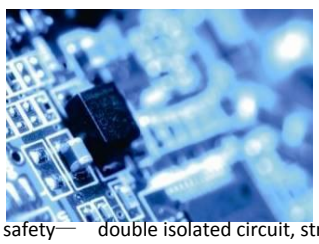
Outstanding Advantages of EV-FT-11

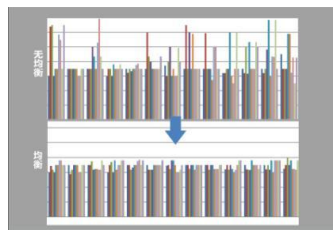
- High precision —adopt special Vmin-EKF algorithm (most accurate SOC evaluation algorithm in the Worldwide); accuracy of SOC evaluation is more than 95%, which is leading in the worldwide.

- High accuracy—based on special D-Filter algorithm high-accuracy collection system, all collection errors of system parameter (such as single cell voltage) are within 0.2%; temperature collecting error ±1 (-20～85 ℃), current collecting error ±1A.

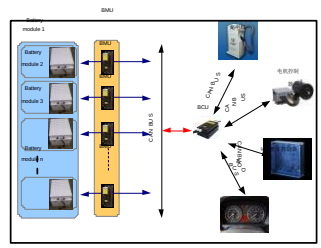


- High safety— double isolated circuit, strong current Safety, electromagnetic compatibility design and Multiple active protection technologies (comprehensive safety management and control system).

- High effective balance — application of leading High-frequency switch circuit and temperature Protection technology (battery intelligent balance Technology) can control the balance of multiple Batteries at the same time with total balance current of 1A and ensures stable and reliable balance circuit Through multiple protections, such as temperature Monitoring and invalid balance and so on.



- Strong reliability — innovative and optimized structure Design; the system circuit adopts high-redundancy design and support two kinds of mode for charge and discharge: CAN bus and high voltage relay; the reliable operation of system is ensured through EMC test, high/low temperature aging, water/dust proof-ness and vibration test and so on; adoption of multiple power isolation programs has significantly improved the reliability of system collection and communication.



- CAN bus communication intelligently interact with complete vehicle controller/motor controller. Instrument and charger through multiple isolated CAN bus to realize the effective sharing of all information.

- Insulation monitoring — the insulation detection module can effectively detect the insulation status of electric vehicles to realize the real-time display of insulation fault class and ensure personal safety.

- Real-time display — communicate with upper computer Or display screen through RS485/CAN interface to realize the real-time display of information as voltage, Temperature, SOC and fault and so on of battery pack.

- Strong current control— design strong current control system and battery-string management unit independently to realize the effective isolation of strong and weak current, avoid crosstalk and improve the performance of anti-electromagnetic interference, ensuring the safe and reliable running of system.

- System POST — the system self tests its voltage, temperature, communication, display and other functions after power on to ensure the normal operation of system itself.

- Heat management with high resolution— the system has multiple temperature management strategies, Such as temperature difference management and high/low temperature limit management and so on, and double management of cooling and heating, which ensures that system can operate within comfortable temperature section and prevents extreme events as battery self-ignition and so on.

- High-capacity data storage — support data storage capacity of 8G; can record all performance parameters of power battery and fault events of battery pack for long time; users can import data into computer quickly for later analysis through USB interface.

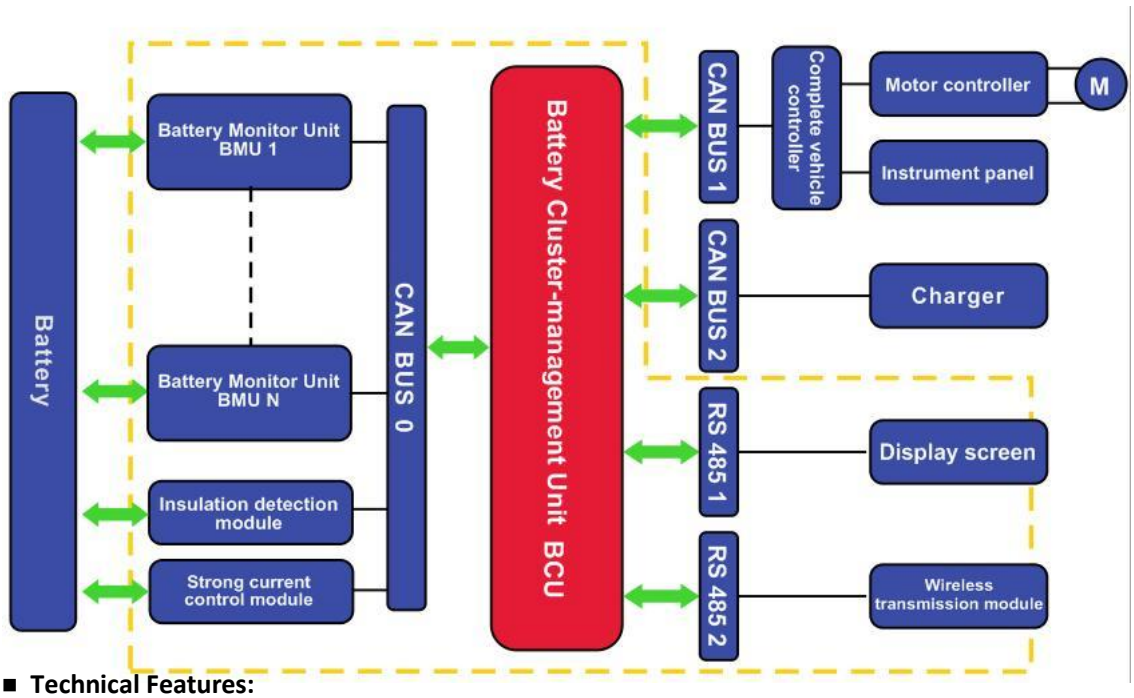
- Remote management interface — the system is equipped with distance-wireless transmission unit (DTU) interface, which can be used to exchange data with remote monitoring center: upload battery voltage, SOC, temperature, fault state and other data.

Typical Application of EV-FT-11

By virtue of strong expandability, EV-FT-11 has been established with the product line for five main series and ten types, from household electric car to electric bus and from hybrid vehicle to pure electric vehicle to meet various all-around demands of different customers.

■ Electric vehicle BMS

In electric vehicles, BMS is an important component of electric control system of complete vehicle, which communicates with complete vehicle controller; intelligent charger and instrument through CAN bus, realizing safe, reliable and effective management of battery system. The complete vehicle controller reads BMS data through CAN bus, controls motor through intelligent motor controller displays data on instrument panel and communicates with intelligent charger through BMS to realize intelligent charging control. The BMS anti-interference performance is very important for hybrid and pure electric bus. The strong electromagnetic interference will influence the normal operation of BMS. In order to solve the problem fundamentally, EV-FT-11. BMS adopts the design of multiple electromagnetic compatibilities and isolations, which has effectively shielded the electromagnetic interference and maintained the normal operation of system. The automotive class processor chip, automotive class CAN bus and high redundancy circuit has improved the safety, stability and reliability of system remarkably. The typical electric vehicle BMS is mainly composed of one Battery cluster-management unit (BCU), several (5-10) battery monitoring units (BMC) and one insulation detection module (LDM).



■ Technical Features:

◆ High level of insulation and voltage-withstand the level of insulation and voltage-withstand of EV-FT-11 can reach to the super insulation specified in national standard (refer to section 6.2.3 in GB/T18384.3 中 6.2.3). The system is

equipped with insulation monitoring function, which can realize the real-time display of insulation status and effective protection of invalid insulation to ensure personal safety.

◆ Heat management with high resolution—the system has multiple temperature management strategies, such as temperature difference management and high/low temperature limit management and so on, and double management of cooling and heating, which ensures that system can operate within comfortable temperature section and prevents extreme events as battery self-ignition and so on.

◆ High flame retardant rating — all system key parts in **EV-FT-11** can reach to or excess automotive class flame retardant rating UL-94-V0.

◆ High anti-vibration level— all **EV-FT-11** systems will be tested according to the vibration test standard specified in national standard before leaving factory to ensure the anti-vibration performance of system effectively.

Strong anti-interference— the model selection of all critical elements meets the model selection requirement of automotive class element; Effective isolation and filtering have been done for input and out-put; the performance of anti-electromagnetic interference has reached to harsh level (level 4 specified in GB/T17626.4-1998).

◆ Distributed two-level management —**EV-FT-11** system adopts distributed two-level management mode with combination of handy management and centralized management, which have divided he system function reasonably, greatly simplifying the complexity of interface and control and improving system reliability.

◆ Powerful balance management —**EV-FT-11** can manage the electric balance of battery according to intelligent balance strategy, which has ensured the consistency of battery effectively; besides, the battery pack can work in the uniform temperature section through heat balance management to ensure the temperature consistency of battery.

◆ Abundant extension interface— **EV-FT-11** externally supports multiple active output, passive out -put and multiple isolated CAN bus output, which meet the requirement of diversified management and can effectively realize the intelligent management of battery.

◆ Accurate collection and estimation — two core technologies of special high-precision collection technology D-Filter algorithm and SOC estimation technology Joint EKF algorithm which is the most accurate in filed at present have effectively ensured **EV-FT-11** industrial leading position in information collection and SOC estimation, guaranteeing the safety and mileage range of electric vehicle.

◆ Remote management interface —**EV-FT-11** system is equipped with distance-wireless transmission unit (DTU) interface, which can be used to exchange data with remote monitoring center: upload battery voltage, SOC, temperature, fault state and other data.

◆ High-capacity data storage — support data storage capacity of 8G; can record all performance parameters of power battery and dispatching events of battery pack for long time; users can import data into computer quickly for later analysis through USB interfaces.

◆ Rapid upgrade of system —**EV-FT-11** series BMS program downloading interface is installed externally, which can be used to upgrade system within 30 seconds.

◆ Management of operation authority —BMS system can set and modify battery operation protection parameters and alarm constant value and so on through touch screen and has the encryption management of operation authority. Any operation which changes system parameters needs authority confirmation.

Safety Guidelines

■ Description of Safety Signs:

Dangerous: dangers caused by operation not compliance with requirement may result to fire hazard, serious personal injury and even death.

Caution: dangers caused by operation not compliance with requirement may result to moderate or minor personal injuries and system damages.

Please read this section carefully when installing, using and maintaining this system and operate according to safety precautions required in this section. Any damage and loss caused by illegal operation have nothing to do with our company.

Application	Dangerous BMS is only applied for information monitoring and management of battery pack and cannot be used for other purposes. Otherwise, system fault or fire hazard may be caused.
Incoming inspection	Caution System damaged or lack of components cannot be installed. Otherwise, accident may be caused. If there is difference between packing list and name of material object, please don't install the system and contact with our company in time (see appendix A of this manual).
Installation	Caution Please handle with care at the time of loading and installation to prevent dropping on foot or product from being damaged. This system must be kept away from combustible objects and heat source. Don't let foreign matters drop into system at the time of installation. Otherwise, system fault may be caused. The shell of insulation detection module must be well conducting with vehicle body. Otherwise, the insulation detection module may be invalid.
Wiring	Dangerous ●The wiring work must be done by qualified operator of electric engineering. Otherwise, electric shock or system damaged may be caused. The power supply must be disconnected before wiring. Otherwise, electric shock or fire hazard may be caused. Caution ●The installation must be carried out in strict accordance with serial number of Battery monitor unit address. Otherwise, the collected data may not be consistent with display on control platform. Check whether the battery quantity is same to that of Battery monitor unit. Otherwise, the collected data may be incomplete. Check whether the connection order of voltage detection wiring harness is correct. Otherwise, the system may be damaged. Check whether the wiring of control relay is correct Otherwise, system and battery pack may be damaged. Check whether positive and negative poles Wiring of power supply are correct. Otherwise, system may be damaged
Operation	Dangerous

	● Power on only after all modules and display screen are connected correctly. The plug Wire cannot be unplugged when the power is on. Otherwise, electric shock may be caused. Parameters of setting page cannot be altered at will. Otherwise, battery may be damaged.
	 Caution
	●Before operation, check whether the system is within allowed range of application. Otherwise, system may be damaged. Before operation, check whether the control strategy of system is right. Otherwise, battery may be damaged
Maintenance and Check	 Dangerous
	● The power supply must be disconnected if it is necessary to disassemble the shell. Otherwise, electric shock may be caused. The circuit board includes a large number of high-accuracy elements . Therefore, don't touch it with hand to prevent the board from being damaged by static electricity. Please designate qualified operators of electric engineering to maintain, check or replace components.
Others	 Dangerous
	● Self-modification for the system is prohibited. Otherwise, serious accident may be caused.

Contents

Chapter 1 Introduction of EV-FT-11 BMS

1.1 Product Structure

With the distributed two-level management system, **EV-FT-11** electric vehicle BMS (hereinafter called **EV-FT-11** system) is composed of Battery cluster-management unit (BCU) and multiple Battery monitor unit (BMU), display screen (LCD), insulation detection module (LDM), heavy-current control system (HCS), current sensor (CS) and wiring harness.

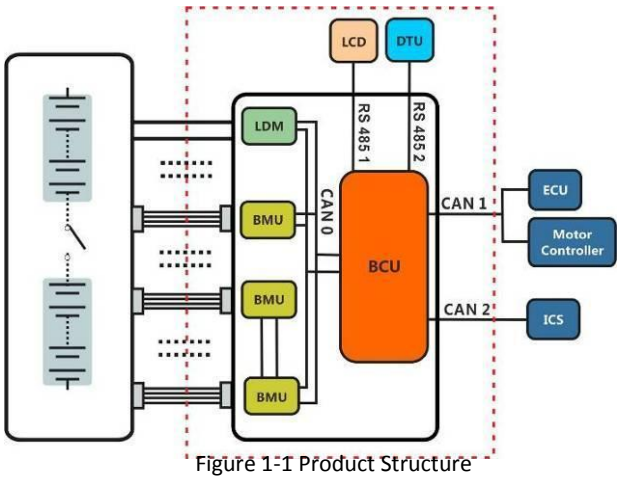


Figure 1-1 Product Structure

1.2 System Configuration

Figure 1-2 System Configurations

1.3 Brief Introduction of Function

In **EV-FT-11** system, BCU module carries out real-time communications with multiple BMU modules and LDM (insulation detection module) through CAN bus to gain system parameters, such as single cell voltage, box temperature and insulation resistance and so on, collects charging and discharging current through current sensor, calculates SOC dynamically and displays related data through touch screen. BCU manages system after gaining comprehensive information of battery pack through calculation and analysis, respectively interacts with ECU, motor controller and charger and so on intelligently through

independently CAN bus and can realize the secondary protection of charging and discharging through relay control to meet diversified safety control demands of customers, ensuring stable and effective operation of system.

1.4 Technical Specifications

Type	Specification	Remarks
Voltage collection range	0～5V	
Voltage collection accuracy	±5mV	
Accuracy of total voltage	0.1%	
Current collection accuracy	±1%	500A current sensor
Error of SOC estimation	≤5%	
Temperature collection accuracy	±1℃	
Temperature collection range	-40～125℃	
Balance current	300mA	3 channels of balance can be switched on at the same time
Power consumption of BMU operation	0.5W	
One BMU module, Power consumption of BCU operation	≤2.8W	
3.5'' display screen	3W	Power consumption of sleep mode: 0.24W
Working input voltage	DC 12/24V	
Storage temperature	-45～125℃	
Weight	BCU:480g BMU:640g	Weight of one Battery monitor unit and one Battery cluster-management unit
Charging control mode	CAN communication, active/passive output	Depend on actual conditions
Discharging control mode	CAN communication, active/passive output	Depend on actual conditions

1.6 Battery cluster-management unit (BCU)

■ **BCU function**

◆ SOC estimation: use Joint EKF algorithm to estimate SOC of battery pack dynamically

◆ Current detection: carry out real-time detection of current in charging and discharging circuits through Hall current sensor.

◆ Communication function: externally installed 3 CAN interfaces, which can be used to communicate with BMU, complete vehicle controller and charger and so on to exchange voltage, temperature, fault code, control command and other information.

◆ Alarm and protection: when there is fault as over-charge, over-discharge and so on, BCU can perform the corresponding alarm and protection according to fault status and display it on LCD screen.

◆ System expanding: BCU supports multiple channels of active/passive node output and can realize two-level control management through CAN communication and relay to ensure effective isolation of strong and weak current and meet diversified safety control demands of customers.

◆ Data storage: support 8G data storage capacity and can record all performance parameters of long-term operation of power battery pack and dispatching and fault events of battery module.

- System self-check: the system checks itself and BMU working status after power on to ensure normal working of system.
- Remote management: BCU is equipped with wireless communication interface, which can realize four-remote function through external DTU module.
- System upgrade: program downloading interface is installed externally, which can be used to upgrade system within 30 seconds.

▪Parameters of BCU module

Item	Performance
Working voltage	DC 12V/24V
Current detection range	±500A (optional)
Current detection accuracy	±1%
Error of SOC estimation	≤5%
Display	Total voltage, total current, maximum and minimum voltages and serial numbers, voltage of single battery, box temperature, charging and discharging status, over-charge alarm prompt, under-charge alarm prompt, over-discharge alarm prompt, over-temperature alarm prompt and insulativity alarm prompt, etc.
Alarm	Grade I alarm: prompted alarm information appears on display screen and no control measures are taken: ◎ Single cell voltage ≤3.0V; ◎100Ω/V≤ insulativity ≤500Ω/V
	Grade II alarm: prompted alarm information appears on display screen and there is bumming; disconnect charging and discharging circuits: ◎ Single cell voltage ≤2.5V or single cell voltage ≥3.9V; delay: 5-30S; ◎ Box temperature ≥75℃; ◎Insulativity ≤100Ω/V
Charging control mode	Use CAN bus and relay to control: ◎ When the cell voltage of single battery ≥3.65V, carry out CAN communication with charger and the current value gradually decreases according to smooth curve. ◎ When the cell voltage of single battery ≥3.9V, disconnect charger output after 30S delay. ◎When the cell voltage of single battery ＜3.4V, charger can be used again for continue charging. ◎When the box temperature ≥75℃, charger is abnormal or charging circuit is disconnected
Discharging control	Use CAN and high-voltage relay to control the over-discharge of battery: ◎ If carrying with CAN communication, when cell voltage of single battery ≤3.0V, reduce motor output power; ◎When the cell voltage of single battery ≤2.5V, disconnect motor power output after 5～10S delay. ◎ When battery box temperature ≥75℃, disconnect discharging circuit.

Note: *all protection parameters in table can be configured.

1.7 Battery monitor unit (BMU)

■ BMU function

BMU connects with battery pack through voltage detection wire, collects voltage of 12 strings of battery cell at most and can equalize battery according to battery single cell voltage. When the voltage of some single cell battery in battery box reaches to 3.55V and battery voltage difference is between 20mv-800mv, the balance function will start automatically. Each battery detection unit can switch on 3 channels of balance at the same time at most. BMU collects box module temperature through 3 temperature sensors at most and can actively manage cooling and heating according to temperature status to ensure battery application capacity and prolong battery service life.

The working power supply of BMU has to be provided by the external 12V (9V～18V self-adaption) or 24V (18V～36V self-adaption) DC power source. BMU transmits the collected battery voltage, box temperature and other information to Battery cluster-management unit through CAN bus.

◆Detection of single cell voltage: realize the real-time detection of each single cell voltage through isolated collection of series single cell voltage.

◆Temperature detection: put 1~3 temperature sensors in box of battery module to realize the real-time detection of box temperature.

◆ CAN communication: transmit the voltage, box temperature and other information of each single cell in battery pack to BCU through CAN bus.

◆ Balance function: balance management can be performed to battery cell according to agreed balance management control strategy to improve the consistency of single battery cell and application performance of battery pack.

◆Heat management: BMU can manage the cooling and heating status of battery actively according to battery box temperature to ensure battery application capacity and prolong battery service life.

◆System upgrade: program downloading interface is installed externally, which can be used to upgrade system within 30 seconds.

■ Parameters of BMU module

Item	Parameter	Remarks
Maximum quantity of collection string	12 strings	
Working voltage	DC9V~36V	
Voltage collection range	0~5V	
Collection accuracy of single cell voltage	±5mV	
Temperature collection range	-40～125	
Temperature detection accuracy	±1	
Communication interface	CAN	
Voltage sampling period	200ms	12s
Power of cooling fan	12W	

1.8 Insulation Detection Module (LDM)

■ LDM function

LDM is used to detect whether the battery pack has electricity leakage on vehicle body. LDM receives the command from BCU through serial bus and transmits the detected data information to BCU, which then will deliver LDM status to display screen. Method to judge whether the battery leaks electricity onto vehicle body: respectively detect whether the insulativity between positive/negative pole of vehicle-mounted battery and body shell is more than 500Ω/V.

Insulativity	System Status	Display Screen
Insulativity ≥500Ω/V	Normal system display	Green displays on screen
100Ω/V≤ insulativity ≤500Ω/V	System alarm I	Yellow displays on screen; system doesn't cut off circuit.
Insulativity ≤100Ω/V	System alarm II	Red displays on screen; system cuts off circuit.

1.9 Heavy-current Control System (HCS)

Heavy-current control system includes heavy-current control module, charging and discharging control circuits and pre-charge circuit, etc.

■ HCS function

◆ Charge and discharge control: charging/discharging of battery is controlled through switching on/off high-voltage relay to prevent over-charge and over-discharge of battery; besides, the function of relay contact detection is also equipped to prevent sticky point of relay in circuit.

◆ Pre-charge circuit: before switching on the discharging high-voltage relay of main circuit, it is necessary to switch on the pre-charge circuit firstly to charge capacitance. Then, switch on the high-voltage relay of main circuit when the voltage at both terminals of capacitance has reached to setting threshold value to ensure the reliability of high-voltage relay of main circuit.

◆ CAN and RS485 communication: use CAN or RS485 bus to communicate with BCU, upload relay status and other information and receive the control command from BCU.

■ Table of Relay Model Selection

Item	Code	Detailed Parameters
Relay Model	01	EV200AAANA
	02	400V/10A
	03	400V/80A
	04	400V/120A

■ Model Selection Table of Power and Resistance of Heavy-current Module

Item	Code	Detailed Parameters
Power Model	00	50W
	01	75W
	02	100W
	04	300W
Resistance Model	01	50Ω
	02	75Ω
	03	100Ω
	07	240Ω

1.10 Current Sensor (CS)

■ CS function

The current of this system is detected with Hall open-loop current sensor with optional range 50A～1000A.

■ Model Selection Table of CS

Item	Code	Detailed Parameters
Current Type	01	50A
	02	100A
	04	200A
	05	300A
	07	500A
	10	1000A

1.11 Display Screen (LCD)

■ LDM function

The display screen is human-machine interface for displaying system operation status. All its models are designed according to industrial standard and suitable for applying in various conditions. The display interface of LCD can display all operation parameters and faults of system.

■ Status description of LCD

The operation indicator of display screen includes three ones: power supply (PWR), running (RUN) and communication (COM). When the display screen is powered on, the power indicator (PWR) is normally on; if the running indicator (RUN) is normally on in yellow, it stands for normal running of display screen; if the running indicator (RUN) is not on, it means that the display screen has fault; when the display screen has connected with BMS, the communication indicator (COM) flashes in yellow.

Figure 1-3 Running Status Indicators

◆ The following table shows the display status of three LED indicators under various conditions:

■ Display description of LCD

The integrated interface information of display screen is as shown in the figure below:

Equipment Status		Green LED (PWR)	Yellow LED (RUN)	Yellow LED (COM)
No power supply		○	○	○
Power on, no communication	3.5'' screen	●	●	●
	5.7'' screen	●	●	○
Communicate with connected equipment		●	●	※
○ LED off ● LED on ※ Flash				

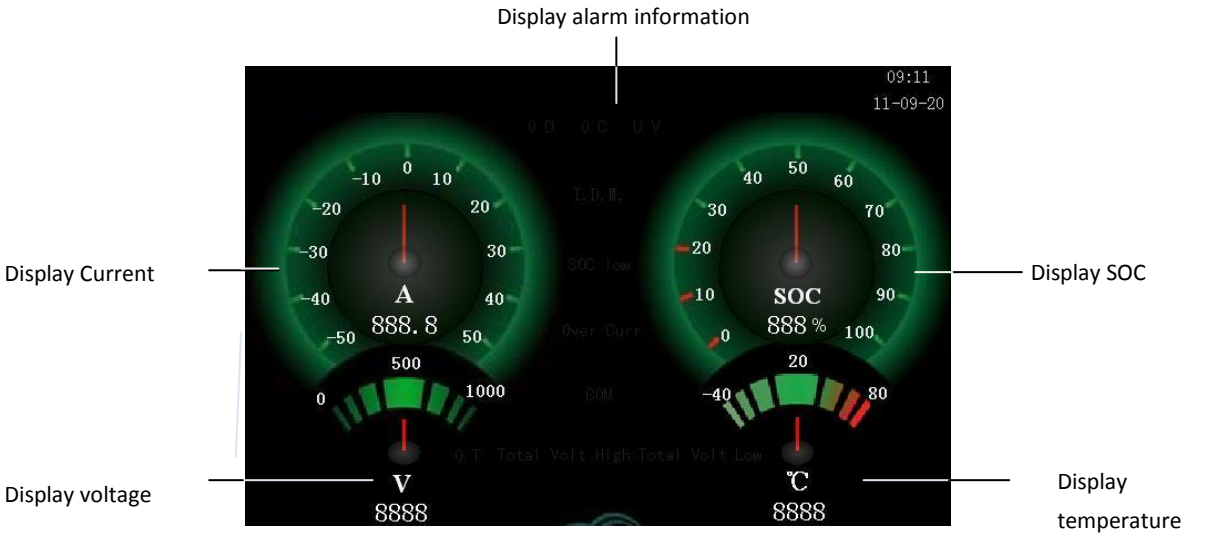


Figure 1-4 Figure of LCD Display Interface

- **Model Selection Table of LCD**

Item	Code	Detailed Parameters	
LCD Model	01	Display screen	3.5”
	02	Display screen	5.7”

Chapter 2 Installation of System

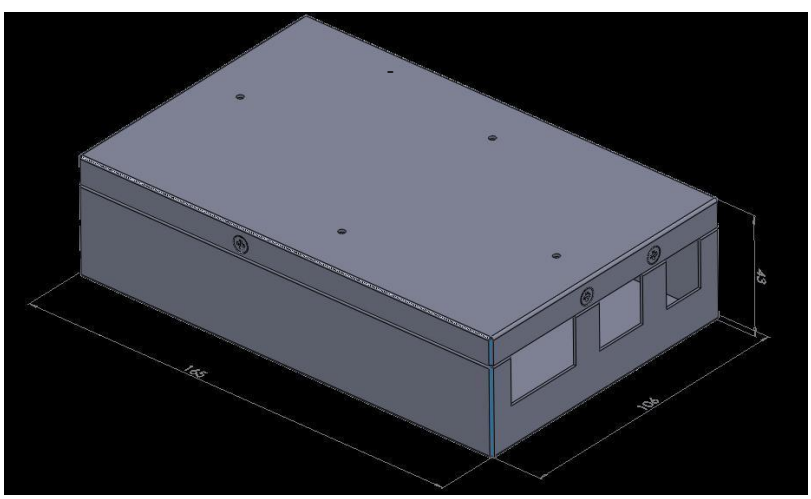
2.1 Installation Dimension and Weight of Product

Product Type	Overall and Installation Dimensions (unit: mm)						d	Weight (KG)
	W	H	D	W1	H1	D1		
BCU	165	106	43	100	50		M4	0.64
BMU	124	91	40	100	40		M4	0.48
LDM	165	120.5	25	105.5	85	15	4.5	1.05
HCS	260	240	100	130	225	26	6	---
LCD	96	81	47	90	75	5	4	0.186
	177	140	40	160.6	130.5	6	4	0.5

Note: W, H and Dare dimensions of external structure; W1, H1 and D1 are installation dimensions of internal structure; d is width of mounting hole.

2.2 Schematic Diagram of Overall Dimensions

- **Battery cluster-management unit (BCU)**



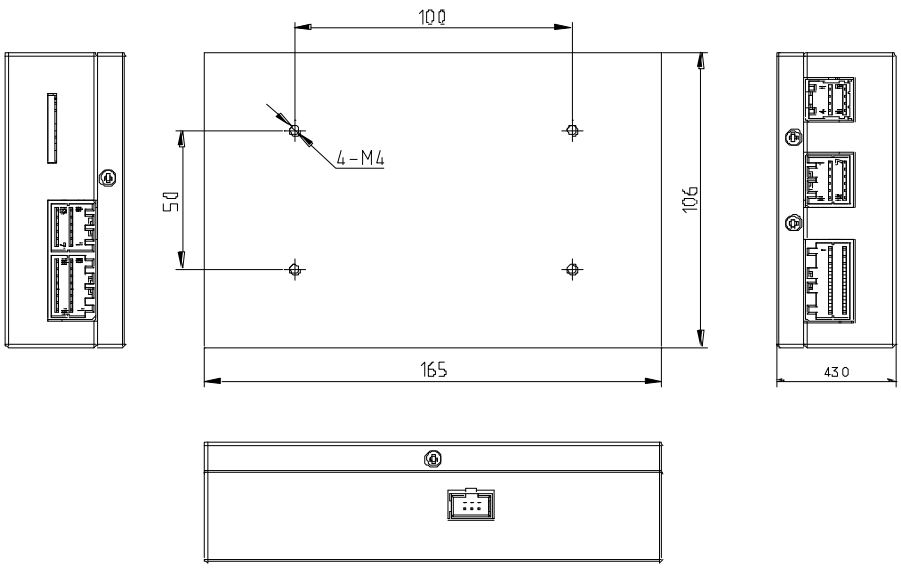
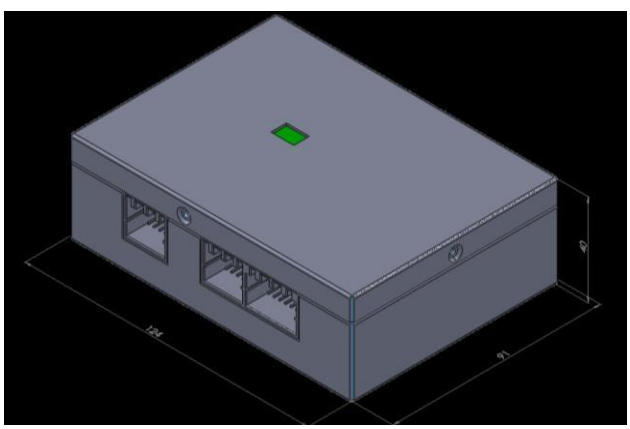


Figure 2-1 BCU Overall Dimension

- **Battery monitor unit (BMU)**



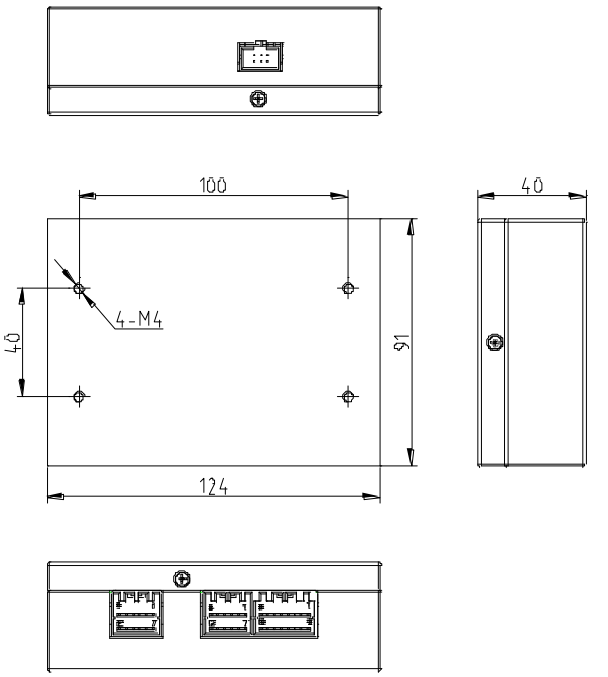
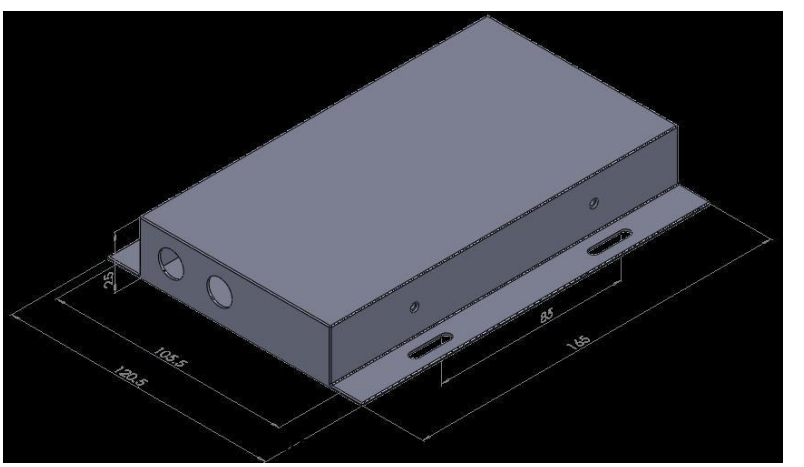


Figure 2-2 BMU Dimension

- **Insulation Detection Module (LDM)**



- **Display Screen (LCD)**

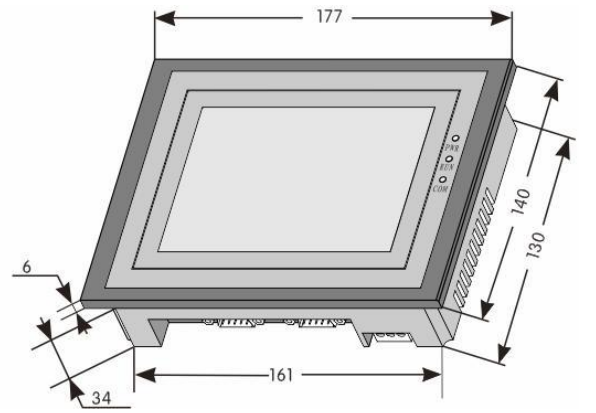


Figure 2-4 Overall Dimension of 5.7'' LCD

- **Current Sensor (CS)**

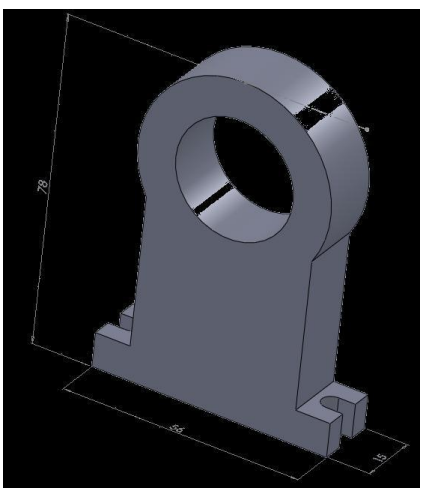


Figure 2-5 CS Overall Dimension

- **Heavy-current Control Box**

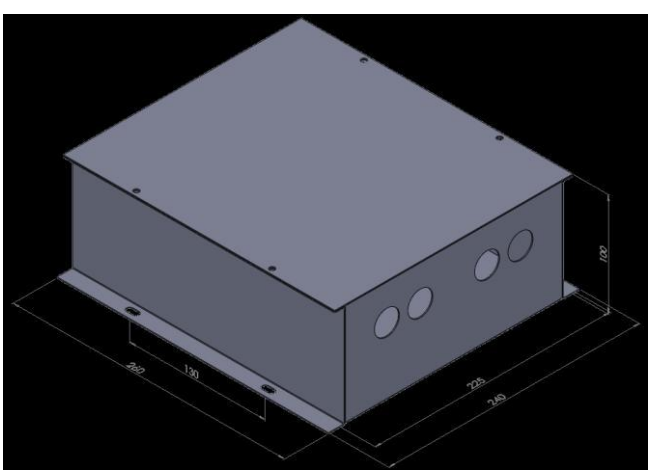
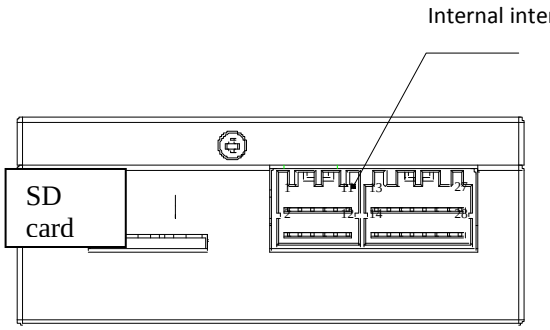


Figure 2-6 Overall Dimension of Heavy-current Control Box

2.3 Interface Description

- **BCU interface**



- **BMU interface**

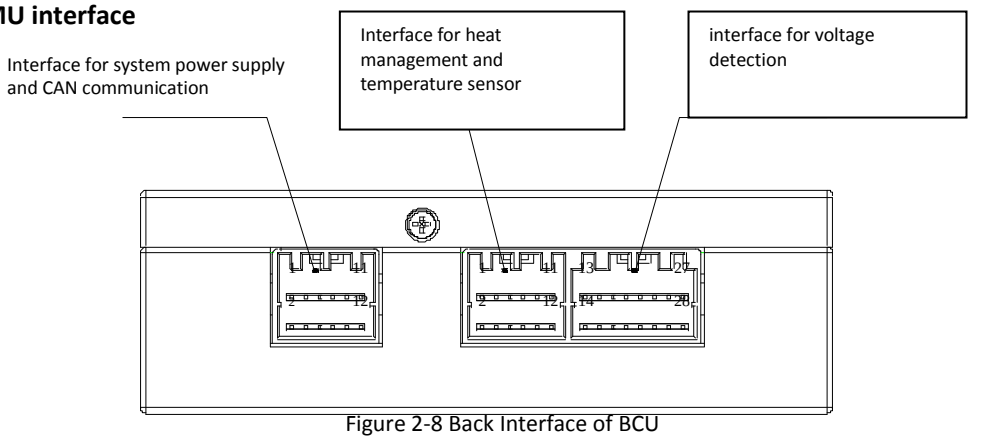


Figure 2-8 Back Interface of BCU

- **LDM interface**

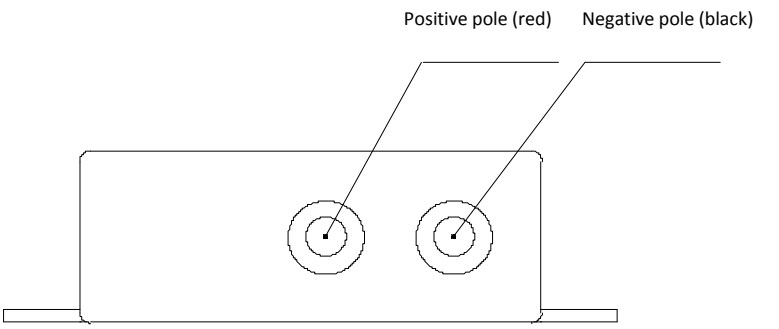


Figure 2-9 Front Interface of LDM

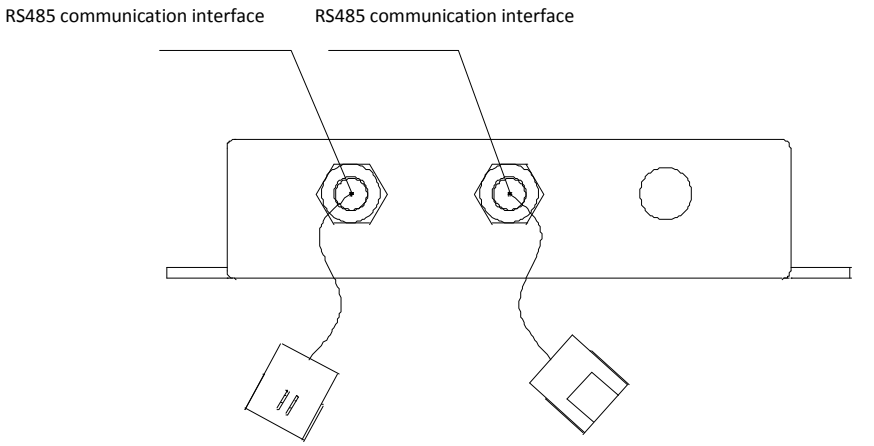


Figure 2-10 Back Interface of LDM

- **5.7'' LDC interface**

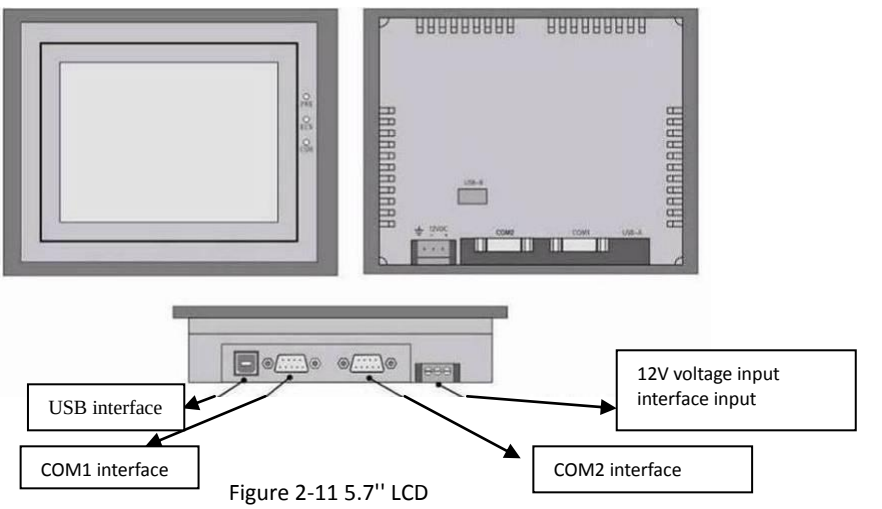
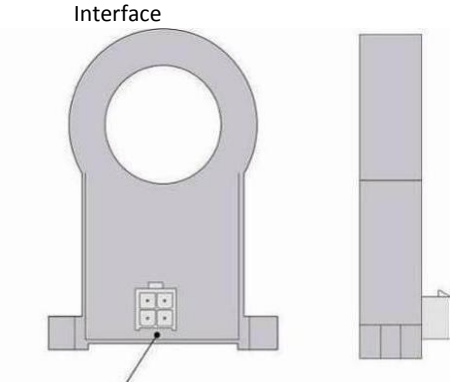


Figure 2-11 5.7'' LCD Interface

- **CS interface**



Interface for current sensor

Figure 2-12 CS Interface

2.4 Wiring Diagram of System

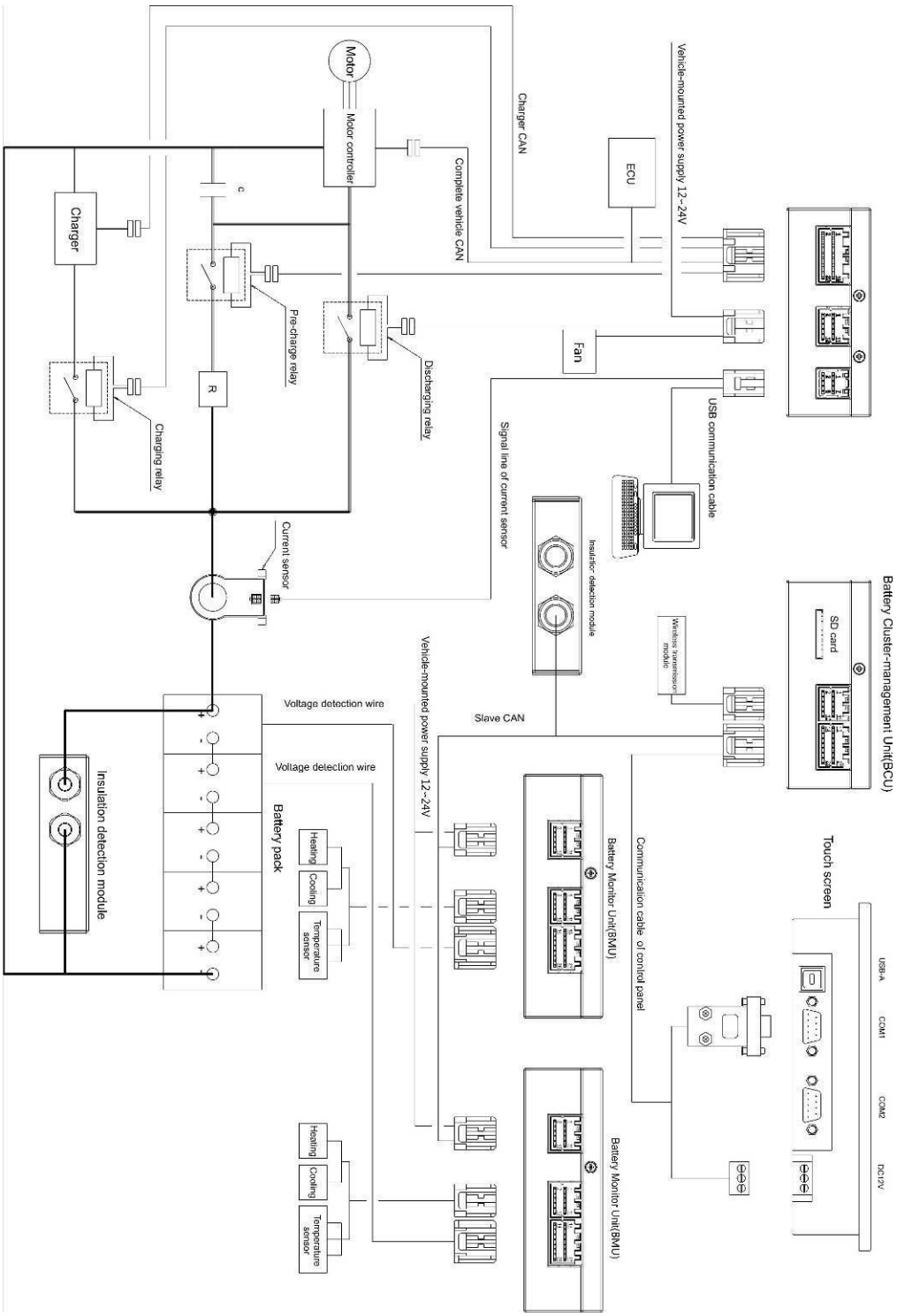


Figure 2-13 Schematic Diagram of Installation

Note: * products of different models may have some difference in functions and settings. The installation method of special connecting lines and adaptors will be provided by the company separately.

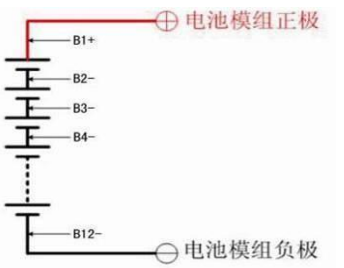
2.5 Wiring Description of BMU

- **Connection of voltage detection wiring harness (take 12 strings for example)**

♦ B1+ connects with positive pole (red line) of first battery;

♦ B1-~B11- connects with negative pole (black line) of each battery in series successively;

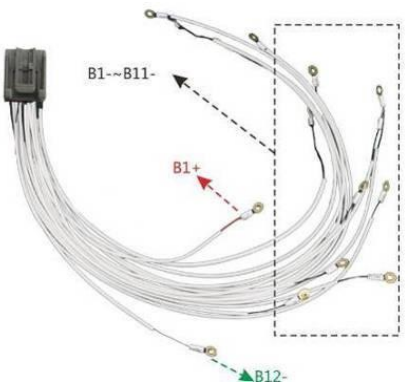
♦ B12- connects with negative pole (green line) of the last battery.



Positive pole of battery module

Negative pole of battery module

Figure 2-14 Schematic Diagram of Connection between Voltage Detection Wiring Harness and Battery



⚠ Figure 2-15 Example Diagram of Connection between Voltage Detection Wiring Harness and Battery

Caution: the connection order of voltage detection wiring harness cannot be wrong. Otherwise, the voltage collection may be incorrect, equalizing circuit may be burnt out and battery may be damaged.

- **Fix temperature sensor onto battery pack**

Figure 2-16 Example Diagram of Temperature Sensor Connection

- **Connect voltage detection cable harness and temperature detection cable to BMU**

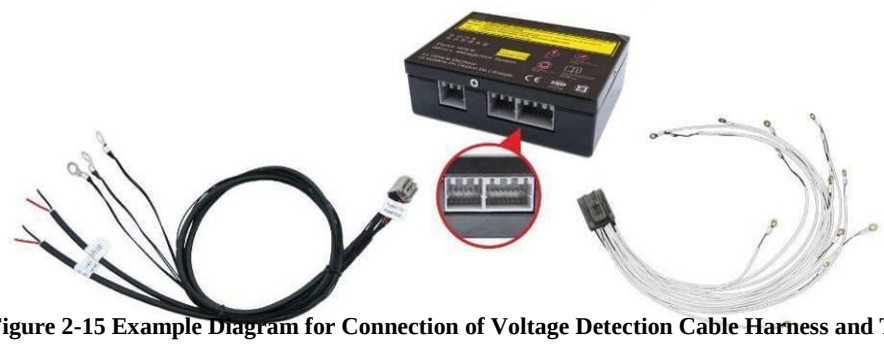


Figure 2-15 Example Diagram for Connection of Voltage Detection Cable Harness and Temperature Detection Cable

- **Connection of CAN Communication Cable**

CAN communication cable is the communication medium between BMU and BCM. The system adopts 3-core shielding line to be communication cable. MOLEX12pin connector assembly and AMP 6PIN automobile connector (cellular type and pin type) are used for joint. The example diagram and schematic diagram of connection are as follows respectively:

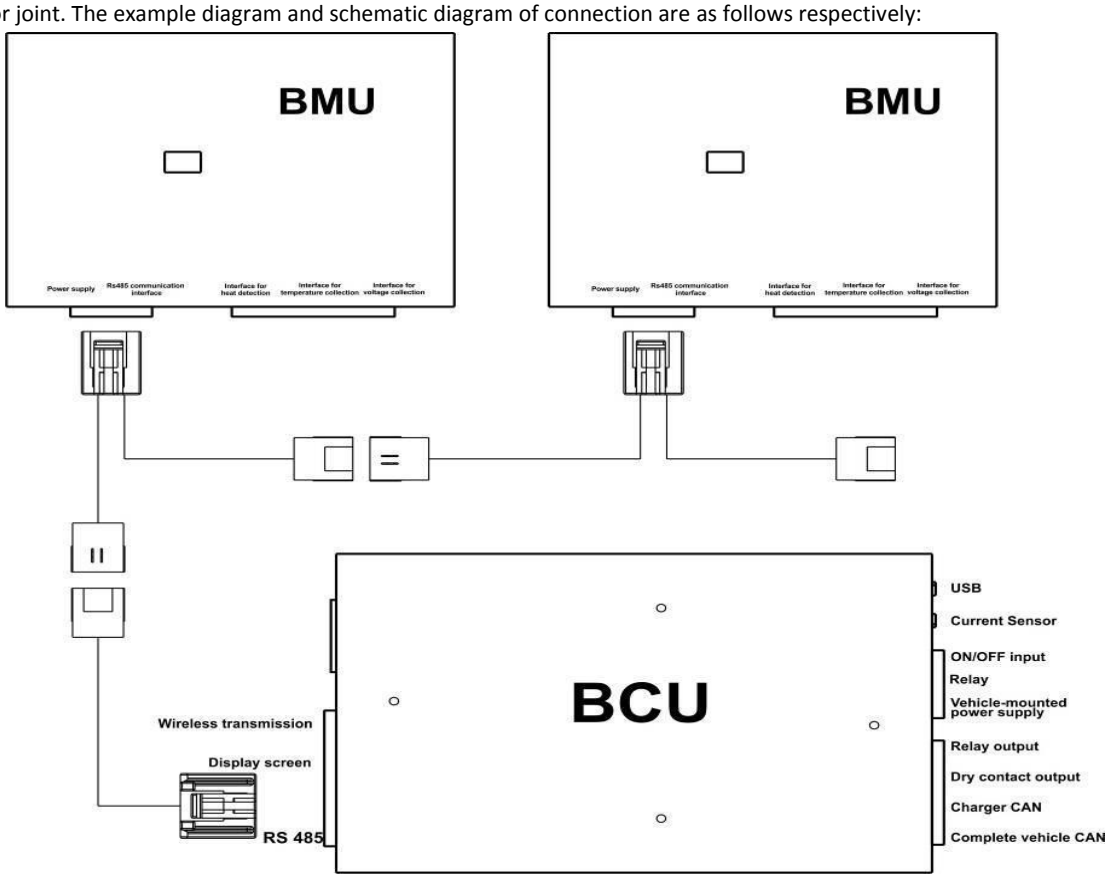


Figure 2-18 Schematic Diagram for Connection of Serial Communication Bus -

The BMU farthest away from BCU connects to No. 2 line and others connect to No. 1 line.

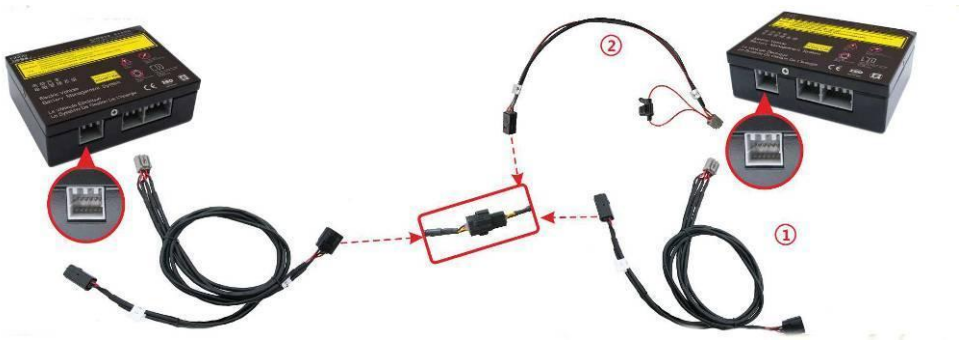


Figure 2-19 Example Diagram for Connection of Communication cables among BMUs

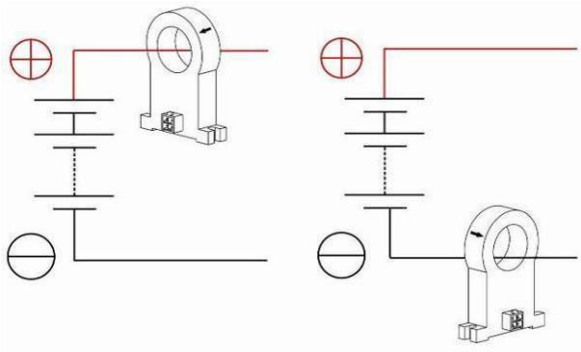
2.6 Wiring Description of BCU

- **Connect communication cable s between BCU and BMU**

Figure Diagram for Connection of Communication cable s between BCU and BMU

- **Connect current sensor**

The current sensor is strung onto the circuit cable of output positive/negative pole of battery pack and has two kinds of wiring modes, as shown in the figure below (pay attention to the arrow on current sensor).



Connection method 1 Connection method 2

Figure 2-21 Schematic Diagram for Connection of Current Sensor Installation

Figure 2-22 Example Diagram for Connection of Current Sensor

■ **Connect the control cable of charge/discharge relay (red line connects with positive pole of relay coil and black one with negative pole of relay coil).**

Figure 2-23 Example Diagram for Connection of Relay Control Cable

■ **Connect CAN communication cables of charger and complete vehicle system/motor controller. (For 3-core shielding line: red is H, yellow is L and black is GND)**

Figure 2-24 Example Diagram for Connection of CAN Communication Cable

Caution: 1. Confirm that the connection of "H" and "L" of CAN bus is correct. Otherwise, CAN bus cannot communicate with other devices.

2. Confirm that the matched resistance of CAN bus is correct. Otherwise, CAN bus cannot communicate with other devices.

■ **Connect the power supply cord of BCU (red line connects with positive pole of power supply and black one with negative pole).**

Figure 2- 25 Example Diagram for Connection of BCU Power Cord

2.7 Wiring Description of LDM

Connect communication cables between LDM and BCU; connect LDM to the master positive pole and master negative pole of battery pack; and make LDM shell contact with vehicle body and keep well conducting between them (LDM shell grounded).

Figure 2-26 Example Diagram for Connection of Communication Cables between LDM and BCU

⚠ Caution: LDM shell must well contact with vehicle body. Otherwise, functions of LDM will be invalid!

⚠ Dangerous: it is necessary to wear insulation gloves when connecting positive/negative pole wire of detection. Otherwise, electric shock may be caused!

2.8 Wiring Description of LCD

■ **Wiring description of display screen (take 5.7" one for example)**

Both interfaces for power supply and communication of display screen of this system have to connect with BCU. The schematic diagram of connection is as follows.

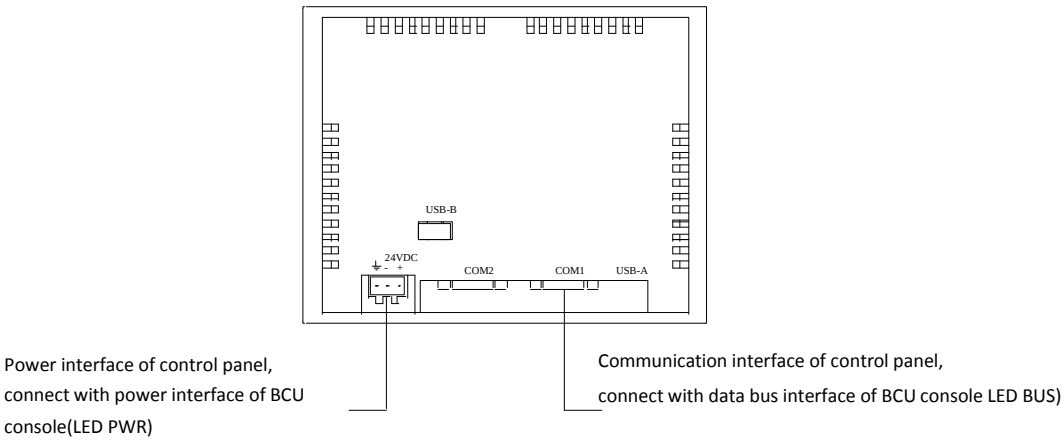


Figure 2-27 Wiring of 5.7'' Display Screen

2.9 Connect Communication Cables between LCD and BCU

Figure 2-28 Example Diagram of Communication Cables between LCD and BCU

Caution: 1. the communication cable interface (DB9 connector) of LCD connects to COM1 communication. interface of D. If it is connected to COM2 interface, the LCD communication will be interrupted!

2. The connection of positive and negative poles of LCD power cannot be reversed. Otherwise, LCD will be burnt out!

3. LCD is powered by DC24V. The positive pole connects with 24V+ and negative one with 24V-!

2.10 Installation Conditions and Requirements

- Avoid installing the system under the condition with oil mist, metallic dust and much dust.
- Avoid installing the system under the condition with harmful gas and fluid or corrosive, flammable and explosive gas.
- Reserve appropriate installation dimensions.
- Cable installation shall be kept away from sharp objects.
- Try best to keep away from conditions with strong electromagnetic interference.
- Parameters of all parts related to connection with this system shall be confirmed by our company.

Chapter 3 Wiring of System

3.1 Type of Cable

No.	Name	Specification	Remarks
1	**Voltage detection cable**	0.5 high temperature wire: one end is MOLEX28PIN connector assembly; the other end is 1.5-8 cold pressed terminal.	Size of cold pressed terminal is determined according to the actual demand of customer.
	Temperature detection cable	2×0.5 high temperature wire: one end is MOLEX28PIN connector assembly; the other end is temperature sensor.	
	Fan power cord	2×0.5 power cord: one end is MOLEX28PIN connector assembly; the other end is null.	
2	**Communication cable among modules**	3×0.5 shielding line and 2*1.0 high temperature wire: one end is MOLEX12PIN connector assembly; the other end is 6PINAMP connector assembly (cellular type and pin type).	Communication among BMUs, and power cord
3	**Power cord**	2×0.5 power cord: one end is MOLEX12PIN connector assembly; the other end is null.	
	Master-slave power cord	2×0.5 power cord: one end is MOLEX12PIN connector assembly; the other end is 6PIN AMP connector assembly (cellular type).	Share the same one 6PIN AMP connector assembly with master-slave communication cable
	Discharge relay cable	2×0.5 power cord: one end is MOLEX12PIN connector assembly; the other end is null.	
	Input signal cable	2×0.5 power cord: one end is MOLEX12PIN connector assembly; the other end is null.	
4	**Discharge CAN cable**	3*0.5 shielding line: one end is MOLEX20PIN connector assembly; the other end is null.	
	Charge CAN cable	3*0.5 shielding line: one end is MOLEX20PIN connector assembly; the other end is null.	
	Charge relay cable	2×0.5 power cord: one end is MOLEX20PIN connector assembly; the other end is null.	
	Pre-charge relay cable	2×0.5 power cord: one end is MOLEX20PIN connector assembly; the other end is null.	
	Charge switching signal cable	2×0.5 power cord: one end is MOLEX20PIN connector assembly; the other end is null.	
	Discharge switching signal cable	2×0.5 power cord: one end is MOLEX20PIN connector assembly; the other end is null.	
5	**Connecting wire of current sensor**	4×0.5 shielding line: one end is MOLEX8PIN connector assembly;	

		the other end is 5569 (2×2) cellular terminal.	
	USB communication cable	4×0.5 shielding line: one end is MOLEX8PIN connector assembly; the other end is USB interface.	
6	**Master-slave Communication cable**	3×0.5 shielding line and 2*1.0 high temperature wire: One end is MOLEX28PIN connector assembly; The other end is AMP6PIN cellular connector assembly.	Share the same one 6PIN AMP connector assembly with master-slave power cord
	Screen communication cable	5×0.3 shielding line: one end is MOLEX28PIN connector assembly; the other end is DB9 terminal (cellular) and 2PIN plug.	
	LDM communication cable	3×0.5 shielding line and 2*0.5 power cord: one end is MOLEX28PIN connector assembly; the other end is AMP6PIN pin-type connector assembly.	

Note: *1. The cable length is determined through consultation between customer and our company.

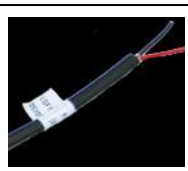
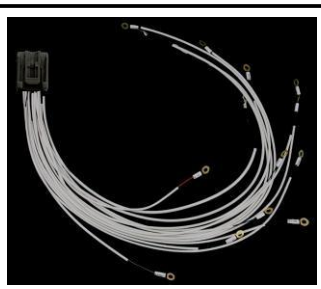
*2. The type of charge and discharge cables is determined according to requirement of customers.

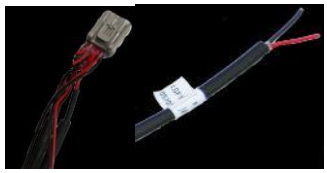
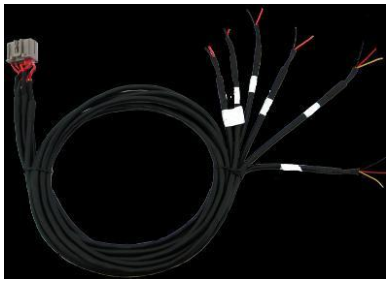
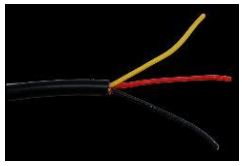
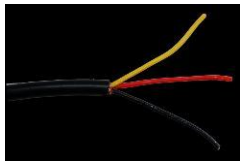
*3. For wiring mode, please refer to instructions for system installation.

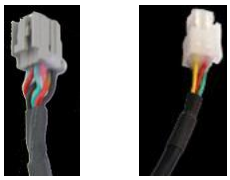
*4. If special cables are needed, please contact technical support center of our company.

3.2 Diagram of Cables

■Following pictures show common cables produced by our company

Diagram	Name	Application	Interface
	Temperature detection cable	Detect temperature information of battery	 
	Fan control cable	Connect with fan on battery box	 
	Voltage detection cable	Connect with battery and BMU, detect voltage	 

	Communication cable among modules	Communication among all BMUs, and power cord	 
	Power cord (red + , black	Supply power for BCU	
	Master-slave power cord	Supply power for BMU	 
	Discharge relay cable	Connect with control cables of discharge relay and BCU	
	Input signal cable	Input level signal for BCU	
	Complete vehicle CAN cable	Connect with motor controller/complete vehicle controller	 
	Charge CAN cable	Connect with charger	 
	Charge relay cable	Connect with control cables of charge relay and BCU	 

	Pre-charge relay cable	Connect with control cables of pre-charge relay and BCU	
	Charge switching cable	Output charge switching signal to charger	
	Discharge switching cable	Output discharge switching signal to motor controller or others	
	Current sensor cable	Connect with BCU and current sensor	
	USB communication cable	Download saved data	
	Master-slave communication cable	Communication cables between BMU and BCU	
	Screen communication cable	Communication between BCU and LCD, and power cord	
	Insulation communication cable	Communication between BCU and LDM, and power cord	

3.3 Cable Quantity

■ in the following table, a set of EV-FT-11 system is taken for example to explain cable quantity required by product. One of products takes one BCU and N (≤22) BMUs for example to explain the quantity of each cable, as shown in the table below.

Name	Qty.	Unit	Remarks
Voltage detection cable	N	Set	Quantity of each set of voltage detect cable is equal to that of determined BUM.
Temperature detection cable	N	Set	There are 3 temperature sensors on each set of cable.
Fan power cord	M	Set	Optional
Communication cable among modules	N	PCS	Communication cables among BMUs
Power cord	1	PCS	Each BCU, BMU and LDM corresponds to one power cord respectively.
Master-slave power cord	1	PCS	
Master-slave communication cable	1	PCS	
Connecting wire of current sensor	1	PCS	
Screen communication cable	1	Set	
Discharge switching cable	1	PCS	The corresponding discharge mode and harness corresponding to one cable are selected by customers.
Discharge CAN cable	1	PCS	
Discharge relay cable	1	PCS	
Charge relay cable	1	PCS	The corresponding charge mode and harness corresponding to one cable are selected by customers.
Charge CAN cable	1	PCS	
Charge switching cable	1	PCS	
Pre-charge relay cable	1	PCS	Optional
USB communication cable	1	PCS	Optional
Input signal cable	1	PCS	Optional
Insulation communication cable	1	PCS	Optional

Chapter 4 LCD Application and Parameter Setting

4.1 Explanation of Parameters

Total capacity	Capacity of battery packs after being fully charged; Usually, it is initially configured to nominal capacity of battery pack.
Surplus capacity	Currently surplus ampere-hours of battery pack; it is set according to parameters provided by battery manufacturer.
Maximum charging voltage	Set maximum allowed charging voltage of charger through CAN communication.
Maximum charging current	Set maximum allowed charging current of charger through CAN communication.
Over-charge protection voltage	Set the maximum voltage threshold value that single cell battery can raise during charging. Carry out over-charge protection to battery and alarm when it is more than this value.
Over-charge protection release	Set to cancel the voltage threshold value of overcharge protection, i.e. to cancel over-charge protection and alarm when the maximum voltage of single cell battery drops to the value lower than threshold value.
Under-voltage alarm voltage	Set threshold value of alarm for low voltage of battery single cell, which is used to prompt low power of battery.
Under-voltage alarm release	Set to cancel the voltage threshold value of under-voltage alarm, i.e. to cancel under-voltage alarm when the minimum voltage of single cell battery recovers to the value more than this parameter.
Over-discharge protection voltage	Set the minimum voltage threshold that battery can drop to during discharging. Carry out over-discharge protection to battery when the voltage is lower than the value.
Over-discharge protection release	Set to cancel the parameter of battery over-discharge protection, i.e. to cancel battery over-discharge protection when the minimum voltage of single cell battery recovers to the value more than this parameter.
Over-temperature protection temperature	Set allowed maximum operating temperature of battery pack. Carry out battery over-temperature protection and alarm when the temperature is higher than the value.
Over-temperature protection release	Set the temperature threshold of over-temperature alarm release, i.e. to cancel over-temperature protection and alarm when the maximum temperature of battery drops to the value lower than the threshold.

4.2 Main Interface of LCD

(1) For terminal user

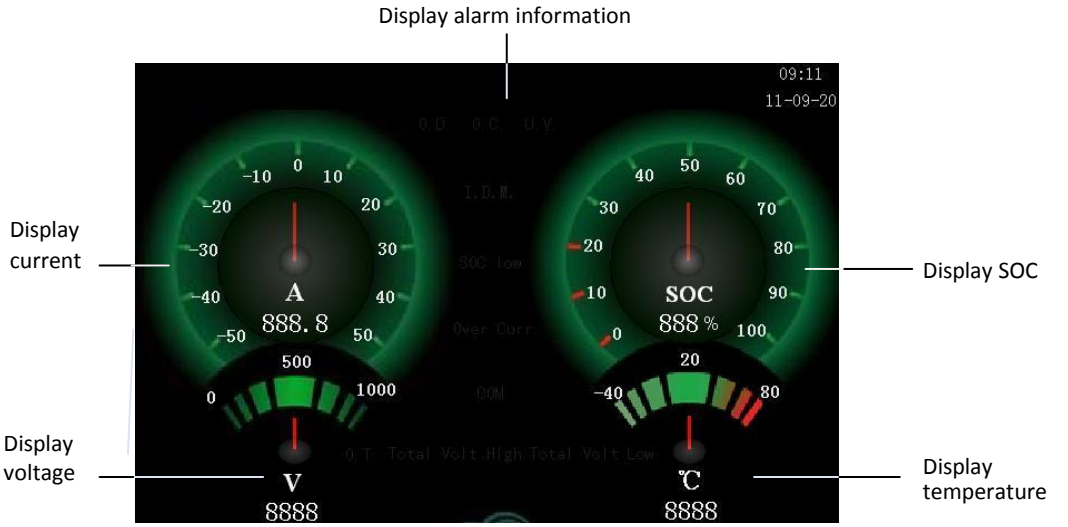


Figure 4-1 Main Interface of Terminal User

Remarks: It displays in gray when alarm information is normal; it displays in red and flashes when there is alarm.

(2) For advanced user

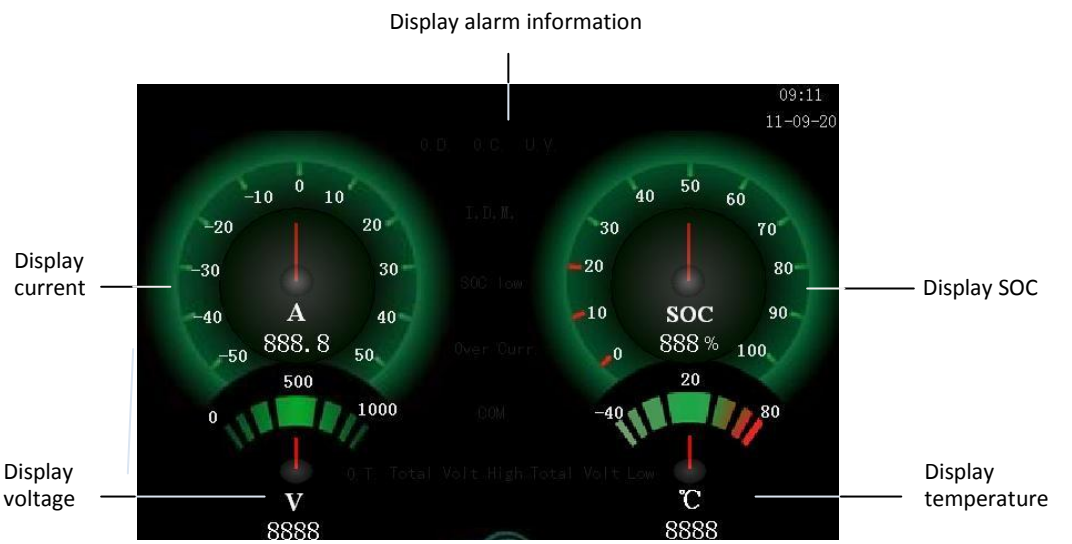


Figure 4-2 Main Interface of Senior User

Remarks: at this moment, click battery information to pop up the window 

Compared with terminal user interface, statistical information and configuration information are newly increased in senior user interface.

4.3 User Permission

The touch screen has the function to set user permission. The terminal user can only browse general information. For senior user, Statistical information and configuration information of battery are increased. When the touch screen is powered on, the default user is terminal user.

- **Steps for modification of user permission**
  - Step 1: click Menu to pop up the window as shown in figure 4.3.1.
  - Step 2: click User Information to pop up the window as shown in figure 4.3.2.
  - Step 3: click Modify and enter password to change user name.
    If the entered password is 1111, the user is terminal user. If the entered password is 5555, the user is senior user.
  - Step 4: click "Return". The main interface can alter automatically according to user name.

Figure 4-3 Menu

Figure 4-4 User Information

4.4 Display of Battery Single Cell Information

The system will enter the corresponding interface after clicking Single Cell Information , as shown in the following figure 4-5.

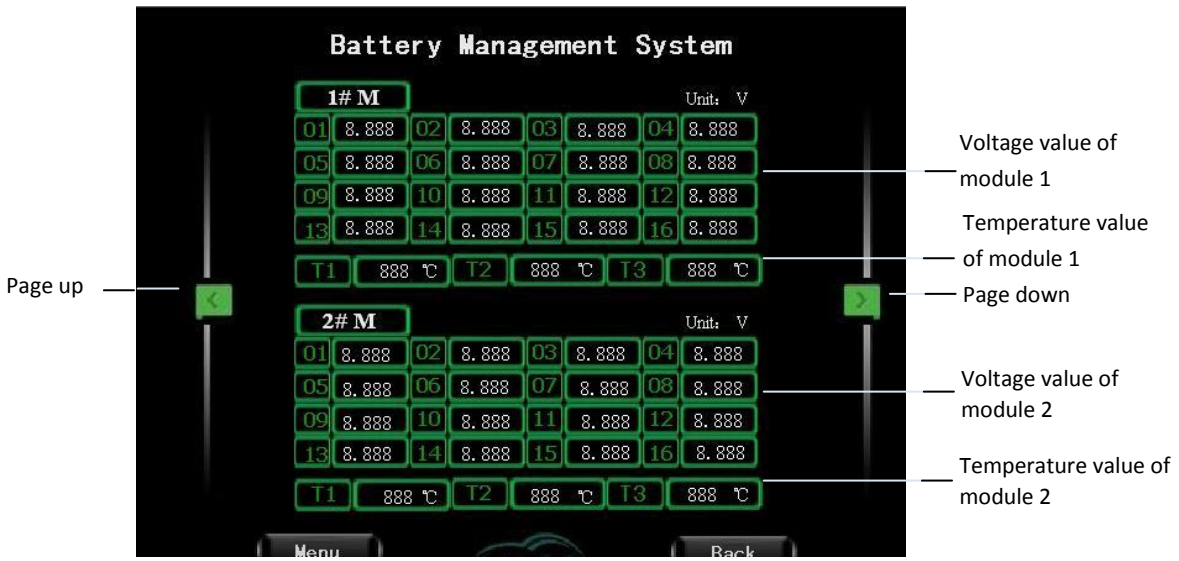


Figure 4-5 Single Cell Information

Remarks: above figure gives the corresponding information of modules 1 and 2. Each module includes the information of 16 single cell voltages and 3 module temperatures.

4.5 Display of Charger Information

The system enters into corresponding charger interface after clicking Charger .

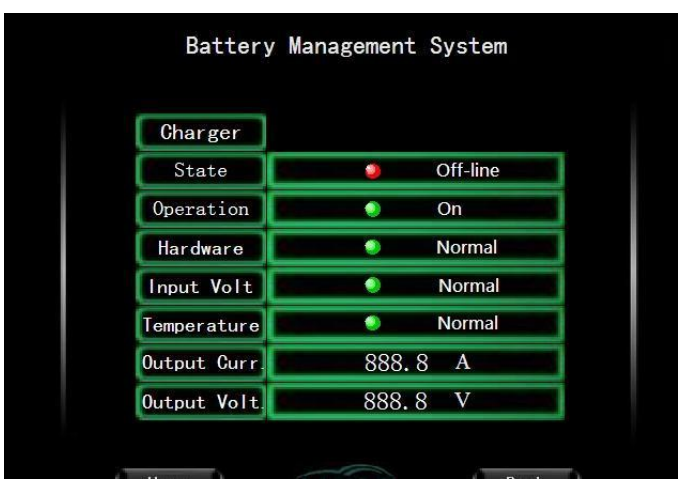


Figure 4-6 Charger Information

Remarks: the interface displays some information of charger. Receive the corresponding messages of charger through CAN communication and display them on the touch screen.

■ **Explanation of parameters**

♦ Online status: communication status of charger; it displays online when charger is communicating with BMS; otherwise, it is offline; the default status is offline.

♦ Starting status: indicate whether the charger has started to charge; it indicates starting after starting to charge; otherwise, it is stopping; the default status is normal.

♦ Hardware fault: malfunction of charger itself, default to normal.

♦ Input voltage: indicate the status of charger input voltage, default to normal.

♦ Temperature status: indicate the temperature status of charger, default to normal.

♦ Output current: indicate present charging current of charger.

♦ Output current: indicate present charging voltage of charger.

4.6 Display of Battery Statistical Information

The information is mainly used for analysis of battery performance and application status.

➢ Step 1: change user information to senior user.

➢ Step 2: click Battery Information.

➢ Step 3: click Statistical Information.

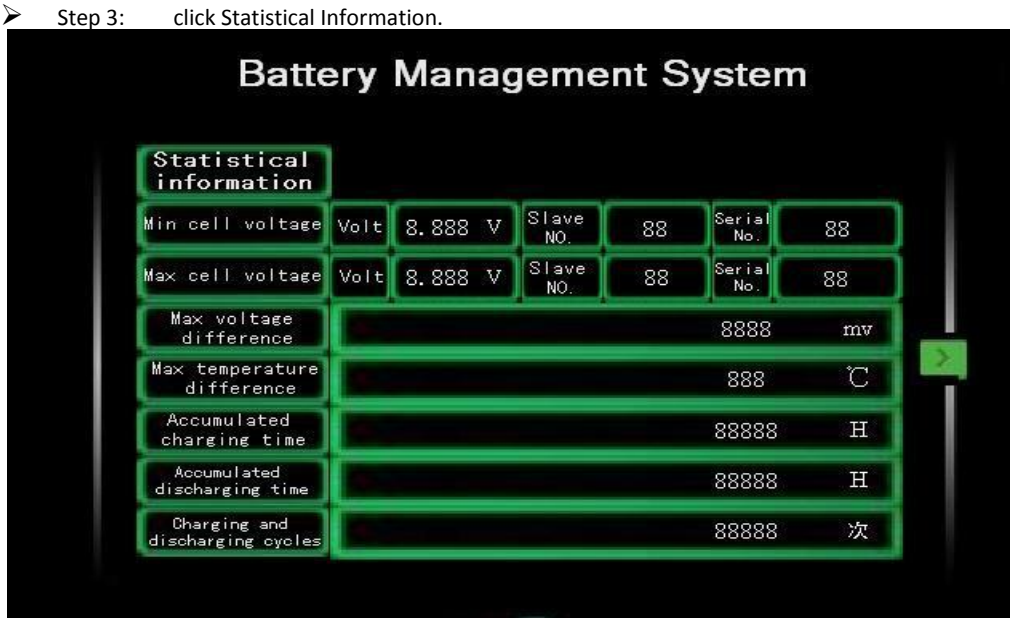


Figure 4-7 Statistical Information

4.7 Configuration Interface

In order to evaluate all parameters of battery accurately, it is necessary to re-configure BMS before its initial running. The configurable content includes: total capacity of battery pack (nominal capacity), current surplus capacity of battery pack, maximum charging voltage, maximum charging current, over-charge voltage of single cell battery, over-charge release voltage of single cell battery, under-voltage protection voltage of single cell battery, under-voltage release voltage of single cell battery,

over-discharge protection voltage of single cell battery, over-discharge release voltage of single cell battery, over-temperature protection temperature and over-temperature release temperature.

- Steps of parameter configuration:

➢ Step 1: change user information to senior user.

➢ Step 2: click Configure Information of main interface. The system displays a configuration interface as shown in figure 4.7.1.

➢ Step 3: click "Read" to read the default configuration parameters of host. The system doesn't support automatic reading of configuration parameter. Therefore, it is required to click "Read" after entering the configuration interface.

➢ Step 4: click the corresponding parameter column to modify the corresponding parameter.

➢ Step 5: Click Write in to enter the password 8888. Configuration parameters are related to the running status of system. Therefore, they cannot be altered at will. After clicking, if you didn't operate step 3 previously, the dialog box for reading will pop up. If you have operated step 3, system will pop up a dialog box for write-in confirmation. The configuration parameter can be read before writing in.

➢ Step 6: When writing into the dialog box, click "Write in" and wait for 5 seconds around. It means that the setting operation has been finished when the COM indicator light flashes normally. If the indicator displays abnormally, you can click Write in again and then click " Return" .

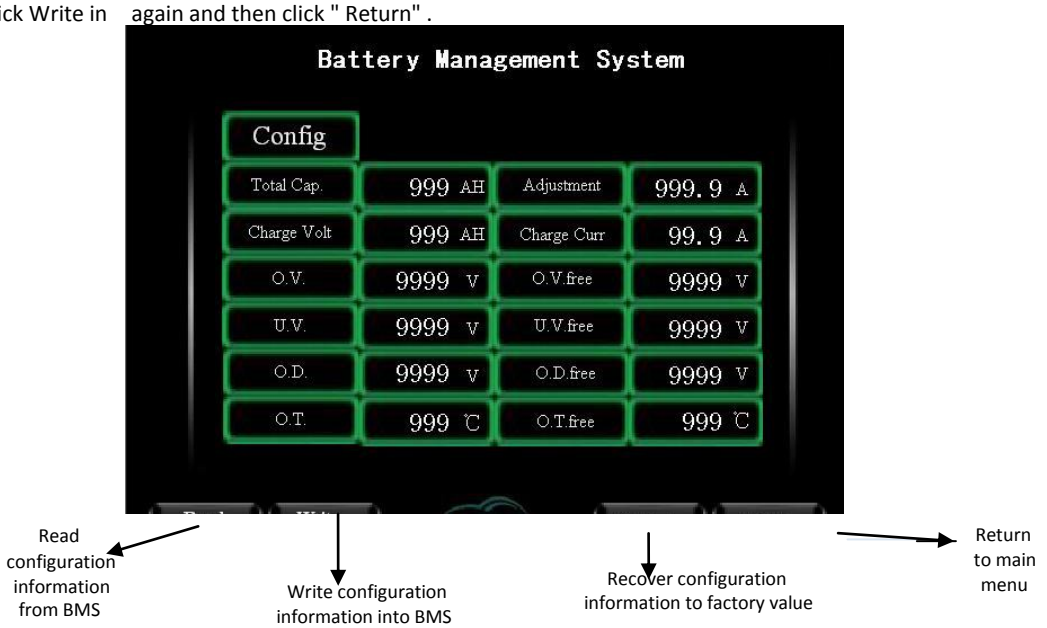


Figure 4-8 Configuration Information

Remarks: the relationship between configuration parameters is as follows:

1. over-charge voltage > over-charge release > under-voltage release > under-voltage voltage > over-discharge ,release > over-discharge protection
2. Over-temperature release < over-temperature protection
3. Surplus capacity < total capacity

- **Recover configuration parameters to default value:**

➢ Step 1: click the button Restore Default. The dialog box to inquire whether confirm the restoration pops up.

➢ Step 2: Click OK in the popped-up dialog box. Then, the configuration information restores to default value.

➢ Step 3: click "Write in" to write default value into BMS.

Chapter 5 Application of Upper Computer Software

5.1 Function of Upper Computer Software

- Communicate with BMU, BCU, memory module and LDM.
- Analyze the data information transmitted by all modules and then display voltage, temperature and configuration value and so on.
- Configure information for each module through upper computer.
- Can request data automatically.

5.2 Software Installation

- System requirement: all systems above Win98.
- Software running: operate .EXE file directly.

5.3 Application of BMU Upper Computer

BMU can be tested and configured independently through using upper computer software.

1. Main interface of configuration

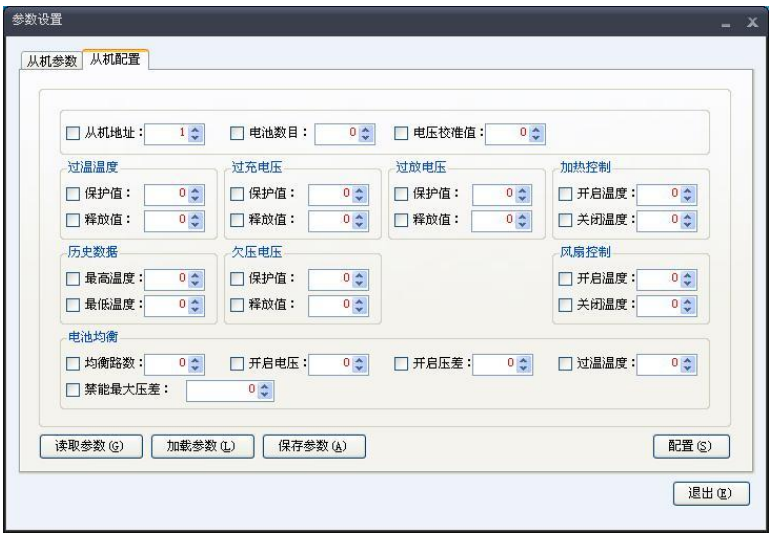


Figure 5-1 Main Interface of M1112 Slave Parameter Configuration

The default configuration parameter of Slave Configuration is as shown in the table below:

1	Slave address	Configure according to actual situation. Range: 1~255 2
2	Battery quantity	Configure according to actual situation. Range: 1~12 strings
3	Voltage calibration value	Configure according to actual situation. Range: 5000~5000mV
4	Over-temperature threshold	Protection value: 60℃
		Release value: 40℃
5	Over-charge voltage	Protection value: 3850mV
		Release value: 3400mV
6	Over-discharge voltage	Protection value: 2600mV
		Release value: 2800mV
7	Heating control	Opening temperature: configure according to actual situation
		Closing temperature: configure according to actual situation
8	Historical data	Maximum temperature: factory configuration is 25℃.
		Minimum temperature: factory configuration is 25℃

9	Under-voltage threshold	Protection value: 2900mV
		Release value: 3000mV
10	Fan control	Opening temperature: 60℃
		Closing temperature: 40℃
11	Battery balance	Number of balance channels: 2
		Opening voltage: 3550mV
		Opening differential voltage: 40mV
		Over-temperature threshold: 60℃
		Maximum differential voltage of energy forbidden: 800mV

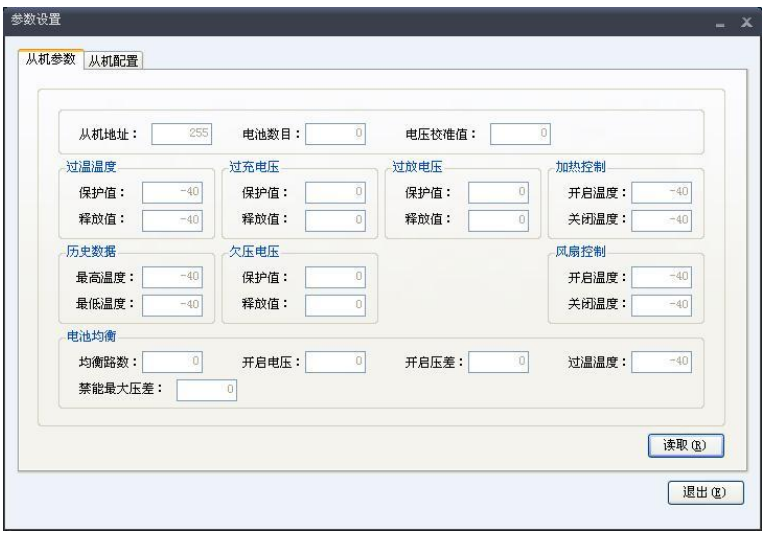


Figure 5-2 Display Interface 3 of Upper Computer Configuration

2. Parameter configuration method

◆ Run upper computer software. Enter interface 1 of dialog box for upper computer connection and connect USB-CAN converter.

◆ Click “Connect“(C) to enter interface 2 of dialog box for device connection (figure 5-4). Select the corresponding device number, channel number and baud rate. Then, click Connect (O) .

Figure 5-4 Interface 2 of Dialog Box for Upper Computer Device Connection

◆ After entering the interface 3 of dialog box for upper computer connection, select "Separate-Slave (S)" to enter the display interface 1 of BMS upper computer configuration (figure 5-5).

Figure 5-6 Display Interface 1 of Upper Computer Configuration

◆ Parameter configuration

Click “Parameter Setting" to enter the dialog box of parameter setting. Select the option "Slave Configuration" . Then, click the button "Load Parameter (L)" to import parameter configuration files or manually fill in data to be configured and select the front check box. Finally, click Setting (S).

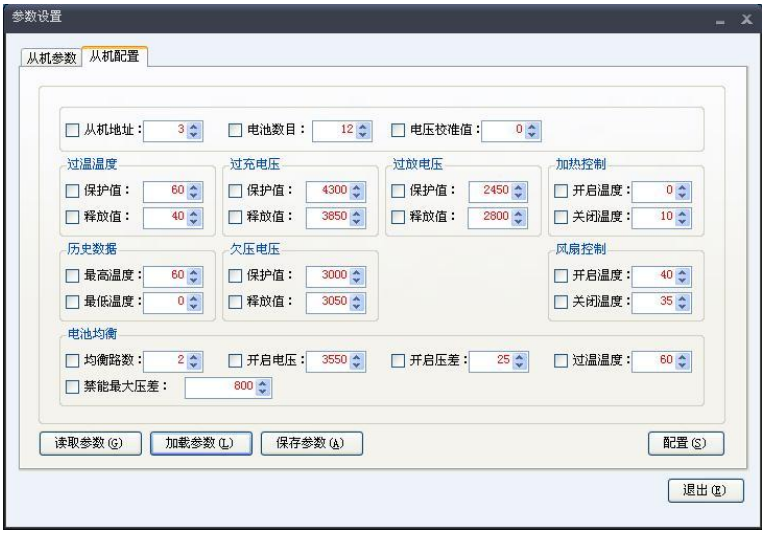


Figure 5-7 Display Interface of Parameter Setting

You can also click the button "Read Parameter (G)" to gain all configuration parameters of slave and modify them as required. When configuring the slave in batches, you can click Save Parameter (A) to generate the similar configuration files as Slave _03_2011_09_01_02_44.lgpara. Hereafter, you only need to re-load.

After finishing the configuration, you can click Read Parameter (G) or return to Slave Parameter. Then, click Read (R) to check the configured slave data. Click Esc (E) to return to main interface after the completion of configuration. Click "Gain (G)" to obtain all data of slave. Select the check box "Automatically Gain" and set the interval time. Then, click "Gain (G)" again to obtain slave information periodically.

5.4 LDM Upper Computer

LCD can be detected independently through using upper computer software. The detection step is as follows:

- Step 1: connect the positive pole and negative pole of LDM to the master positive pole and master negative pole of battery respectively.
- Step 2: connect LDM with PC through USB/RS485 adaptor.
- Step 3: supply power for LDM with DC12V or DC24V.
- Step 4: open upper computer software (initialization setting as shown in figure 5-9), "Port" is COM1 (freely configure according to upper computer interface), Baud Rate is 9600, Check Bit is None, Data Bit is 8, Stop Bit is 1. Then, click the Open Serial Port in the interface.
- Step 5: after connection of power cord, click the button "Check" (parameter check as shown in figure 5-10) in the interface to read display value.

⚠Normal detection conditions of insulation monitoring:

- Insulation resistance of positive pole: >1MΩ.
- Insulation resistance of negative pole: >1MΩ.
- Total voltage: only values above 100V are valid.
- Fault code: 00 stands for normal working; 01 stands for offline status; 02 stands for electricity leakage.
- Working code: 00。

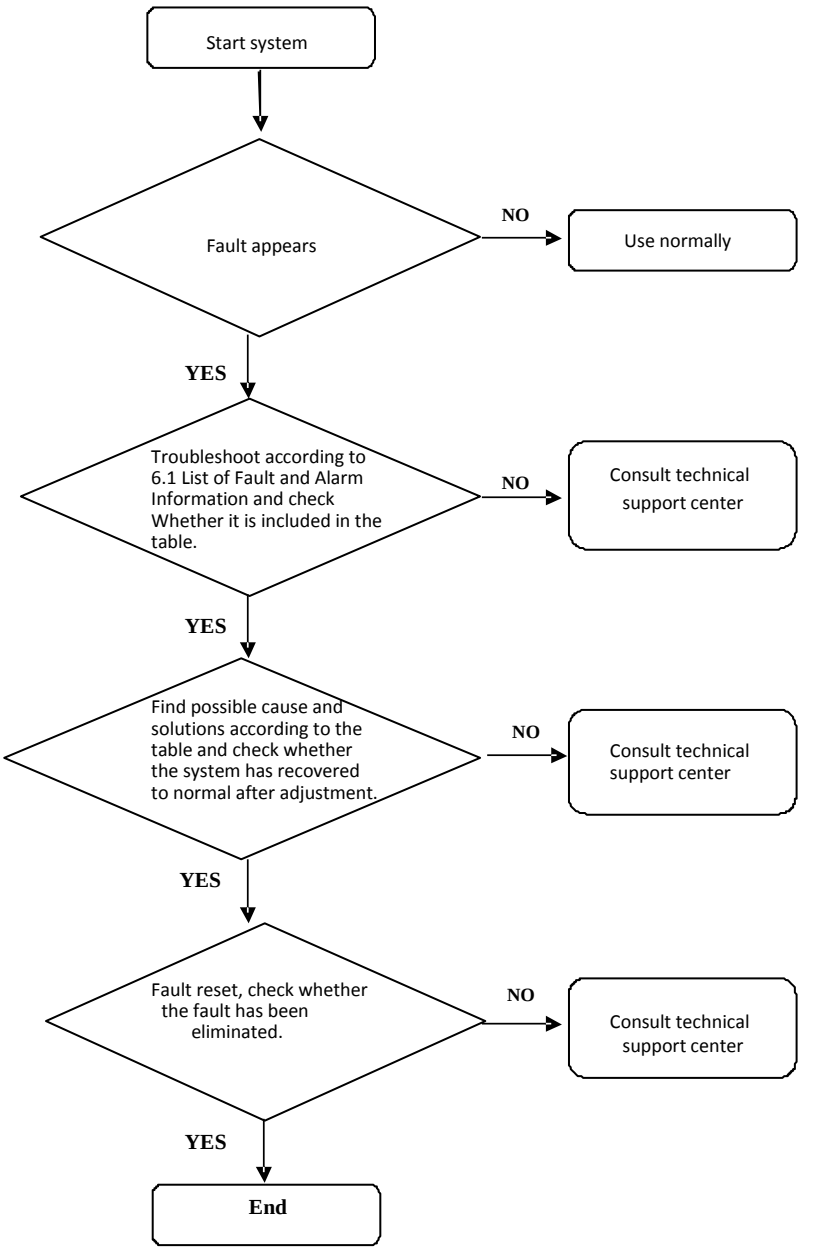
Chapter 6 Fault Diagnosis

6.1 List of Fault and Alarm Information

EK-FT-11 BMS has perfect management functions, which can prolong the service life of battery. Some fault tips may appear during application. Please carry out analysis, judge causes and eliminate fault according to the following table.

No.	Fault Description	Possible Cause	Solutions
1	System doesn't work.	1. working voltage incorrect 2. no power supply 3. DC power supply damaged	1. Check whether the working voltage is within normal voltage range. 2. Supply power for system. 3. Maintained by professional technicist.
2	Buzzer alarms and LCD displays fault.	1. Over-charge, over-discharge or under-voltage 2. over-temperature 3. communication interrupted	1. Check parameter setting of battery protection. 2. Disconnect charger or stop supplying power for battery. 3. Check communication interface.
3	Buzzer alarms. But LCD has no fault display.	1. Temperature difference at temperature detection point is too large. 2. SOC too low	1. Stop charging and discharging and restart after temperature recovery. 2. Charge battery or correct configuration manually.
4	LCD displays error communication.	Incorrect connection of communication cable	Check whether the power interface of LCD is loose or has fallen off.
5	LDC displays voltage=0 (multiple batteries or two consecutive batteries)	Incorrect connection of voltage cable	Check whether the voltage detection cable harness is connected in good stations.
6	The maximum temperature indicates -40℃.	Incorrect connection of temperature sensor	Check and reconnect temperature sensor.
7	Voltage display of partial batteries is abnormal.	Incorrect connection of voltage collection cable for the corresponding battery	Check and reconnect voltage collection cable.
8	Current displays positive when discharging and displays negative when charging.	Incorrect installation direction of current sensor	Change the direction and re-install current sensor.
9	No current display	Incorrect connection of current sensor	Check whether the current sensor is connected in good stations.
10	There is current display when system is static.	"Current digital calibration" is not set.	Refer to "explanation of configuration parameters".
11	Current display is incorrect when system is operated.	Incorrect matching of current sensor	Check whether the current sensor is original configuration of system.
12	LCD doesn't work.	No power supply voltage	1. Check whether the host has supplied power. 2. Check whether the power cord between host and LCD is connected correctly.
13	Charging current ＜ maximum current of charger	Maximum charging current is set too low.	Reset parameter of maximum charging current.
14	Cannot protect over-charge or over-discharge	Incorrect parameter setting	Reset parameter
15	SD card cannot write in.	SD card write-in is protected.	Switch off SD card write-in protection.

6.2 Procedure of Fault Diagnosis



Chapter 7 Daily Maintenance

Factors as service environment (such as temperature, humidity, dust and interference and so on), aging and abrasion of internal components and so on will increase the fault occurrence rate of system. It is necessary to carry out daily maintenance to decrease fault occurrence rate and prolong system service life.

Caution:

Only trained professional operators can disassemble and replace the internal components.

It is necessary to switch off the power supply before checking and maintaining.

Prevent metal or other matters being left in system. Otherwise, system may be short circuited and damaged

Daily maintenance	Service environment	※In order to improve the function realization and prolong the service life of system, it is necessary to keep good installation environment. Generally, it is required to avoid direct high light for long time or other radiation and prevent water, other fluid, dust or dirt and so on from entering.
	BCU and BMU modules	※Check input voltage and input current with voltmeter and ampere meter to see whether they are within normal range. You can refer to description of system parameters. The output voltage and output current also can be checked with voltmeter and ampere meter to see whether they are within rated range. It is possible to perform intuitive judgment through touching, smelling and visual inspection to prevent these factors influencing its functions.
	LCD	※It is necessary to clean LCD frequently to keep it clean. Don't crash or abrade it. Otherwise, the sight line will be interfered, which will cause incorrect judgment.
Component replacement	Different components have different service life. The service life of components is influenced by environment and application conditions. Keeping good operating environment is good for the improvement of component service life.	※Wires of various plugs (e.g. air plug), PIN connector and serial port easily fall off from their welding spot, causing open circuit. Please replace them in time if there is any damage. It is necessary to cut off power supply before replacement. ※ DC-DC is easily short circuited or damaged under high voltage. Please replace it in time if there is any damage. It is necessary to cut off power supply before replacement. ※ Various wires are easily of short circuit or open circuit due to vehicle vibration, aging or falling off of plug from welding point. Please replace them in time if there is any damage. It is necessary to cut off power supply before replacement.
Regular maintenance	※ Check whether any connector assembly is loose. If yes, please fix it. ※ Check whether any cable is worn. If yes, replace it in time. ※ Check the communication between BCU and BMU. If the communication is abnormal, please check it by yourself according to appendix. If the problem still cannot be solved, please contact technical support center of our company in time. ※ Check module collection accuracy; mainly refer to voltage accuracy and temperature accuracy. It is necessary to check whether the voltage is within normal range with special instrument when measuring voltage. Also, use special instrument to detect whether the battery temperature is consistent with the value displaying on console. Please check it by yourself according to appendix if there is any abnormality. If the problem still cannot be solved, please contact technical support center of our company in time. ※ Regularly check whether LCD display is normal. Please check it by yourself according to appendix if there is any abnormality. If the problem still cannot be solved, please contact technical support center of our company in time. ※ Regularly check whether any module is loose. If yes, please tighten it in time.	

Appendix List of System Accessory

List of Accessories

No.	Name	Specification	Qty	Remarks
1	BCU	1-25 groups of BMU	1 PCS	
2	BMU	1-12 strings	M PCS	
3	LDM	0~800V	1 PCS	Optional
4	Serial communication cable	1 meter	M PCS	Connect BMU and BCU, among BMUs
5	CAN bus cable	1 meter	1 PCS	Connect with charger
6	BCU power cord	1 meter	1 PCS	Supply power for BCU
7	Voltage detection cable harness	N string (s)	M(N+1) PCS	1 set of voltage detection cable harness includes N+1 pieces of voltage detection cable
8	Temperature sensor	1 meter	M set	Each set of temperature sensor has 3 temperature sensing probes.
9	Current sensor	0-1000A	1 PCS	
10	Connecting wire of current sensor	1 meter	1 PCS	Connect with BCU and Hall sensor
11	LCD communication power cord	1 meter	1 PCS	Connect with BCU and LCD
12	Upper computer software		1 set	Optional
13	LCD	3.5''/5.7''	1 PCS	Optional
14	User manual	1 copy		
15	Outgoing inspection report	1 copy		
16	Certificate of conformity	1 copy		
17	Bill of sales	1 copy		