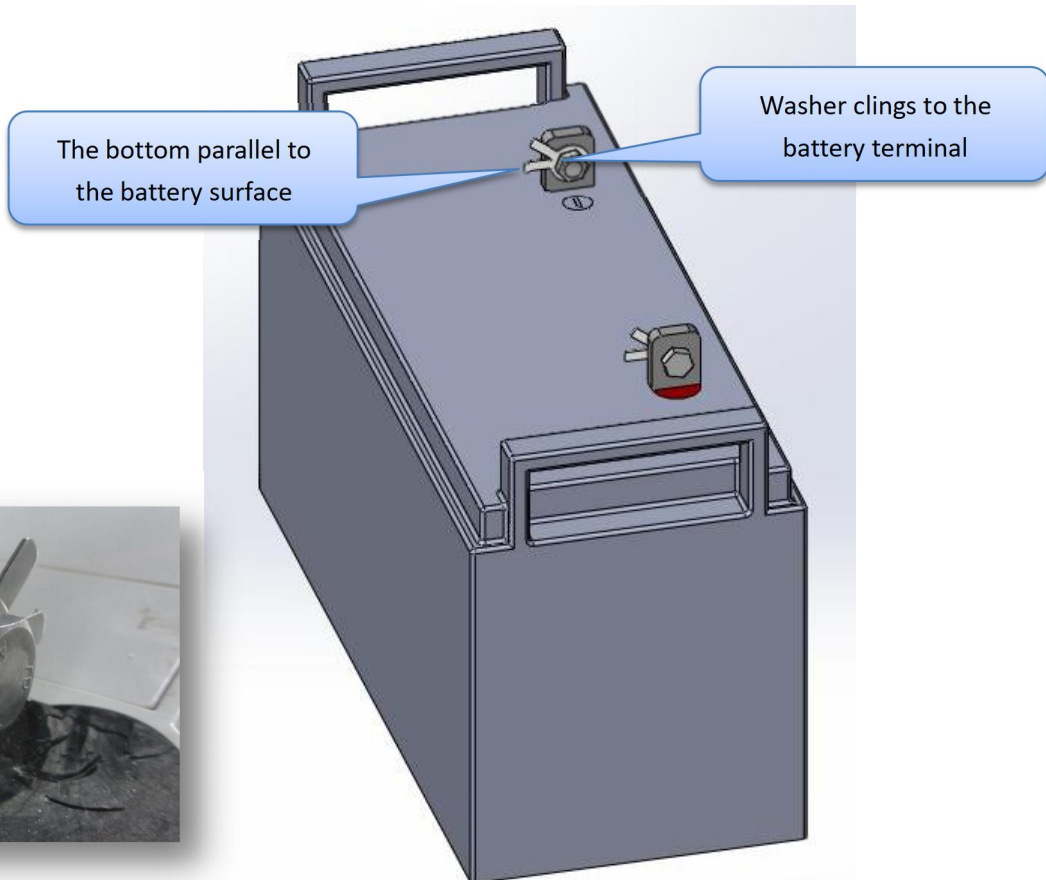
### 5.3. Step 2: Install the Kelvin washers



**Electrical Hazard:** A short-circuit can result in injury or death. Do not work alone.

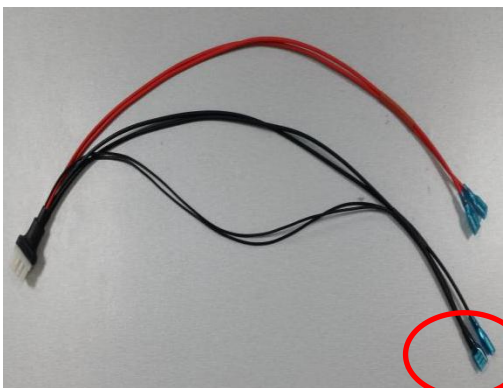
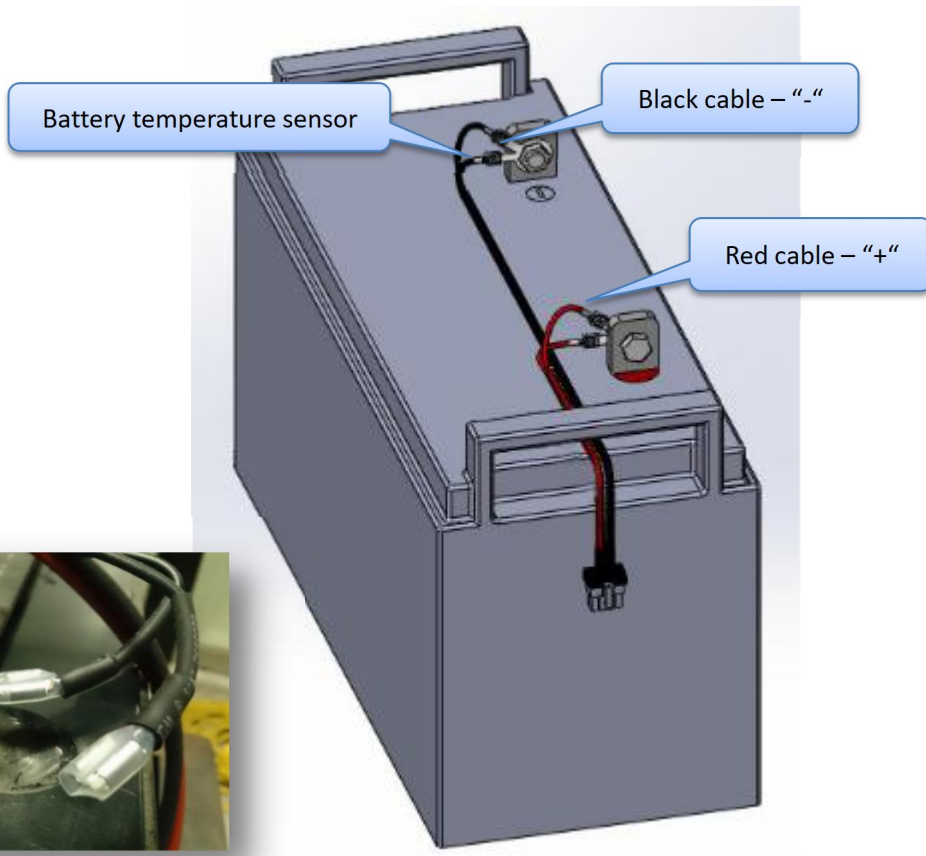
Perform a battery disconnection from the UPS system. Use Multimeter measures and confirms there's no voltage difference between battery and battery rack.

- 1) Remove the bolt from a battery;
- 2) Place the Kelvin Washer above the existing battery connection, behind the hex-head of the bolt.
- 3) Replace the bolt in the battery, and adjust its torque according to the specifications of the battery manufacturer.



### 5.4. Step 3: Connect the battery cables

- 1) Use an insulated pair of pliers (**Important: Do not use your bare hands!**) to slide the receptor end of each cable over the tab portion on the washers that you installed on the positive and negative terminals of each battery.
- 2) Remove the backing from the adhesive patches on the temperature sensor then position and mount it onto the top or side of the battery block (**Important: Make sure the surface is clean!**).





### 5.5. Step 4: Install battery sensor BM3KRS



- 1) Find the correct ID of Battery Sensor BM3KRS according to the battery number, then insert the 8 pin connector on battery cable to BM3KRS.



- 2) Place a horizontal reference line to make the sensors look neat.

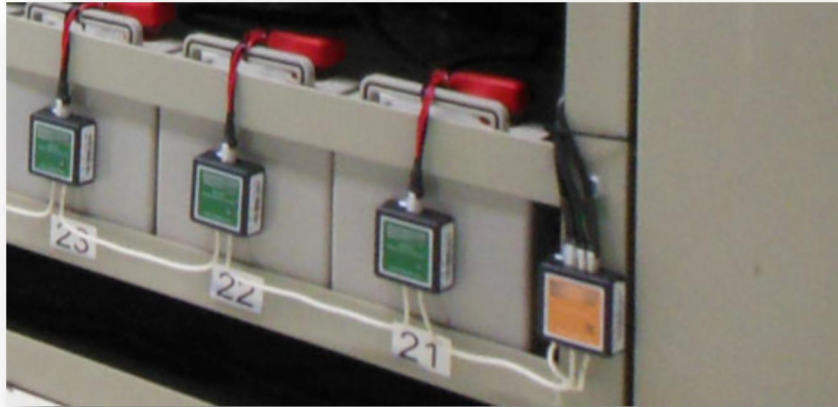


- 3) Remove the backing from the adhesive patches on the battery sensor then position and mount it onto the top or side of the battery block (**Important: Make sure the surface is clean!**).

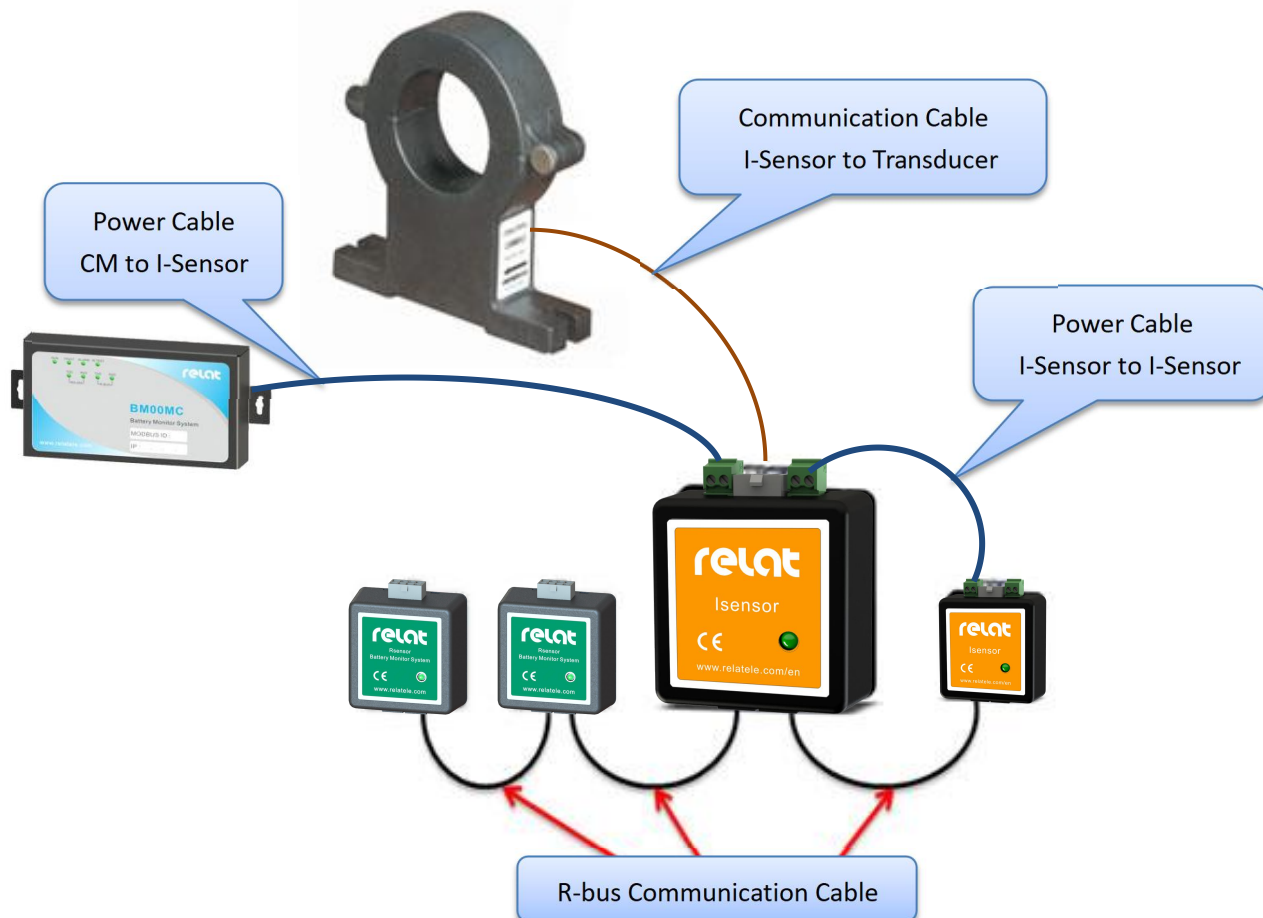


### 5.6. Step 5: Install Current Detector BM00IS

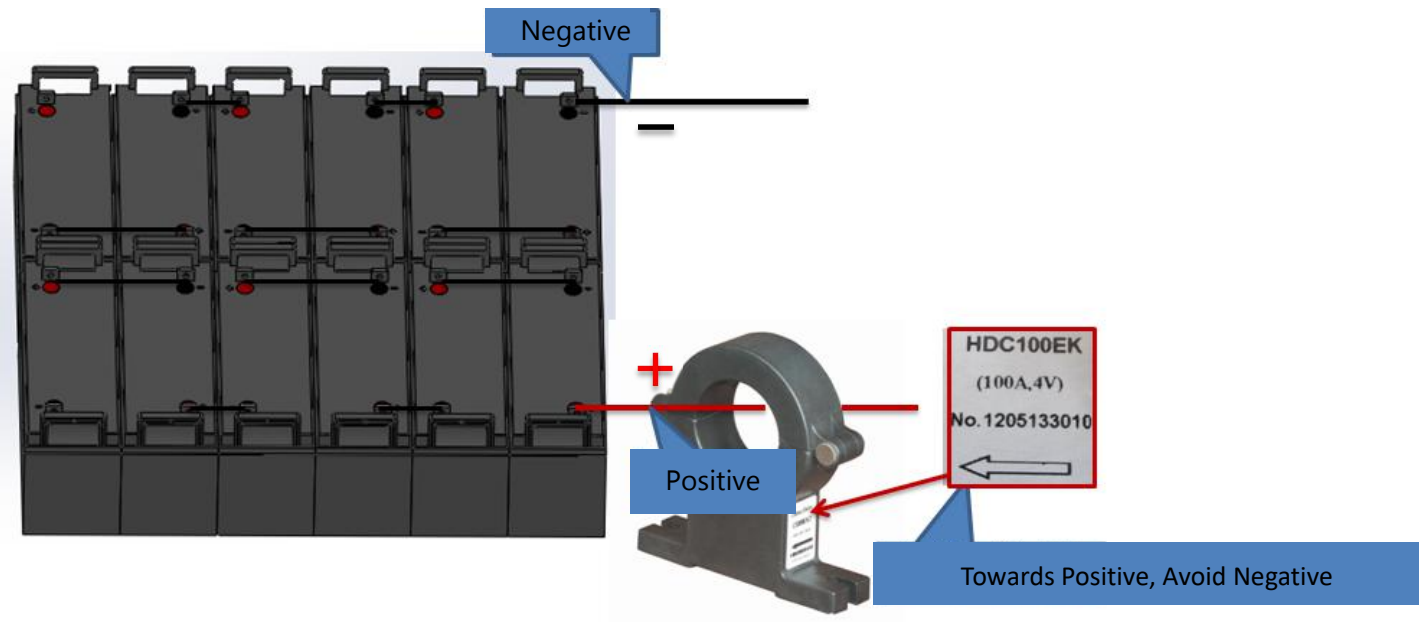
Remove the backing from the adhesive patches on the I-Sensor then position and mount it onto the top or side of the battery block, or on the battery rack (**Important: Make sure the surface is clean!**).



Connect all the cables as below.



Make sure the current transformer is in correct direction.



### 5.7. Step 6: Connect R-bus communication cable

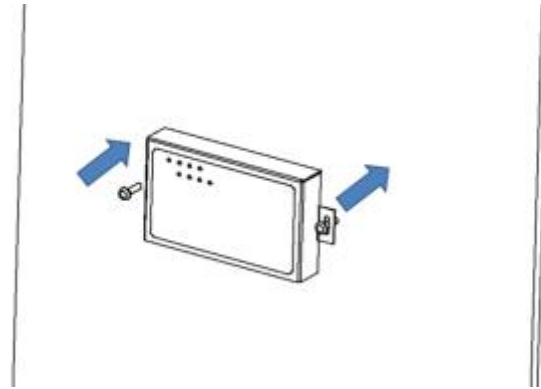
Connect all R-bus communication cables of battery sensor BM3KRS and BM00IS.



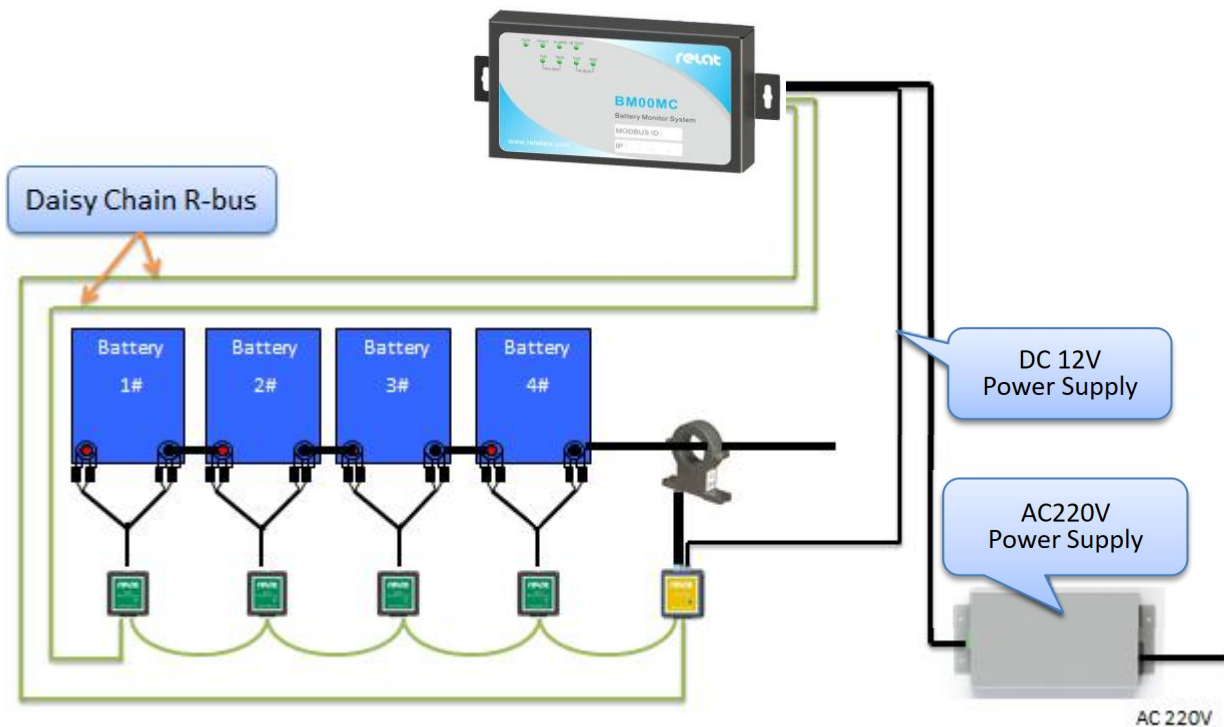


### 5.8. Step 7: Install Control Module

Wall Mount the Control Module or Mounting at the battery rack as below picture.



Connect all the cables to the Control Module BM00MC as following.



Control Module BM00MC have 2 RBUS Ports, Max. Connect with 508 PCS battery sensors.  
 Each R-BUS port of BM00MC is Max. Connect 254 PCS of battery sensor  
 Please connect the battery sensor and current detector to RBUS-1 Port  
 The remaining battery sensor and current detector are connected to RUB-2 Port

Till now, all the installations is complete. Check all the connections of battery sensor, I-Sensor and Control Module, to make sure all are correct, especially the positive and negative terminal of batteries and power, before power on them.

## 6. Configuration Tool

The configuration tool will be more easier for user to revise the system configuration and alarm setting. It's allowed to connect the configuration tool via serial port Or Ethernet port.

Please confirm the serial port is in normal use. If you know the network address and port number of the control module BM00MC, you can also use network cable to remote configuration.

### 6.1. Reset IP

Normally, the network configuration of control module BM00MC has been default setting as below.

IP Address	192.168.001.100
Gateway	192.168.001.001
Modbus	01

Long press 5 seconds of the RESET Button which is at the side of control module BM00MC, the IP address of control module will restore default setting.

### 6.2. Cable Connection

There have 2 ways connect the control module for configuration, kindly select one way to connection.

1. Serial Port Connection, please use an RS232 to RS485 Converter as below picture, and use RS232 to USB cable connect from control module to the computer.

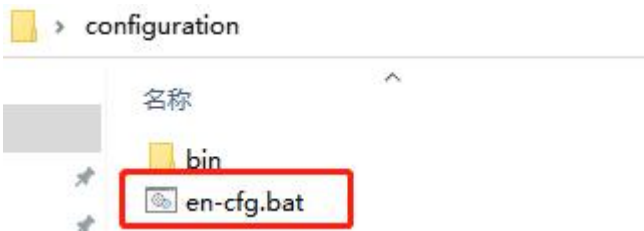


2. Ethernet Port Connection, please use the Ethernet cable connect from control module BM00MC to the computer. Please confirm the IP address of control module and the computer are in the same local area network.

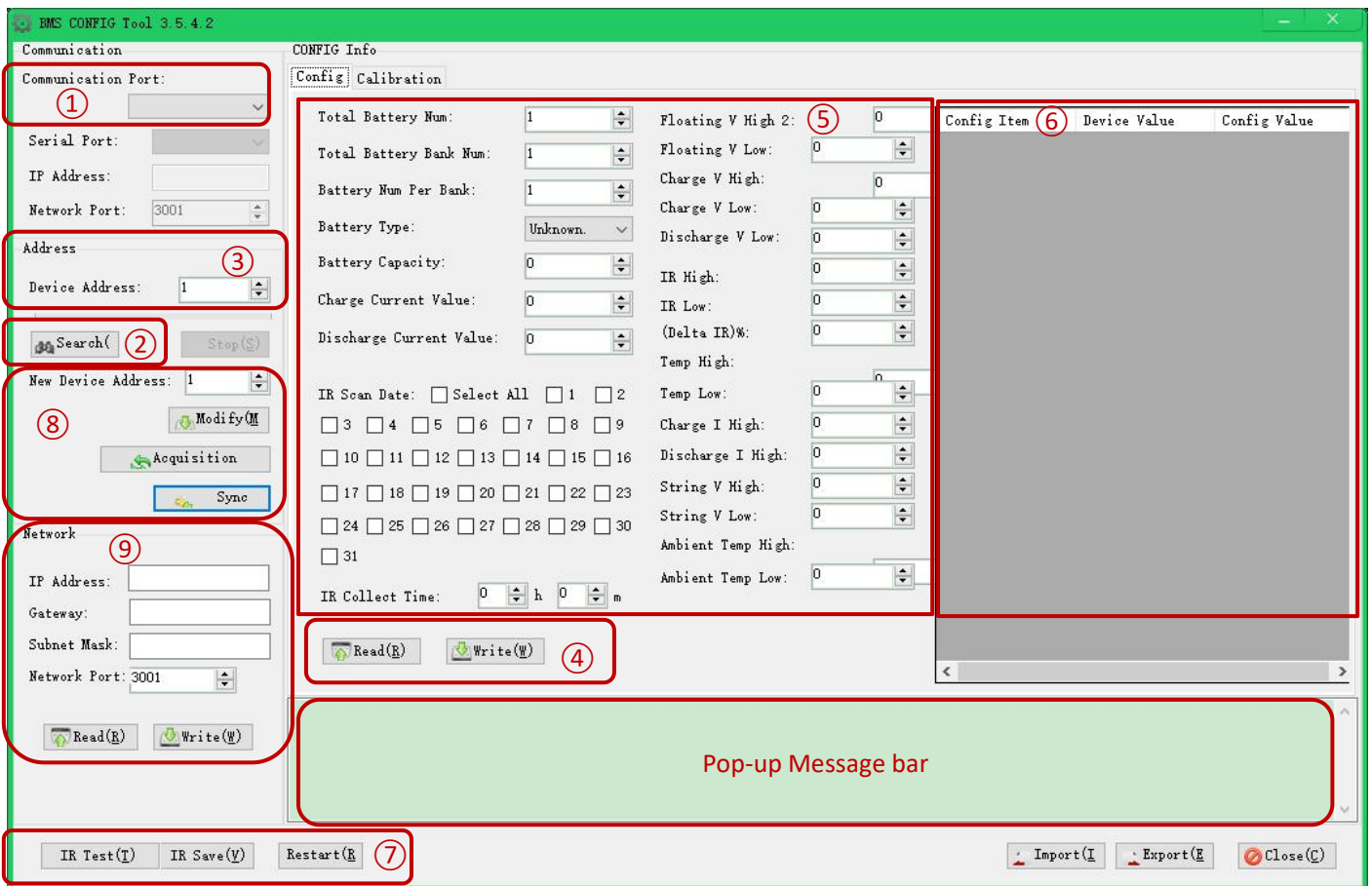
When finish connection, please power on the control module, the power supply of BM00MC is DC12V.

### 6.3. Configuration

Please unzip the folder and open the configuration file, and double click en-cfg.bat



It will go into the configuration page as below picture



① Please select the communication port, if use the serial port connection, please select 'serial port' and select the relevant serial port, if use the Ethernet port connection, please select 'Network', input the IP address and the network port number

② Please click 'Search' to find the control module, the search result will Pop-up in Message bar. If the Message bar shown, "No device address was found" or "Failed to initialize the network address", etc., please check the cable connection of the control module and check the control module if power on.

③ If found the control module, the device address will display Modbus ID of control module

④ Click 'Read' to get the original setting of the control module

⑤ **Alarm Setting:**

**Floating V High 2:** the high limit of individual battery floating voltage

**Floating V Low:** the low limit of individual battery floating voltage

**Charge V High:** the high limit of individual battery charge voltage

**Charge V Low:** the low limit of individual battery charge voltage

**Discharge V Low:** the low limit of battery discharge voltage

**IR High:** the high limit of internal resistance

**IR Low:** the low limit of internal resistance

**(Delta IR)%:** the change rate of the original internal resistance valve

**Temp High:** the high limit of individual battery temperature

**Temp Low:** the low limit of individual battery temperature

**Charge I High:** the high limit of charge current

**Discharge I High:** the high limit of discharge current

**String V High:** the high limit of string voltage

**String V Low:** the low limit of string voltage

**Ambient Temp High:** the high limit of ambient temperature

**Ambient Temp Low:** the low limit of ambient temperature

If you need to revise original setting, please input the new values and click 'Write', the setting will be revised.

⑥ Compare all the settings between device valve and config valve, the different setting items will be shown as red color in the List, then press button "Write" and save all settings to device valve. If you just need to change some of items, select the items in Configuration List and click right, select "Write The Select Data", then the select item will be saved and the others remain unchanged.

⑦ Manual IR Test, the first time running the system, please click 'IR Test' to gain all battery original internal resistance values, and Click 'IR Save' to store all these original internal resistance values

⑧ Revise Device Address (Modbus ID of control module). If you need to revise the device address, please input the new device address and click Modify, the device address will be revised.

Click 'Acquisition' will acquisition time of control module,

Click 'Sync' the time of control module will synchronize time with the computer clock

⑨ Network Configuration, Click 'Read' will get the network configuration of the control module.

If you need to revise the network configuration, please input the new IP, Gateway, Subnet Mask and Network Port, click 'Write', the network configuration will be revised. If the cable connection is via Ethernet Port, please restart the control module, and use the new IP address reconnection to the configuration tool.

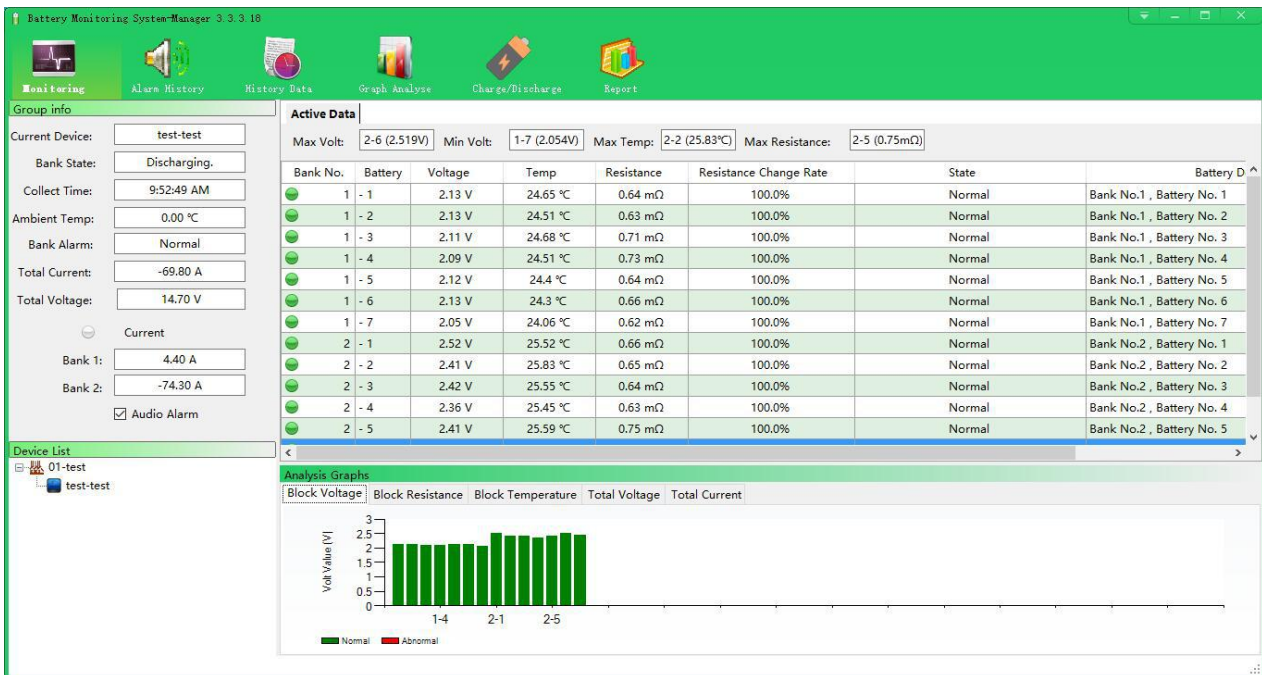
## 6.4. Alarm Setting List

The alarm setting should be based on your battery manufacturer, we submit some alarm setting by our side for reference

Alarm Type \ Block Voltage	2 V	6 V	12 V
Discharge Voltage Low Limit	1850 mv	5550 mv	11100 mv
Float 1 Voltage High Limit	2350 mv	7050 mv	14100 mv
Float 2 Voltage High Limit	2350 mv	7050 mv	14100 mv
Float Voltage Low Limit	2150 mv	6450 mv	12900 mv
Charge Voltage High Limit	2350 mv	7050 mv	14100 mv
Charge Voltage Low Limit	1850 mv	5550 mv	11100 mv
(Delta $\Omega$ )%	200%	200%	200%
Temp H	45 °C	45 °C	45 °C

## 7. Battery Management Software

BM3000 BMS comes complete with Battery Management Software package which allows all battery systems to be monitored 7 x 24 hours via a remote computer. It allows for remote viewing and data management of all connected battery monitoring systems. Report generation, trending analysis, & detailed alarming can all be viewed on a single or multiple PC's on the same network.

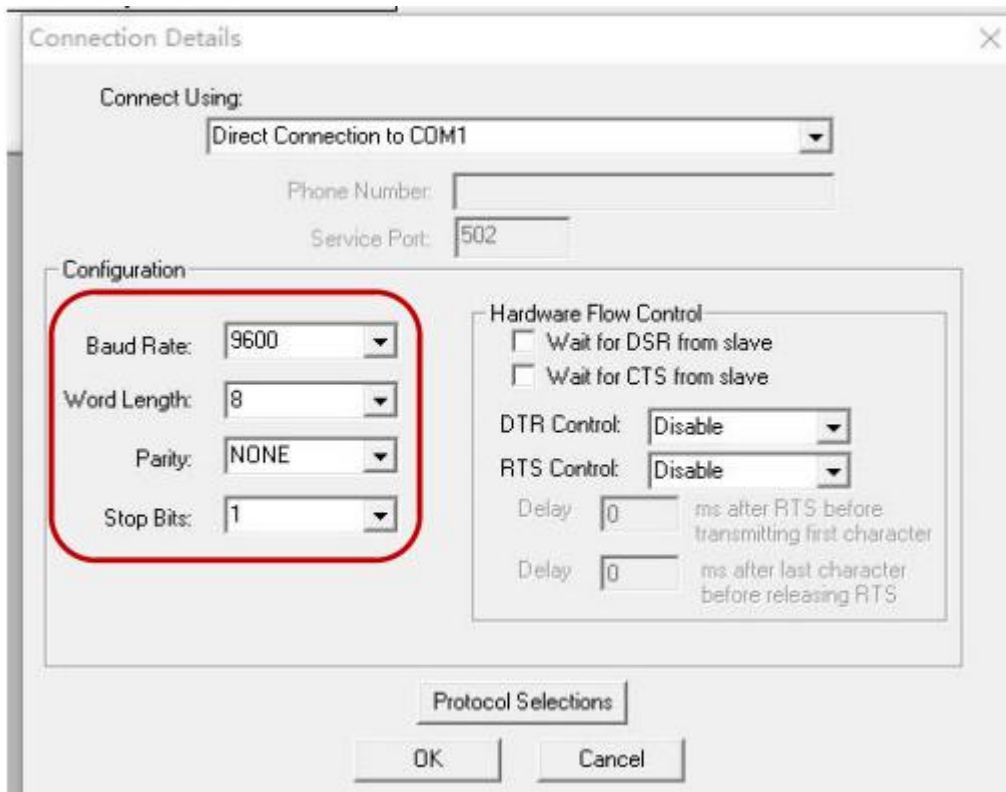


## 8. Integrated to the 3rd party software

### 8.1. RS485 Port

Control module have RS232/RS485 Port, it support MODBUS RTU Protocol, it's able to use RS485 port to integrated to the 3rd party software, please find our Modbus Register Map for reference.

If connect Using direct connection to COM 1, please configuration the info the same with the red box below.

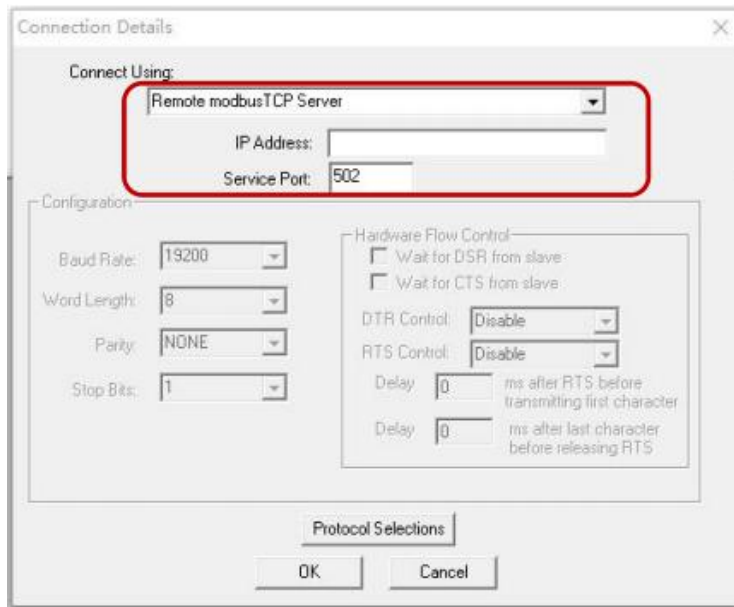




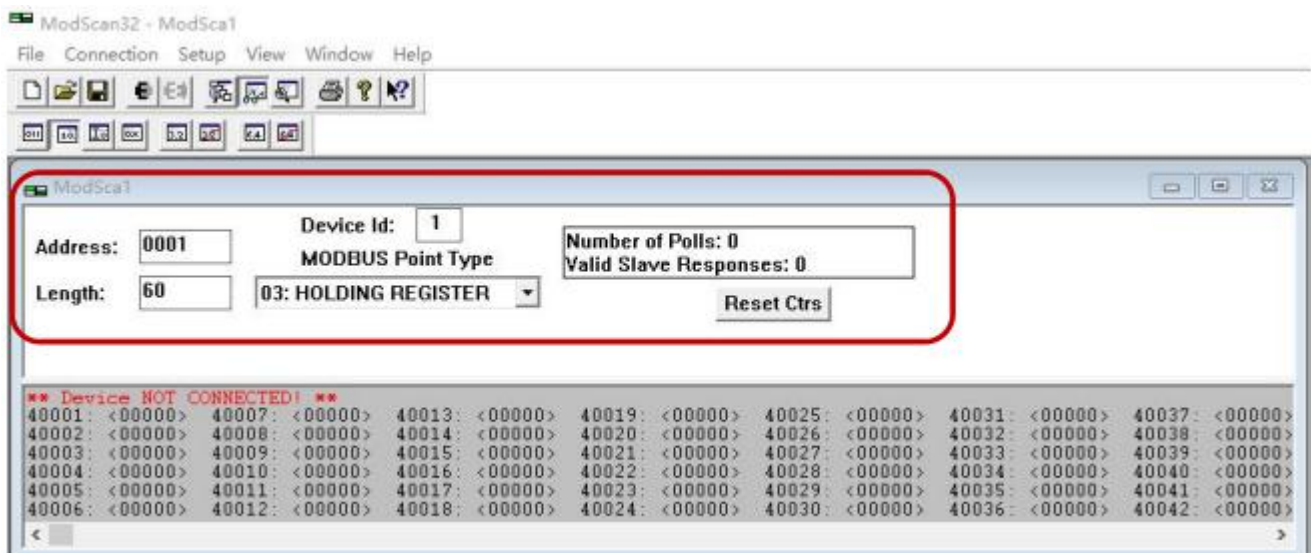
## 8.2. Ethernet Port

Control module have Ethernet Port, it support MODBUS TCP/IP Protocol, it's able to use Ethernet port to integrated to the 3rd party software, please find our Modbus Register Map for reference.

If connect Using direct connection to Ethernet port, please select 'Remote Modbus TCP Server' from the Modscan tool. please confirm the IP address and Service Port are same with the Control Module.



If it's success to get Modbus TCP connection from control module, please set as below to polling the measurement data.



<The End>