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EK-YT-21
Battery Management System
User Manual

EK-YT-21 Battery Management System
LG/A-019-1109'September 2011

Foreword

Thank you very much for choosing our EK-YT-21 BMS (BMS: Battery Management System). In order to help you install, use and maintain the product better, please read our user manual (hereinafter referred to as manual) carefully before installing and using it.

EK-YT-21 BMS is a new generation of BMS specially developed for light cars, mini-cars, space vehicles and electric motorcycles. Because of the low working voltage of light cars, mini-cars, space vehicles system, less strings of battery pack can meet the requirement of the system. Due to limited total volume, the electric motorcycles require a kind of BMS with smaller volume, more functions and more stable performance.

EK-YT-21 BMS can also be applied to forklift trucks, road sweepers and other special vehicle as emergency power supply for communication base station BMS etc.

With unique design structure of collection and control in collection, EK-YT-21 BMS reduced its volume greatly, lower the requirement for installation space; its high integration degree of the system makes wiring installation more concise .

EK-YT-21 BMS also provides communication mode of CAN Bus, RS485 Bus, and perfect balance failure protection and balance control strategy.

1.1 Suggestion

This manual contains important information that the users must grasp, if customers are not in strictly with the manual direction to install, use and maintain the product, our company would not take any relevant consequence and responsibility.

1.2 Qualifications and Relevant Certificates of Company

1.3 Statement

To ensure the accuracy, this manual has been validated and rechecked.The description and direction of EK-YT-21 BMS in this manual is correct ,but because of technical improvements, the EK-YT-21 BMS and the manual may change without prior notice.

Prominent Advantages of EK-YT-21BMS

■ Power Function

System integration of voltage, current, temperature and other battery information collection functions, integrated SOC estimation, battery balance, data storage and other ancillary functions, support CAN Bus, 485 Bus communication, relay control, stem node control and other management features, function is powerful

■ High Reliability

Adopting multiple power isolation plans in order to greatly increase reliability of the system sampling and communication; high redundancy design of circuit enhance the stability of system; unique balance failure protection to ensure the balance function in stable state; protection circuit design for each of the power supply output interface, effectively improve fault tolerance of the system; passed EMC test, insulation resistance, pressure-proof, high and low temperature aging, waterproof, dustproof and vibration experiment to ensure the system is in reliable operation.

■ Easy Installation

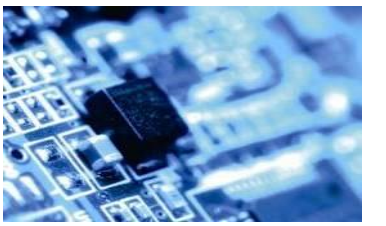
Unique integration design of detection and management integrates the collection system and control function in one module, only 4 interfaces achieve a variety of collection, detection, communication and control functions, greatly reduces the complexity of system connection, improves efficiency of the product installation, commissioning and maintenance convenience.

■ Small Volume

Highly integrated automotive control chip, small volume and excellent performance of automotive components, realize three-dimensional narrowing of length, width and height, greatly improve the product adaptability to various models and equipment

■ High Accuracy

Adopting unique SOC estimation algorithm of battery capacity-- Vmin-EKF algorithm (theory) estimation accuracy is over 97%,being the first in this industry; based on unique D– filter algorithm with high accuracy collection system; system parameters (dynamic battery voltage, current, etc) collection errors are higher than this industry



■ Widely Application

High reliability, small volume, powerful function and other features make the system can be widely applied to various electric vehicles (such as electric motorcycle, light cars, mini-cars and the space vehicles), special vehicle and communication base station BMS, especially suitable for a variety of small volume, small capacity battery system.

Typical Application of EK-YT-21 BMS

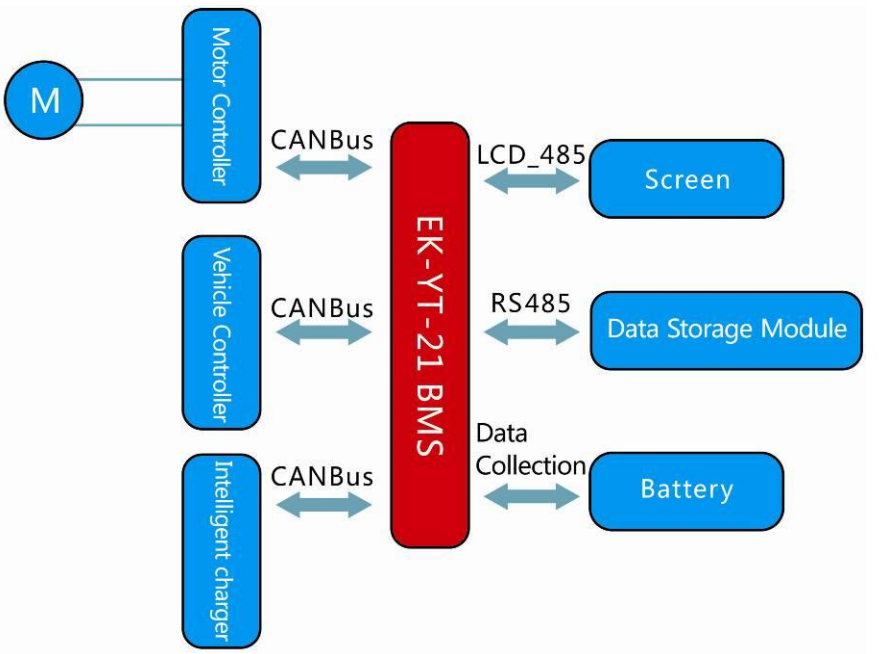
EK-YT-21 BMS can be widely used in a variety of less than 24 strings of battery system, from electric vehicles battery to emergency power supply of communication base station, meet different customers' various requirements in a full range.

■ Application in Electronic Vehicle

BMS plays a very important part in the whole electric control system of the electronic vehicle. BMS manages the whole system in a safe, reliable and high efficient way by communicating with MCU and intelligent charger.

➢ **Technical Features:**

- ◆ Strong communication function: Communicate with MCU and intelligent charger via CAN-Bus or RS485 to insure the efficient of the vehicle. Communicate with monitor via RS485 to show real-time parameters of the vehicle;
- ◆ Perfect system control : BMS set up a perfect system control strategy, the alarm and the corresponding control signals would be sent out timely and accurately when the overcharge, under voltage, over discharge, over-current, over-heat occurs ; including sound and light alarm, CAN communication, switch signal and the relay control.
- ◆ Powerful environmental adaptability: the system through EMC testing, high and low temperature aging, waterproof and dustproof, vibration and other simulation experiment, can be adapted to the actual use of electric transport processes in a variety of harsh environment, ensure the reliable operation of system;



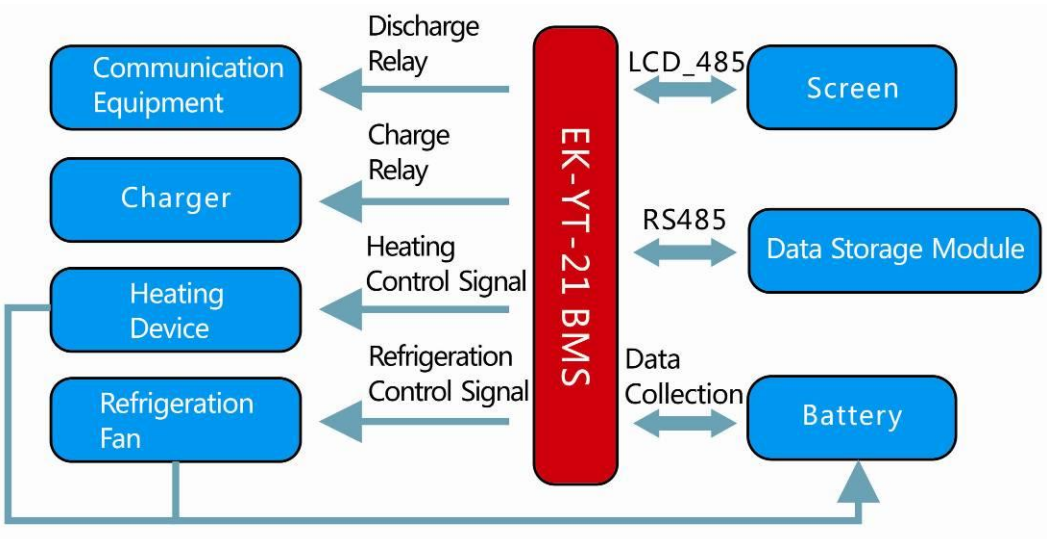
Pic 1 Electric Transport System (uncertain)

■ The Application of Communication Base Station

Although communication base station environment is relatively stable, its working state need asks for an extremely stable system if keeping working. Only more stable, more reliable management system can effectively ensure power supply to the communication base station.

➢ **Technical Features:**

- ◆ Powerful Protection Function: Overcharge protection, under voltage protection, over discharge protection, over heat protection, over current protection etc, and reasonable logical control, provide powerful protection for equipment continuous and stable operation
- ◆ The comprehensive early warning: LCD screen sound alarm, LCD screen icon warning, buzzer alarm management system and other sound and light warning mode, improve the system of early warning ability, facilitate a timely processing to equipment
- ◆ Storage and analysis of data: Optional DSM to achieve real-time record and save every key data, then analyze and reconstruct all the data to establish a best mode of charge and discharge;



Pic 2 Communication Base Station System

Security Guide

- Security warning explanation:

 Hazards: Hazards that may cause fire or serious personal injury or death due to the failure of following required operations.

 Attention: danger that may cause a slight or moderate injury or damage to the system due to the failure of following required operations.

Please read this part carefully during installation, adjustment or repairing. The user must follow the security instructions of this part. In case of any damage or loss caused by any irregularities, the manufacturer party won't take any responsibility for the damage or loss.

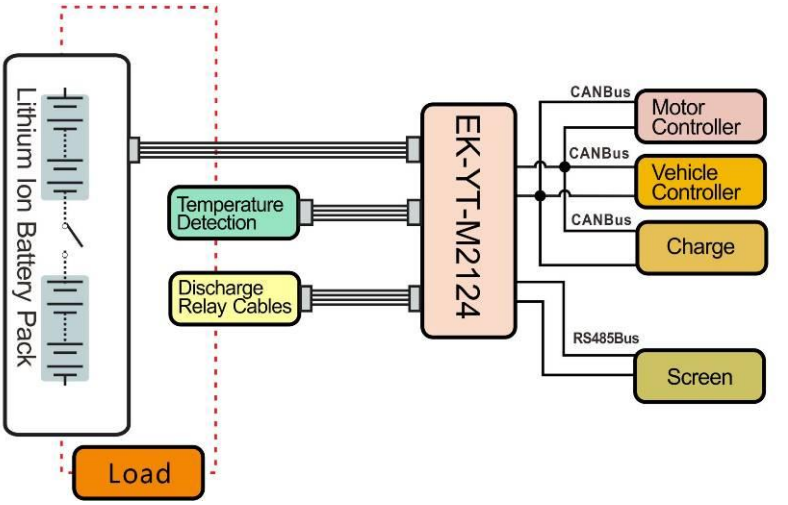
Usage	Hazards
	● This series of BMS must be specified voltage of power supply, or the system will get damaged. ● This series of BMS is applied for monitoring and management of battery pack. It can't be used for other application, or it will cause system failure or fire.
Inspection of the goods' arrival	Attention
	● If it is found the BMS is damaged or any parts are missing, don't install it .or accident may occur. ● When the goods you receive doesn't match the Pack list ,please contact sales person soon before installation.(see Part Eight of this manual: Service Direction)
Installation	Attention
	● Handling with care during moving, installation to avoid damage of the product or injury to the person. ● Keep away from inflammable items and heats. ● Never let debris come into the BMS, otherwise it will lead to system failure. ● The shell of Insulation Test Module must have good connection with the body of the vehicles, or the module will be ineffective.
Wiring	Hazards
	● Wiring should be operated by qualified electrical engineers. Otherwise, there will be risk of electric shock or damaging the system. ● Before wiring, make sure the power supply is cut off or it has risks of electric shock or fire.
	Attention
	● Strictly follow the sequence of the address of the Data Collection Module during installation, or the data that DCM has collected won't match with the data that the screen displays. ● Make sure if the serial number of DCM is the same with the battery serial number, otherwise it leads to incomplete data collection. ● Make sure the sequence of wiring of voltage monitoring cables is right or not, or it will damage the system ● Check the wiring of relay is correct or not, or it will cause system failure or battery pack damage. ● Check the wiring of positive pole and negative pole of the power supply is correct or not, or it will cause system failure.
Operation	Hazards
	● After all the modules and wirings are correctly connected, power on the system. ● The parameter on the screen can't be changed at ease, or it might damage the battery pack.
	Attention
	● Before running, make sure this system is used within the allowed conditions and applications, or it might cause system failure. ● Before running, make sure the control strategy is correct or not, or it might cause damage to the battery pack.
Maintenance And check	Hazards
	● Cut off the power supply before removing the shell to avoid the risks of electric shock ● Circuit board has a lot of chips. Don't touch it to prevent electrostatic damage to the circuit board. ● Specify qualified electrical engineers for maintenance, inspection or replacement of parts.
Other	Hazards
	● Prohibit self-transformation of this system to avoid any serious accident.

Catalogue

Chapter 1 Introduction of EK-YT-21 Battery Management System

1.1 System Structure

EK-YT-21 BMS is composed of EK-YT-M2124 module which has functions of system management and information monitoring, monitor(optional), current sensor and cables.



Pic 1-1 System Structure

1.2 System Configuration

Pic 1-2 System Configuration

1.3 Function of System

The EK-YT-21 system adopts the design of detection and management in collection , with high precision, high accuracy function of information collection, can collect voltage of single cell, battery voltage, battery box temperature and other data, balance single cell ,analyze and processing the battery pack data; send alarm and control according to the battery status

The EK-YT-21 system through the current sensor to collect current data, determine the charging and discharging state, complete working current measurement, charge and discharge control of the battery pack, comprehensive utilization of the battery data to do SOC estimation and discrete evaluation.

The EK-YT-21 system can also real-time display the battery pack voltage, current, temperature, SOC etc. and convenient setting by screen.

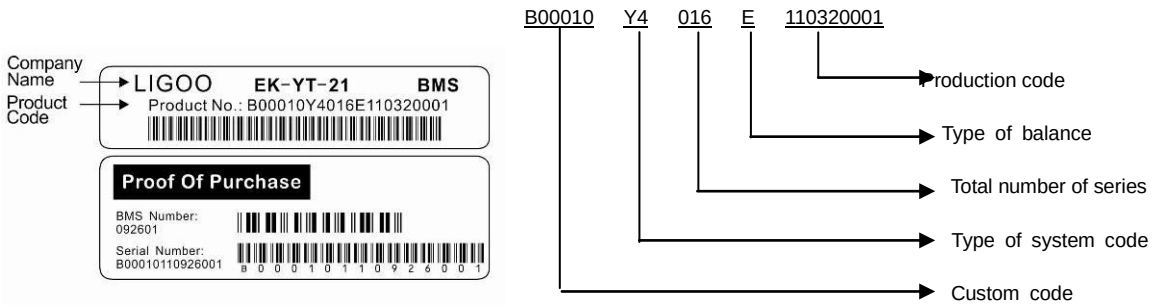
1.4 Technical Parameters

Table 1-1 Technical Parameters of BMS

	Specification	Remarks
System Power Supply	DC12V/DC24	DC9~16V/DC16~32V
System Power	≤3W	Not Including Screen and other accessories.
Accuracy of Monomer Voltage Detection	±10mV	0~4.7V
Current Accuracy	±1%	±500A
	±0.3A	≤30A
SOC Accuracy in theory	≥97%	
Accuracy of Temperature Detection	±1℃	-40℃~85℃
	±2℃	85~125℃
Rated Current of Relay	≤1A	Peak≤2A
Rated Current of Switching Signal	≤1A	
Working Temperature Range	-20℃～70℃	
Storage Temperature Range	-40℃～85℃	
Balance Current	250mA/Circuit at most	
Working Moisture Range	40%～90%	
Anti-electromagnetic Interference Range	400MHZ~1000MHZ	

Note)* Voltage of single cell only take Lithium iron phosphate battery for example, other types of batteries can be customized based on customer requirements

1.5 Product Code



Pic 1-3 Product System Code

Chapter 2 EK-YT-M2124 Module in EK-YT-21 BMS

2.1 Function of EK-YT-M2124

EK-YT-M2124 is the core equipment in EK-YT-21 for collect, process and control of system data. The main functions are as follow:

Information Collecting Function

- Max.24 of single cell voltage real time high precision data collection and wave filtering processing
- Max. 4 of real time acquisition and processing to temperature sensor signal
- Collection and processing to charging and discharging current

Communication and Control Mode

- 1 CAN-bus communication
- 1 communication mode of display screen LCD_485
- 1 RS485 communication mode to realize customers' requirement
- 2 relay control modes (charge and discharge)
- 2 switch signal control modes

Battery equilibrium strategies

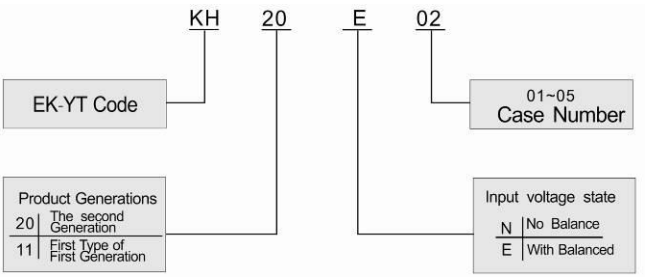
- The battery voltage real-time detection of consistency
- The 250mA charging balance
- The balanced failure protection function

System Management Function

- SOC high precision estimation
- The battery failure alarm

- Real time processing and distribution of battery pack and system information

2.2 Model of EK-YT-M2124 Module



Pic 2-1 EK-YT-M2124 Module Mode

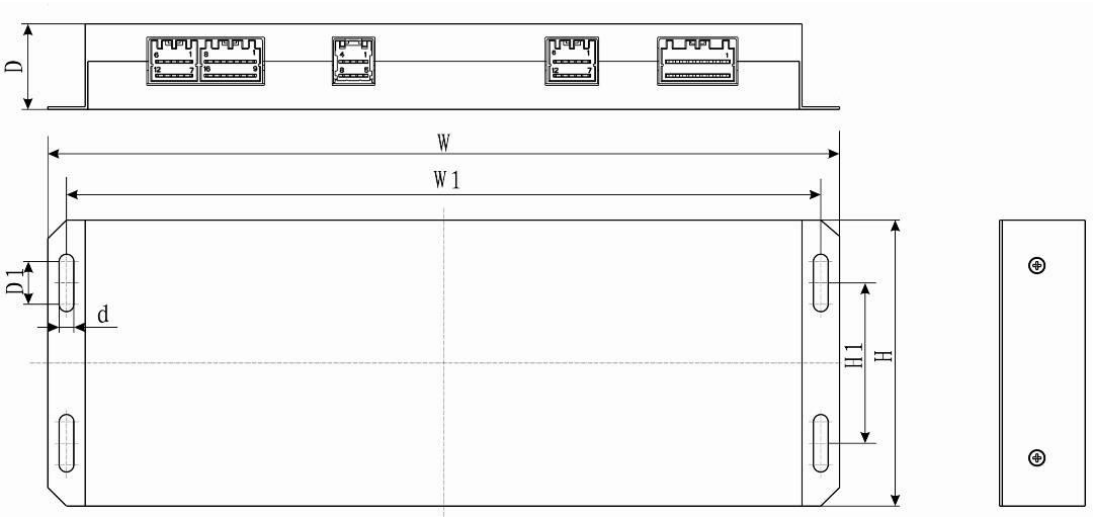
2.3 EK-YT-M2124 Module Basic Protection Parameters

Table 2-1 EK-YT-M2124 Module basic protection parameters (uncertain)

Name	Value
Overcharging protection voltage	3.70V
Overcharging release voltage	3.60V
Under Voltage alarm voltage	3.15V
Under Voltage release voltage	3.20V
Over discharging protection voltage	2.60V
Over discharging release voltage	2.8V
Over heat protection temperature	55℃
Over heat release temperature	40℃

Note)* The above parameters are basic protection parameters, they can be configured according to customer demand.

2.4 EK-YT-M2124 Module Installation Size



Pic 2-2 EK-YT-M2124 Module Installation Size Diagram

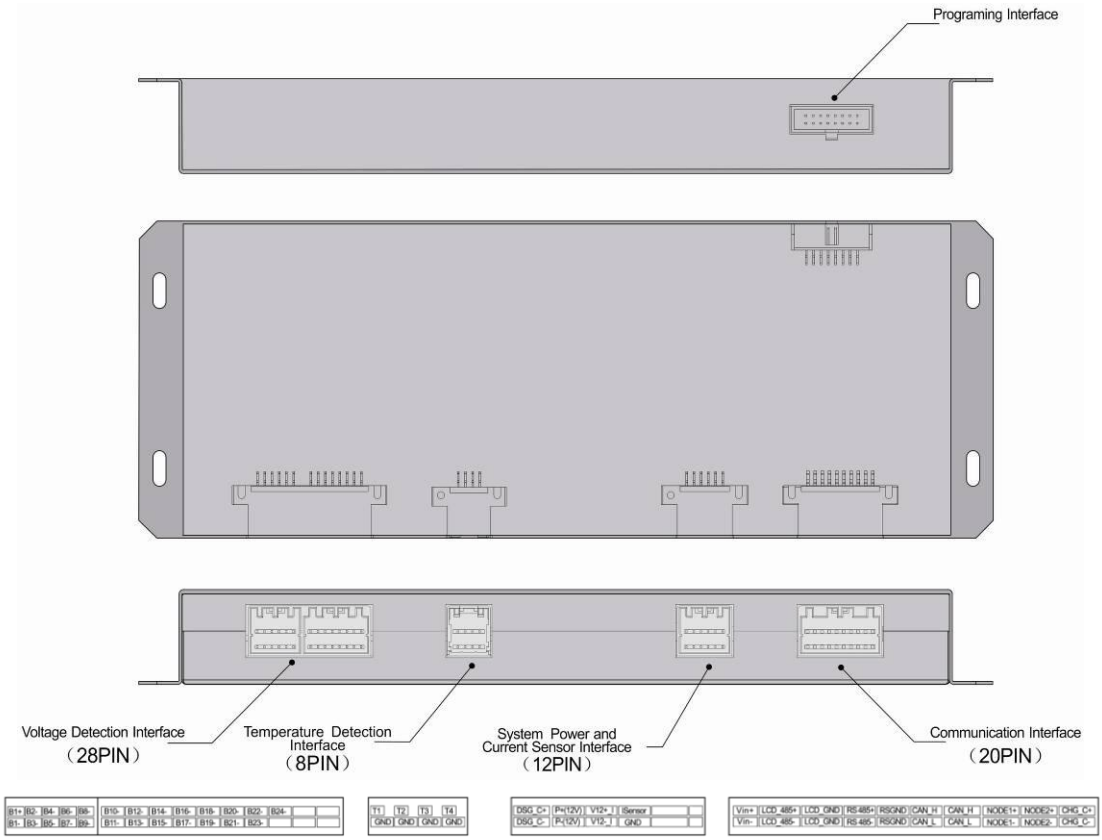
Table 2-2 Size of EK-YT-M2124 Module

Product Name	Product Model	*Shape and Installation Size（Unit：mm）*							Weight(KG)
		W	H	*D*	W1	H1	D1	d	
EK-YT-M2124 Module	KH20E02	296	107	31	283	60	12	4.5	0.89

Note)* W, H, D as the external structure size, W1, H1, D1 as the installation size of internal structure , D is width of installation hole

2.5 EK-YT-M2124 Module Interface

- **2.5.1 EK-YT-M2124 Module Interface Distribution**



Pic 2-3 EK-YT-M2124 Module Interface Distribution Picture

■ 2.5.2 EK-YT-M2124 Module Interface Function

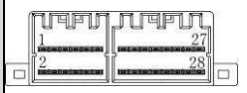
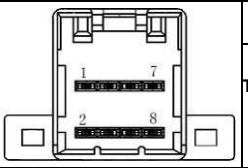
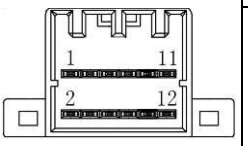
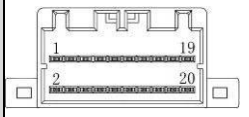
Table 2-3 EK-YT-M2124 Module Interface Function

Interface Number	Interface Name	Interface Function
1	**Voltage Detection Interface**	Fulfill the voltage detection of a single battery
2	**Temperature Detection Interface**	Real time monitor of battery temperature
3	**System Power and Current Sensor Interface**	Supply the working voltage of EK-YT
		Connect to current sensor to monitor real time working current.
		Output control of discharge relay
4	**Communication Interface**	LCD display power output
		LCD display 485-bus
		CAN-bus to communicate with vehicle control system
		CAN-bus to communicate with charge
		485 to communicate with optional DSM

		Reserve 2 switching signal control circuit to meet customer specified
		Control charge relay

■ 2.5.3 EK-YT-M2124 Module Interface Define

Table 2-4 EK-YT-M2124 Module Interface Define

	Interface Exterior	Interface Line Order Define								
1		1	2	3	.....	25		26/27/28		
		B1+	B1-	B2-	.....	B24-		空		
2		1		3		5		7		2、4、6、8
		Temperature Sensor Signal 1		Temperature Sensor Signal 2		Temperature Sensor Signal 3		Temperature Sensor Signal 4		GND
3		1	2	3	4	5	6	7	8	9、10、11、12
		Discharge Relay Control+	Discharge Relay Control-	System Power Input+	System Power Input-	Current Sensor Power Output+	Current Sensor Power Output -	Current Sensor Signal Input	GND	空
4		1		2		3		4		5
		LCD Power Output+		LCD Power Output-		LCD RS485+		LCD RS485-		GND
		6		7		8		9		10
		GND		RS485+		RS485-		GND		GND
		11		12		13		14		15
		CAN_H		CAN_L		CAN_H		CAN_L		External Switching Signal Control 1+
		16		17		18		19		20
		External Switching Signal Control 1-		External Switching Signal Control 2+		External Switching Signal Control 2-		Charge Relay Control +		Charge Relay Control -

Chapter 3 Screen on EK-YT-21 BMS

3.1 Screen Function

Screen is the User Interface of system running situation. All types are all designs by industry standard and suitable to various environments. The display interface of screen can display all kinds of operation parameters of the system and fault condition.

Description:

There are three lights on the screen that indicate the status of the operation of the system, including power light (PWR), Running (RUN), communication (COM). When the screen is powered on, the PWR light will be always bright; if the RUN light is always bright, it means the screen is running fine; if the RUN light is dark, it means the screen has something wrong; if the EMS is connected, COM light is flash yellow.

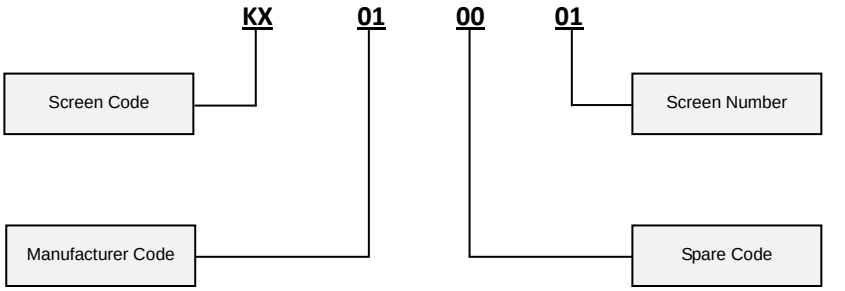
Pic 3-1 Indicator Light in Operation Status

- The following table shows indicator lights status in different state:

Table 3-1 Pilot Lamp Condition on Screen

Equipment Status		Green LED（PWR）	Yellow LED(RUN)	Yellow LED（COM）
No Power		○	○	○
Power on and no communication	3.5 Inch Screen	●	●	●
	5.7 Inch Screen	●	●	○
Communicate with equipment		●	●	※
○ LED Off ● LED On ※Flicker				

3.2 Screen Selection

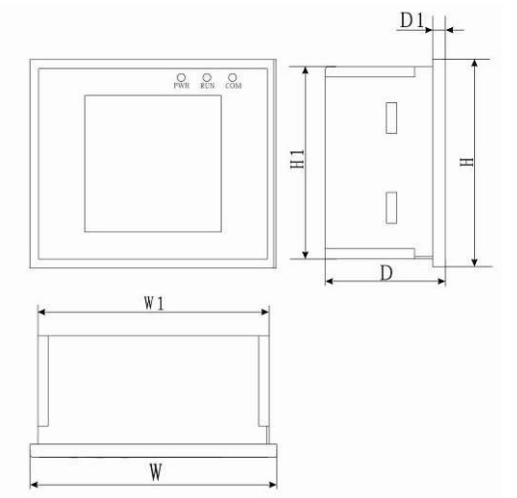


Pic 3-2 Screen Model

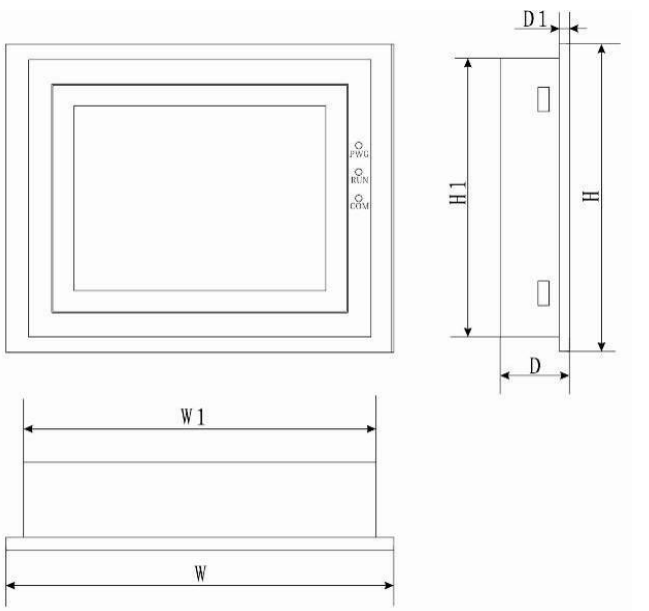
Table 3-2 Screen Selection Table

Product Name	Screen Model
3.5 Inch Screen	KX010001
5.7 Inch Screen	KX010002

3.3 Screen Shape Size



Pic 3-3 3.5 Inch Screen Size



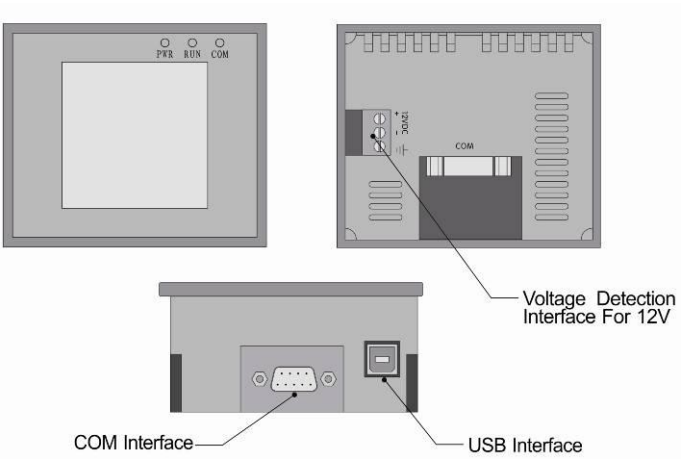
Pic 3-4 5.7 Inch Screen Size

Table 3-3 Screen Size

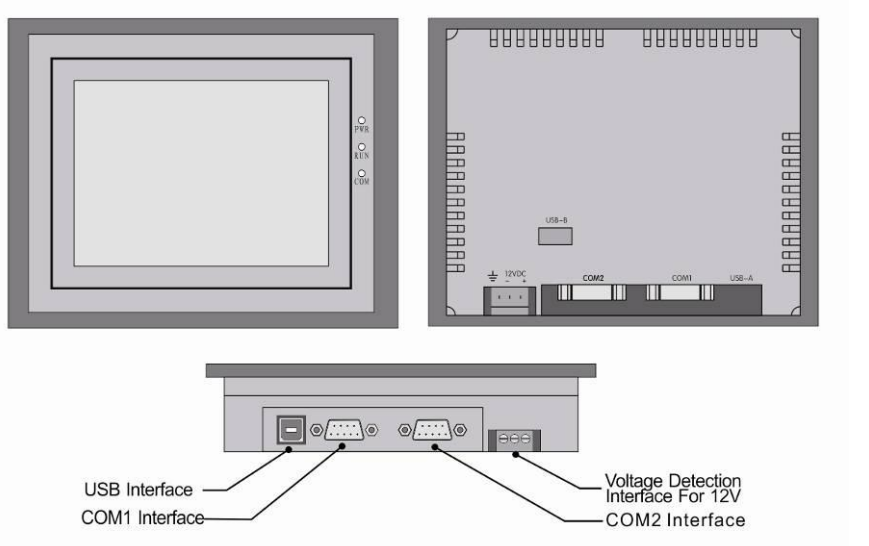
Product Name	Product Type	Shape and Installation Size（Unit：mm）							Weight(KG)
		W	H	D	W1	H1	D1	d	
3.5 Inch Screen	KX010001	96	81	46	90	73	4	4	0.186
5.7 Inch Screen	KX010002	177	140	40	161	130	6	4	0.5

Note)* W, H, D as the external structure size, W1, H1, D1 as the installation size of internal structure , d is width of installation hole

3.4 Screen Interface



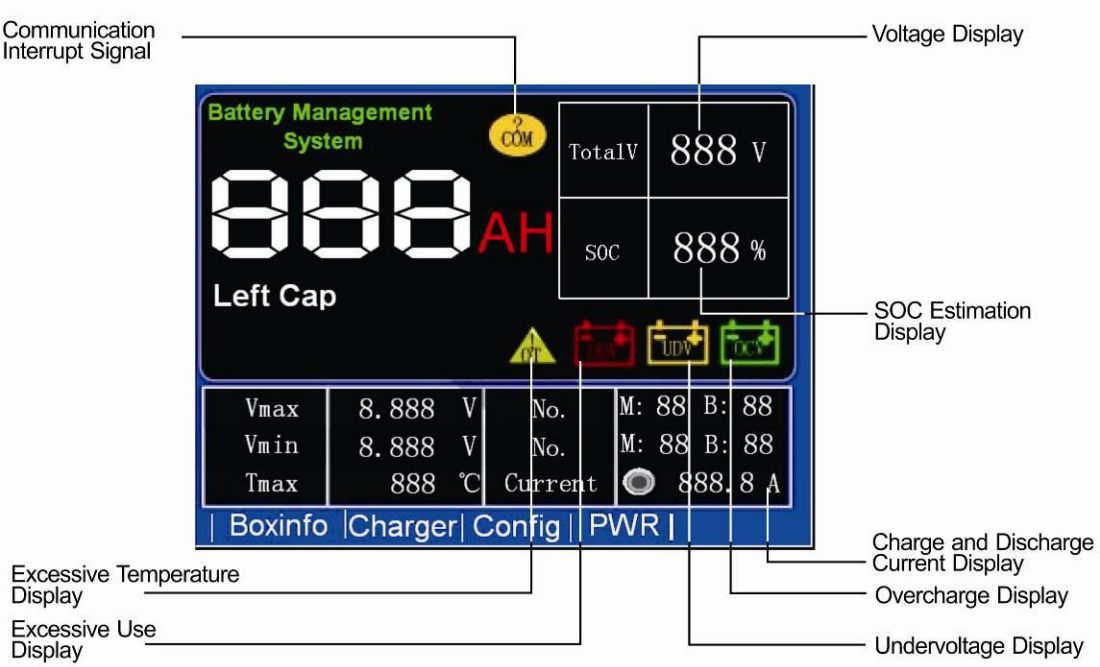
Pic 3-5 3.5 Inch Screen Interface



Pic 3-6 5.7 Inch Screen Interface

3.5 Main Interface of Screen

When screen is working with system power, the main interface of screen will be as the following picture:



Pic 3-7 Screen Main Interface

Note)*1. The above  、  、  、  、  icon only displayed in failure state and not display in nornal condition.

* 2 Both 1-30 seconds delay for all the protection and release

* 3 Display screen may change, please take the actual one as true.

3.6 Display Configuration Parameter

- **Total Capacity**

Battery releases the maximum capacity when it completes charging. Generally batteries' nominal capacity would be used for initial configuration.

- **Remain Capacity**

Current ampere value of battery, it is configured according to the parameters provided by the manufacturer.

- **Calibration of Current**

Used for current zero point correction, current calibration values is 0.0A in default condition, if the system stops running (no charge or discharge), the screen shows current is not 0, ", the current can be calibrated to 0A by setting the" Current Cal. Calibration range from - 20.0A to 20.0A. For example: the screen shows current values for 0.6A when the system

stops," Current Cal by typing" 0.6A, and click the" Settings", current can be calibrated to 0A by inputting 0.6A for Current Cal and click "setting".

- **Calibration of Voltage**

Used for zero correction of voltage value, the calibration value of voltage is 000mV in default condition

- **Max Current of Charging**

Defines CAN communication charger allowed maximum charging current.

- **Overcharging Protection Voltage**

Defines the highest allowed rising voltage value during charging process of single cell, above this value it needs to perform overcharging protection and alarm to the battery.

- **Overcharging Release Voltage**

Canceling the protection voltage threshold, of overcharging i.e. when the max voltages value of single cell below this value it cancels the overcharging protection and alarm.

- **Under voltage Protection Voltage**

Define low voltage alarm threshold of single cell, for prompting the battery is not much.

- **Under voltage Release Voltage**

Cancelling alarm voltage threshold when under voltage i.e. under voltage alarm is cancelled when the lowest voltage of single voltage is higher than the parameter.

- **Over discharging Protection Voltage**

Definition of lowest voltage allowed falling when battery discharges, discharge protection occurs when below this value.

- **Over discharging Release Voltage**

Defines cancelling parameters of over discharging protection, i.e. when the lowest voltage is higher than the parameter of single cell, it will cancel over discharging protection to battery

- **Over Heat Protection Threshold**

Definition of battery maximum allowable working temperature, over-temperature protection and alarm to battery occurs when higher than the temperature.

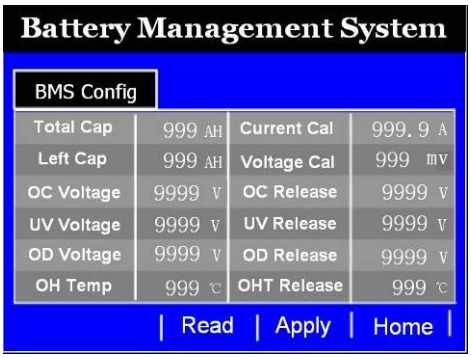
- **Over Heat Release Threshold**

Definition of overheat alarm release temperature threshold, i.e. it cancels over-temperature protection and alarm when the highest temperature of the battery is lower than this value.

3.7 Display Screen Parameter Configuration

In order to accurately estimate all parameters of batteries, BMS can be re-configured for the first time of running. The parameters that can be reset includes: total capacity of the battery pack (nominal capacity), SOC, current calibration, over charge voltage of single cell, over charge release voltage of single cell, under-voltage protection voltage for single cell, under-voltage release voltage for single cell, over discharge protection voltage, over discharge release voltage for single cell, over heat protection temperature, overheat release temperature.

- Step 1 Click the button “Apply” and then input the password “8888” to enter BMS configuration page.



Pic 3-8 BMS Configuration

- Step2: For the first time of entrance BMS configuration page, the actual parameters of BMS can be obtained until press ”Read”. so user should press “Read” to see the parameters that have been set;
- Step 3: Click relevant pages to do initialization settings in terms of the actual parameter of the batteries;
- Step 4: Input all the parameters into BMS. Click "apply" and wait for 5 seconds until the COM light flashes, then the setting is finished;
- Step5: Verify the setting is successful. Click ”Read” .if the parameters are the same as the ones you have input before, that means the setting is OK. Otherwise please go back to step 2~step 5;
- Step 6: Press "home" and come back to home page.

Note: *1 All the parameters can be customized, modified, and added.

***2 It is not allwed to modify the parameters at ease if all the settings have been done and the system has got running. Any wrong settings of the parameters are possible to failure of protection to the batteries.**

3.8 Battery Cell Information Display

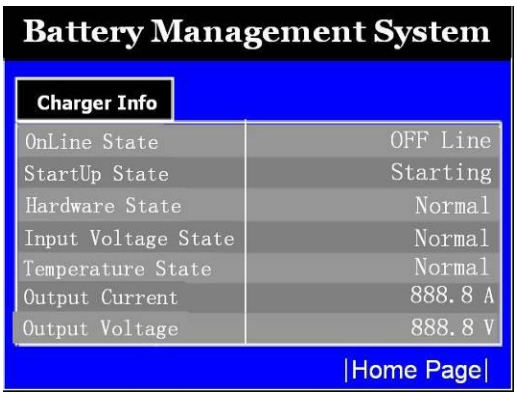
Via "menu" button, enter other pages. Click Boxinfo, the single cell information interface is as follows:

Pic 3-9 Interface of the Battery Cell Information

Take 24 strings of battery for example; the voltage and temperature of 24 cells in series can be all displayed. Click "Menu”, all the batteries of the pack information can be seen on the screen.

3.9 Charger Information Display

Click" charger", the information of charger will be displayed as follows:



Pic 3-10 Interface of the Charger Information

- Online sate: if charger is communicating with the BMS, it shows "online", otherwise "offline", the default state is "offline"
- Startup state: indicate the charger has started charging or not. If charging is started, it shows "starting", otherwise "stop". the default state is "normal"
- Hardware state: malfunction state of the charger. The default state is "normal"
- Input voltage state: display the state of the charger with input power supply. The default state is "normal"
- Temperature state: display the state of temperature of the charger
- Output current: display present charge current of the charger.
- Output voltage: display present charge voltage of the charger.

3.10 Instruction of Charging Control

EK-YT-21 can control charging by the intelligent charger with CAN. Related configuration parameters: maximum charging current (current during the constant-current charge stage), over charging protection voltage, over charging release voltage. The process of charging has two stages: constant-current charge period, and constant-voltage charge period.

The current during the constant-current period can be set by setting the "Charger Cur" on the configuration interface. The range of the charging current varies from 1A to 0.3C.(C is for capacity, I .e. it is 3 times of rated charging current). If the nominal current of the charger is less than the configured charging current, the actual current output of the charger during the constant-current charge period is the nominal current of the charger.

For Lithium iron phosphate battery, the process of EK-YT-21 controlling the charger is below:

- Step 1: After the broadcast message of the charger is detected, start the charger immediately. When the signal of starting charger is received, enter step 2.
- Step 2: The constant-current charge period. The current in this stage is the minimum value between the

configured current and the nominal charge current of the charger. Having enough power supply, the maximum charging current can be set as the nominal current.

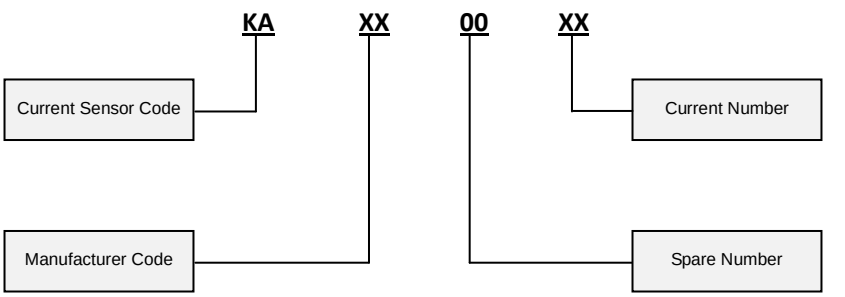
- Step 3: If the maximum voltage of the single cell is higher than 3.65V, BMS will automatically adjust the charging current by CAN-bus ,so as to avoid the single cell voltage rising to the overcharging voltage too quickly.
- Step 4: When the single cell voltage is higher than charging voltage, delay 1~10S,BMS will send controlling signals through the CAN Bus and cut off output of the charger.
- Step 5: When the maximum single voltage get lower than the overcharging release voltage, BMS will send controlling signals via the CAN Bus and restart the charger.

Chapter 4 Current Sensor on EK-YT-21 BMS

4.1 Current Sensor Function

As one of the important parts of BMS current collection and SOC estimation, current sensor is mainly used for collecting current value under the condition of battery charging and discharging, providing parameter reference for analyzing, calculating and judging by the system. The current sensor is Hall open current sensor. The current detection range is -500A——500A.

4.2 Current Sensor Selection

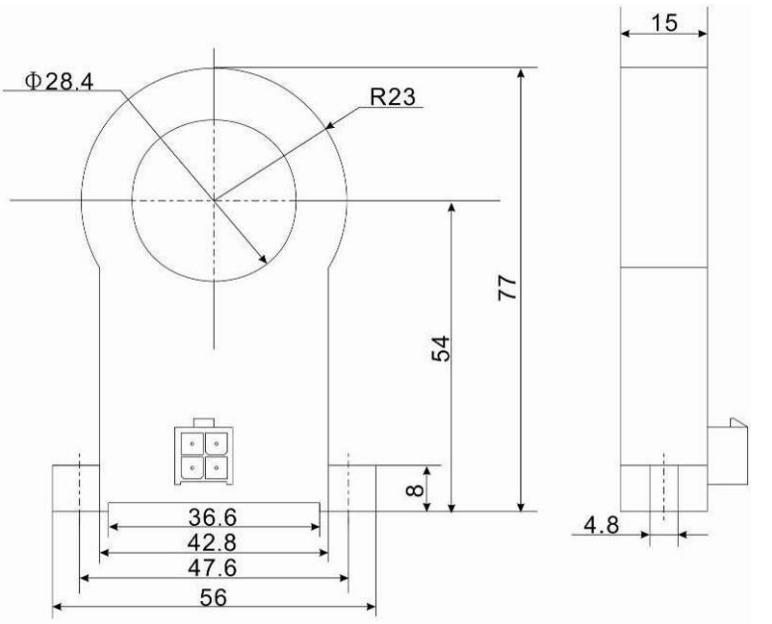


Pic 4-1 Current Sensor Model

Table 4-1 Selection Table of Current Sensor

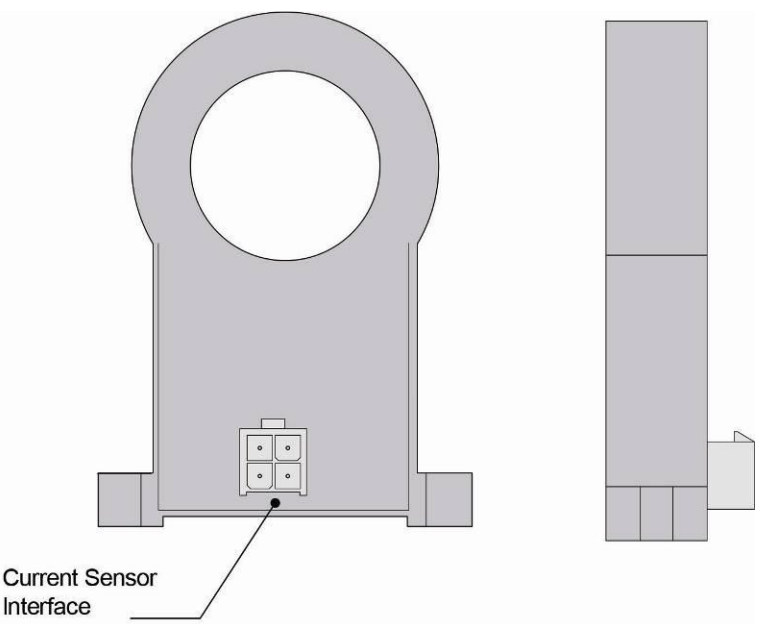
Name	Current Number	Current Sensor Model
Current Sensor	01	50A
	03	100A
	04	200A
	05	300A
	07	500A

4.3 Current Sensor Size



Pic 4-2 Current Sensor Size

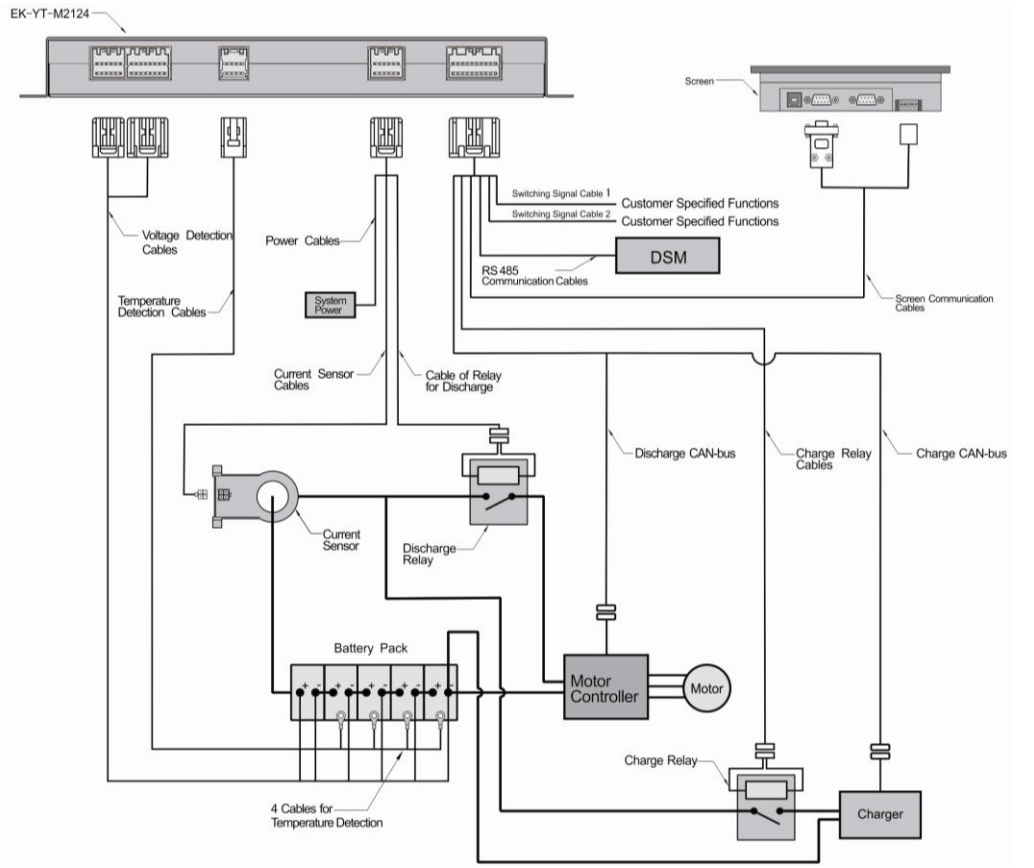
4.4 Current Sensor Interface



Pic 4-3 Current Sensor Interface

Chapter 5 Installation of EK-YT-21 BMS

5.1 System Wiring Diagram



Pic 5-1 Installation Schematic Diagram

Note：*The functions and configurations of the products will vary due to different models. The installation instructions will be provided by us for the connection of any special cables and ports.

*** Charger, battery, motor controller and motor for the customer system configuration.**

*** Charging and discharging relay is optional by customers (coil current ⩽1A), also can be configured by Ligoo.**

5.2 Installation Environment and Requirement

- Avoid installing the EMS in mist, metal dust or heavy dust occasions.
- Avoid installing the EMS in places of hazardous gas, liquid, corrosive, flammable and explosive gas
- Reserve appropriate space for installation.
- Avoid touch any sharp objects when installing cables.
- Keep far away from strong electromagnetic interference environment
- All the accessories that is related to installation of this EMS should get confirmation from the manufacture.

Chapter 6 System Wiring for EK-YT-21 BMS

6.1 Type of Cables

Table 6-1 Table Types

No.	Name	Type	Marks
1	**Voltage monitoring cables**	0.5 High temperature cable One side is Molex68145_28 terminal The other side is 1.5-8 cold pressed terminal	The size of cold pressed terminal depends on specific requirement of customers.
2	**Temperature detection cables**	0.35 high temperature cable One side is Molex68145_8 terminal The other side is NTC temperature sensor M6	
3	**Power line**	2*0.5 power line One side is Molex68145_12 aviation plug The other side is nothing or depends on customer's requirement	
4	**Current sensor cables**	4*0.5 power line One side is Molex68145_12 aviation plug The other side is nothing or depends on customer's requirement	
5	**Cable of relay for discharge**	2*0.5 power line One side is Molex68145_12 aviation plug The other side is nothing or depends on customer's requirement	The cable is used when the discharge control method is relay.
6	**CAN cable for charge**	2*0.3 power line One side is 2-pin Φ16 aviation plug The other side is Molex68145_20 aviation plug	The cable is used when the charge control method is CAN
7	**CAN cable for discharge**	2*0.3 power line One side is 2-pin Φ16 aviation plug The other side is Molex68145_20 aviation plug	The cable is used when the discharge control method is CAN
8	**Cable of relay for charge**	2*0.5 power line One side is Molex68145_20 aviation plug The other side is nothing or depends on customer's requirement	The cable is used when the charge control method is relay
9	**Monitor communicate cables**	2*0.3 power line One side is 5-pin Φ16 aviation plug The other side is Molex68145_20 aviation plug	
10	**RS485 communicate cables**	5*0.5 power line One side is KST_26 pin aviation plug The other side is Molex68145_20 aviation plug	
11	**Switching signal cables**	2*0.5 power line One side is Molex68145_20 aviation plug The other side is nothing or depends on customer's requirement	

Note：

***1 The length of cables are the result of consultation between the customer and our company.**

***2 The way of connections of the cables can be seen in the part of "installation instruction"**

***3 If any special cables are required, please contact the sales people soon.**

6.2 Cables

- The form below includes the wires that are used of connection in the BMS.

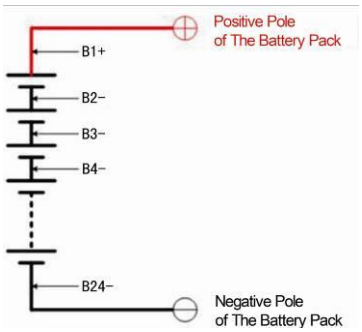
Table 6-2 Cables Illustrate

Icon	Name	Application	Interface
	Voltage Detection Cables	Battery Pack	
	Temperature Detection Cables	2 cables for the following 16 strings 4 cables for 16 to 24 strings	
	Power Cables	Connect to System Power	
	Current Sensor Cables	Current Sensor	
	Discharge Relay Cables	Discharge Relay	
	Discharge CAN-bus	Motor Controller	
	Charge CAN-bus	Charger	
	Charge Relay Cables	Charge Relay	
	Screen Communication Cables	Screen	
	RS485 Communication Cables	DSM	
	Switching Signal Cables	Customer Specified Functions	

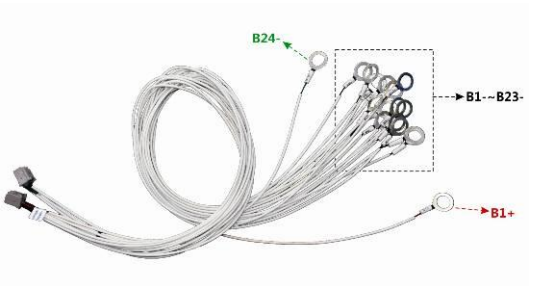
6.3 Cable Connect Mode

■ 6.3.1 Voltage detection cables connection（24 string for example）

- B1+ connects to the positive pole of the first cell. (red line)
- B1-~B23- connects to negative pole of each cell in sequence. (black line)
- B24- connects to the negative pole of the last cell. (green line)



pic 6-1 Voltage Detection Cables Connects to Pole of Battery



pic 6-2 Voltage Detection Cables Connects to Pole of Battery

Pic 6-3 Voltage Detection Cables and EK-YT-M2124 Module Connection

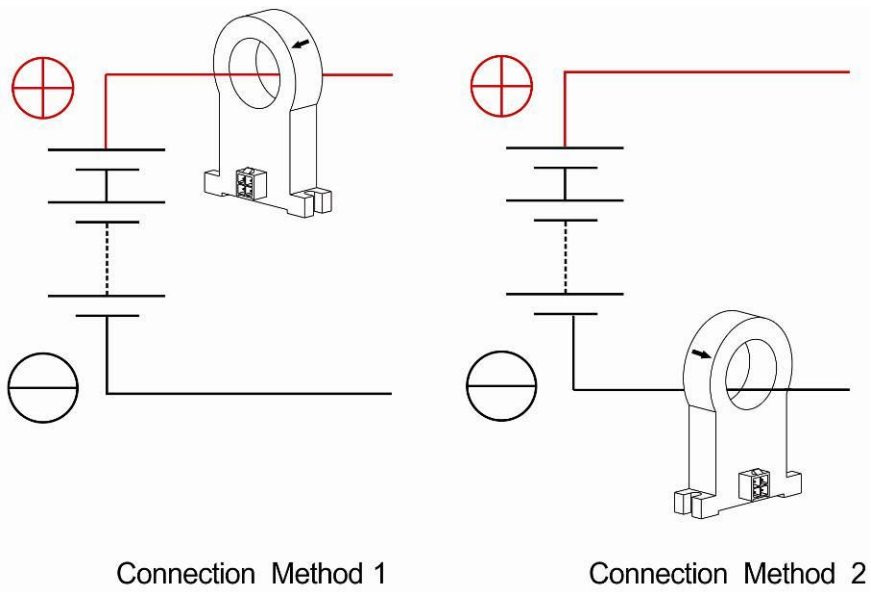
⚠ **Note:The voltage detection cables can not be connected in wrong sequence, or it will lead to wrong voltage collection, burn the banlance circuit and damage the battery!**

■ 6.3.2 Temperature Detection Cables Connection

Pic 6-4 Temperature Detection Cables connect to EK-YT-M2124 Module

■ 6.3.3 Current Sensor Connects to Discharge Relay

The current sensor gets through the cables of the circuit of +pole or -pole of output of the battery pack. There are two ways of connections as the following picture (pay attention to the direction of the arrow of the current sensor)



Pic 6-5 Current Sensor Installation Connection

Pic 6-6 Current Sensor and Discharge Relay Connects to EK-YT-M2124 Module

- **6.3.4 Power Line Connection**

Pic 6-7 Power Line Connects to EK-YT-M2124 Module with Control Cables

- **6.3.5 Screen Connection(3.5 Inch for Example)**

Pic 6-8 Screen Connects to EK-YT-M2124 Module with Communication Line

Note：1 Communication line interface of display Screen (DB9 connector) is connected with the COM communication interface!

2 The positive and negative poles cannot be reversed, if so, display screen will be destroyed.

3 Before installation please confirm whether the display working voltage and the operating voltage of the system is consistent!

4 when the screen is 5.7 inches, communication interface by default only use COM1 interface!

Chapter 7 Malfunction Handling

7.1 Malfunction and Prompts

EK-YT-21 Energy Management System has perfect protection function, which can prolong lifespan of batteries. During usage, user will see some prompts of malfunctions. Please analyze the cause of malfunction according to the following table and solve the problems.

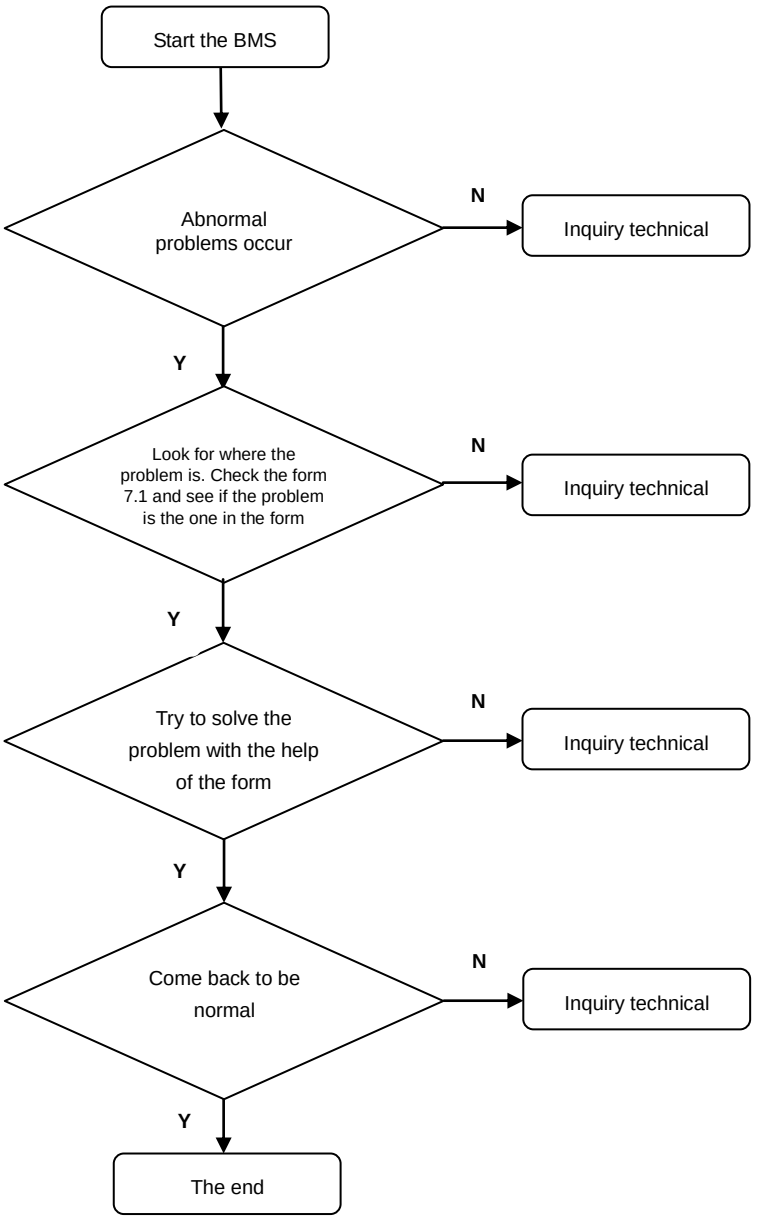
(any problems can be settled or any damage of the system, please contact your direct sales person or our distributor to find solution.)

Table 7-1 Malfunction and Prompts List

code	Description of the malfunction	Possible reason	solution
1	**The system can't get started**	Incorrect working voltage	Make sure if the working voltage is within the normal range or not.
		Without power supply	Supply power for the BMS
		Power is damaged	Contact the manufacturer of distributor for repair.
2	**Buzzer sends alarm and the screen can display data**	Over-charge, over-discharge or under-voltage	Check the protection parameter configuration of the batteries.
		Over heat	Cut off the charger or stop supplying power to the batteries under safe condition
		Communication is cut off	Inspect communication port
3	**Buzzer sends alarm and the screen has no display**	Temperature different is too large	Disconnect the circuit under safe condition, and restart when the temperature is recovered.
		SOC is too low	charge the batteries
4	**The screen displays communication error**	Communication cable is not appropriately connected	Check the power port of the screen is loose or fall off
5	**The screen displays 0V voltage**	Battery monitoring cables are not connected or not connected firmly	Check whether the voltage monitoring cables are appropriately connected
6	**Display the maximum voltage "-40℃"**	The current sensor is not appropriately connected	Check and connect the current sensor again
7	**Some cells' voltage are not correctly displayed**	The voltage monitoring of those cells are wired in the wrong way	Check and connect the voltage monitoring cables again
8	**Display + during discharge, display- during charge**	The temperature sensor is connected in the wrong way	Connect the temperature sensor in the opposite way as before
9	**No display of current**	Current sensor is not appropriately connected	Check the current sensor is correctly connected or not
10	**In static condition, the screen**	Don't configure "current digit	Read "Parameter Configuration"

	displays current	calibration"	
11	**In dynamic condition, the current displayed is not accurate**	The model of current sensor is wrong	Check the current sensor is the original device of the system
12	**The screen doesn't work**	Without power supply	Inspect if there is voltage of Commit the connection of the power line between CCM and screen is correct or not.
13	**Current is lower than the maximum charge current of the charger during charging**	The maximum charge current of BMS is configured too low	Adjust the maximum charge current again
14	**No protection when Over-charge or over-discharge**	Mistakes of parameter configuration	Re-configure the parameter according to "Parameter Configuration"

7.2 Procedures of Diagnosis of Malfunction.



Chapter 8 Regular Maintenance

Operating environment (such as temperature, humidity, dust, interference), aging and wearing Inside the device and so on, are the factors that increase the incidence of breakdown of system. For lowering the breakdown incidence and prolong the system, regular maintenance is quite necessary.

Attention:

- Only professional person is allowed to dismantle or replace any internal parts.
- Ensure the system powered off before inspection or maintenance.
- Avoid metal or other objects left in the system, otherwise, it will cause short circuit or damage to the BMS.

Regular Maintenance	Operating environment	● To ensure a good performance and prolong lifespan of the BMS, user should offer a good operating environment. Avoid long time strong and direct sunlight or other radiation condition, prevent water or other liquid, dust or dirt from entering the BMS.
	CCM and DCM	● Check the input and output voltage and current by use voltmeter and ammeter to see whether they are in the normal range. User can take "Parameter Instruction" as reference. Or user can make a judgment via touch, smelling, visual and other intuitive judgment.
	Screen	● Keep the surface clean, no bump or wearing. So that it can prevent interference with line of sight , resulting in misjudgment.
Replacement of Components	The lifespan of various types of components varies. It is affected by the operating environment and application conditions. So we should keep a good working environment to improve the life of the components.	● The wires and joint solder of all kinds of plugs, such as aviation plug, PIN connector, serial port, etc prone to fall off which result in short-circuit. They should be replaced if damaged. Power off before replacement. ● DC-DC prone to short circuit or high voltage prone to be damaged. Replace them on time and power off before replacement. ● All kinds of wires should be replaced on time if any damage due to any short circuit caused by vibration, aging, the plug joint fall off .power off before replacement.
Regular Maintenance	● Check if all the connectors are firmly connected. Reinforce them if any are loose on time. ● Check if all the wires are in good condition. Replace them if any is worn. ● The communication of CCM and DCM. Check the LED is bright or not. If no bright, there is something abnormal with the communication. Please check Appendix B on Page55 to solve the problem. If the problem can't be settled ,please contact the distributor or manufacturer. ● The inspection of accuracy of voltage and temperature. User should plug off the voltage monitoring cables when checking voltage. User should use a professional measurement device to check the voltage are in the normal range or not; use professional device to check the temperature is the same with the screen. If anything abnormal, pls check Appendix B on page 61~64. If the problem can't settled please contact the distributor or manufacturer. ● Regularly check if the screen is working fine or not. If anything abnormal, please read Appendix B on page 61~64.if problem can't be settled, please contact the distributor or manufacturer. ● Regularly check the module is fixed firmly or not. If loose, please reinforce it on time.	

Chapter 9 Service Direction

9.1 Contact Information

Company address: No 28, Hehuan Road, High-tech District, Hefei, Anhui,China.

Website： www.ligoo.cn

Phone：0551-6105555

Fax：0551-6105566

Post code：230088

Technical support：

Hotline：400-0551-306

Appendix A System List

System Accessories

No.	Name		Type	Quantity	Remarks
1	Voltage Detective Cables		N Strings	1*（N+1） line	1 set of voltage detection cable has N+1 voltage detection cables
2	Temperature Detective Cables		1 Meter	2 cables for the following 16 strings 4 cables for 16 to 24 strings	4 temperature sensors at most
3	Control Cables	Power Line	1 Meter	1 line	Supply power to EK-YT-M2124
		Current Sensor Cable	1 Meter	1 line	Current Sensor Cable
		Discharge Relay Cable	1 Meter	1 line	Discharge relay control cable
4	Communication Cables	Discharge CAN Cable	1 Meter	1 line	Discharge CAN control cable
		Charge CAN Cable	1 Meter	1 line	Charge CAN control cable
		Charge Relay Cable	1 Meter	1 line	Discharge control cable
		Screen Communication Cable	1 Meter	1 line	Screen communication and power line(variable)
		RS485 Communication Cables	1 Meter	1 line	RS485 communication cable(variable)
		Switching Signal Cable	1 Meter	2 line	Switching signal control cable
5	Current Sensor		-500~ 500A	1	
6	Screen		3.5/5.7 Inch	1	Optional

System Accessories

1	User Manual		1	
2	Shipment Inspection Report		1	
3	Certificate		1	
4	Shipment Document		1	

Appendix B Product Certificate

产品检验合格证
CERTIFICATE OF THE QUALITY CREDIT

LIGOO 力高新能

尊敬的用户:

非常感谢您对力高产品的支持和信任，选择了力高品牌的优质产品和服务，我们本着顾客至上的宗旨，将随时倾听您的宝贵意见。
如有问题请与我们的专业人员联系，谢谢!

Dear Customers:
Thank you for choosing LIGOO products and service. We will stick to the "Customer First" objection and try to serve you. We are also looking forward to hearing your advice.
If you have any questions, please contact our professional staff. Thank you!

客户支持热线/Hotline: 400-0551-306

产品名称 Name	电池管理系统 Battery Management System
产品型号 Model No.	EK-YT-21
检验 QC.	
日期 Date	

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电池管理专家 全力支持您
BMS Expert Fully Support You

EK-YT-21 System with
High Performance and Small Size

• Please contact

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