ASCENT
Communication Technology

U3 $LiFePO_4$ Battery System

Operation Manual

Revision A

ACT U3 LiFePO4 48V Battery System Operation Manual

ACT Document Control: ACT_48V_Lithium_Battery_Module_Operation_Manual
ACT Document Number: ACT 48 V Lithium Battery Operation Manual Revision A

This document is produced to assist professional and properly trained personnel with installation and maintenance issues for the product. The capabilities, system requirements and/or compatibility with third-party products described herein are subject to change without notice.

For more information, contact ACT: sales@ascentcomtec.com

Revision History

Revision	Date	Reason for Change
A-1a	10/19/2015	Initial release
A-1b	10/01/2016	EMS Update

Chapter 1. Safety and Warning

The ACT U3 series LiFePO4 battery system installation, operation, maintenance should follow important recommendations in this manual:

- The equipment shall be installed by the professional trained staff
- Battery maintenance should be carried out by the experienced professionals and aware of the preventive measures on the potential harm of the battery.
- Be care of the risk of electric shock for large current in case of battery short circuit, pay attention to the following points during operation
  - Remove watches, rings or other metal objects
  - Use tools with insulated handles
  - Do not place tools or metal objects on the battery
- Do not direct access to the battery system to the mains grid power outlet
- Do not put the battery system into fire, do not use or storage the battery near to the high temperature source
- Do not use liquid or other objects placed into the battery system.
- Do not open or cut the battery, not to hit, throw or step on the battery
- Using special communication between battery module and power plant to charge battery
- Be sure to subject to charge and discharge parameters setting in this manual
- The output interface of the system is still voltage when grid power cut, avoid electric shock or short circuit when operation
- Please check if the box is damaged. If damaged, please immediately notify the supplier
- If you find leaking liquid or white powder residue on product, prohibit operation.

Chapter 2. Product Introduction

2.1 Overview

U3C series battery system is 48V system for communications back-up type LiFePO 4 (lithium iron phosphate) battery products, the system uses the advanced LiFePO 4 battery technology with the benefit of long cycle life, small size, light weight, safety and environmental protection, and has a strong environmental adaptability, it is idea for harsh outdoor environments.

The system also integrates a smart battery management and monitoring module, support for remote centralized monitoring and remote battery management and maintenance, to meet the requirements of unattended. Therefore, the U3C system can fully meet the backup power supply requirements of the access network equipment, mobile communications equipment, transmission equipment, micro base stations and microwave communication equipment.

2.2 Working Principle

The U3C battery system mainly includes Fe lithium battery pack, battery protection, cell balancing unit, monitoring module and charge-discharge management module for optional. Its schematic diagram shown in Figure 2.1

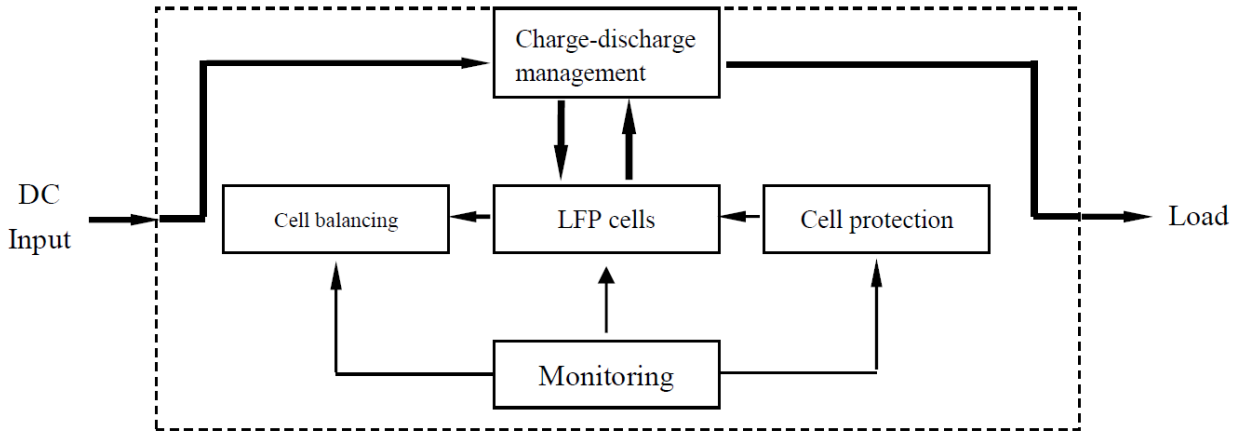


Figure 2-1 Schematic Diagram

LFP cells	Chemical power, energy storage and power supply components
Battery protection	Protect LFP cells against overcharge, over discharge, over current, over temperature, short circuit
Cell balancing	Equalization LFP cells for cells unbalanced
Charge-discharge management	Discharge circuit management, and charging current limit (optional according to customer requirements)
Monitoring	Support centralized monitoring system (optional according to customer requirements)

U3C battery working principle:

DC power input charge and discharge management unit after filter, DC divided two circuits, one circuit directly supply the load, another circuit to charge Fe lithium pack. When grid power on, the system supply the loads and charging inside Fe lithium batteries; When grid power failure, Fe lithium inside system supply DC power to the load, to ensure uninterrupted power supply as power system.

2.3 Battery Management System (BMS)

Smart BMS technology is adopted for battery modules of U3C series to assure smart automatic management for batteries. Features of BMS are shown as below:

- There is a centralized monitoring unit in BMS. Functions such as remote measurement, remote communication, remote controlling are available. Battery modules can be controlled remotely by staffs in control center. U3C series are in line with the requirements of the development of modern communications technology.
- It is combined by technologies of power source and computer. Parameters and status of rectifiers and AC/DC distributions can be detected and controlled.
- Excellent electromagnetic compatibility. BMS used for battery modules of U3C series can comply with the outdoor power plants during operation, no interfere with each other.
- BMS can provide protections against overcharge, over-discharge, over-temperature, overcurrent, short circuit, etc., to assure reliable safety and operation life. With patented cell balancing technology, BMS provide high efficiency for cell balancing and prolong system operate life.
- Configuration flexibility, support parallel connection expansion

2.4 Applications

- Terminal of FTTX
- Access network system
- Indoor distribution system
- Telecom BTS
- Integrated outdoor power cabinet
- UPS
- Internet data center (IDC)
- Solar energy
- Etc.

2.5 Battery Model Instruction

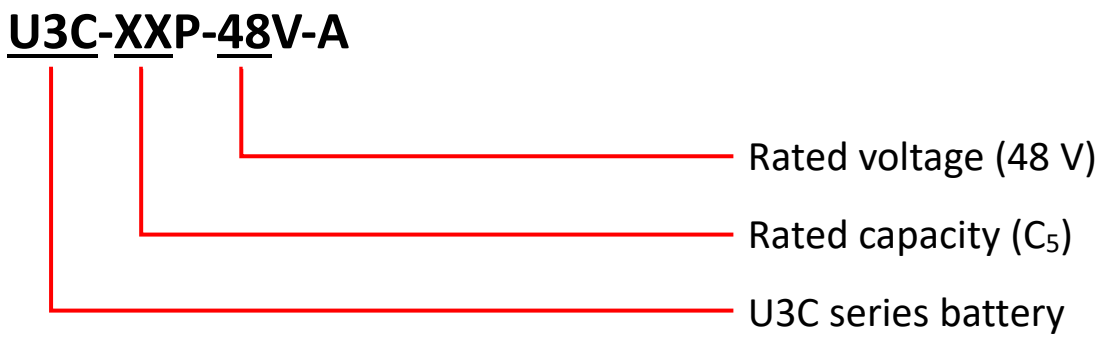


Figure 2-2 Instruction of Battery Model for U3 Series

2.6 Electric Performance

Table 2-1 Battery Model and Electric Performance of U3 Series

Battery Model	Rated Voltage	Rated Capacity	Voltage Range	Charge Voltage	Charge Current		Max. Discharge Current
					Recomm.	Max.	
U3C-10P-48V-A	48 V	10 Ah	40.5 V to 54 V	54.0 V	2 A	10 A	10 A
U3C-20P-48V-A	48 V	20 Ah	40.5 V to 54 V	54.0 V	4 A	20 A	20 A
U3C-30P-48V-A	48 V	30 Ah	40.5 V to 54 V	54.0 V	6 A	20 A	20 A
U3C-50P-48V-A	48 V	50 Ah	40.5 V to 54 V	54.0 V	10 A	50 A	50 A
U3C-70P-48V-A	48 V	70 Ah	40.5 V to 54 V	54.0 V	10 A	60 A	60 A
U3C-75P-48V-A	48 V	75 Ah	40.5 V to 54 V	54.0 V	15 A	75 A	75 A

NOTES

① Battery Model

Battery models listed in the datasheet are standard products. Ascent can also supply customized design in cell, BMS and dimensions for various application scenarios.

② Rated Voltage

48 V = 3.20 Vpc * 15 pcs (Rated voltage of each LFP cell is 3.20 Vpc)

③ Rated Capacity

Five hour rate capacity (0.2 C to 40.5 V at 25℃)

2.7 Structural and Mechanical Performance

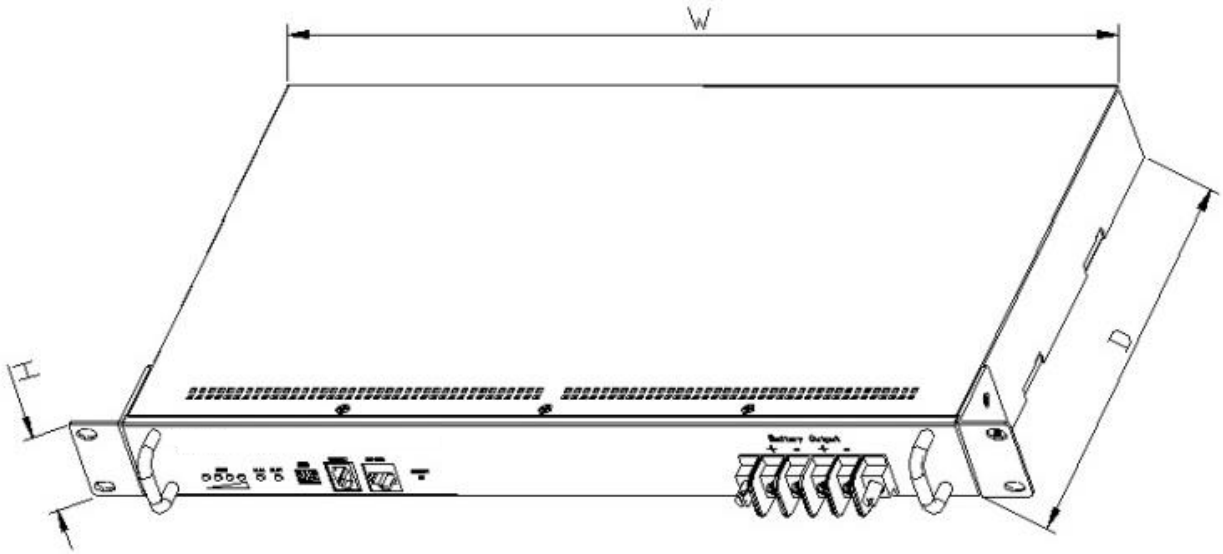


Figure 2-3 Structural Drawing of U3 Series Batteries (U3C-10P-48V-A as sample)

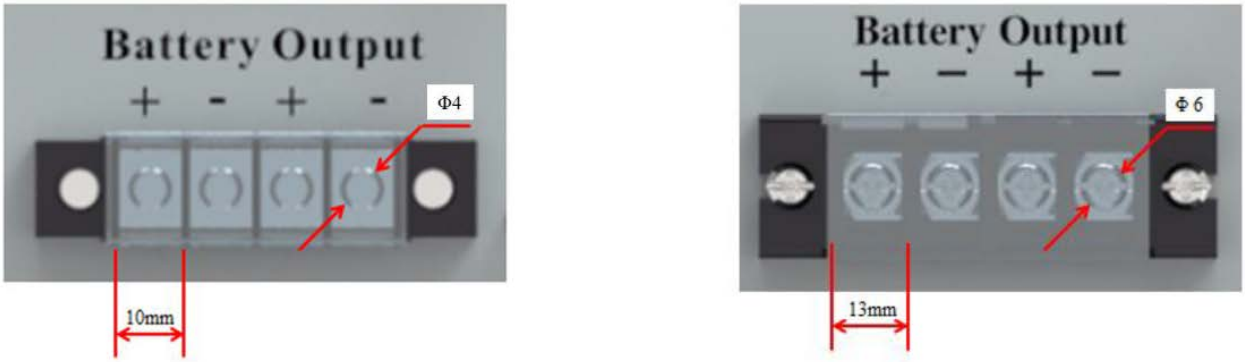


Figure 2-4 Battery Output Terminal

Table 2-2 Mechanical Performance of U3 Series

Battery Model	Rated Voltage	Rated Capacity	Dimensions Width	Depth	Height	Weight	Battery Output Terminal
U3C-10P-48V-A	48 V	10 Ah	442	245	44 (1U)	7.3 kg	10 mm / M4
U3C-20P-48V-A	48 V	20 Ah	442	245	88 (2U)	13.4 kg	10 mm / M4
U3C-30P-48V-A	48 V	30 Ah	442	245	133 (3U)	18.4 kg	10 mm / M4
U3C-50P-48V-A	48 V	50 Ah	442	390	133 (3U)	32.0 kg	13 mm / M6
U3C-70P-48V-A	48 V	70 Ah	442	400	133 (3U)	40.5 kg	13 mm / M6
U3C-75P-48V-A	48 V	75 Ah	442	400	225 (5U)	44.0 kg	13 mm / M6

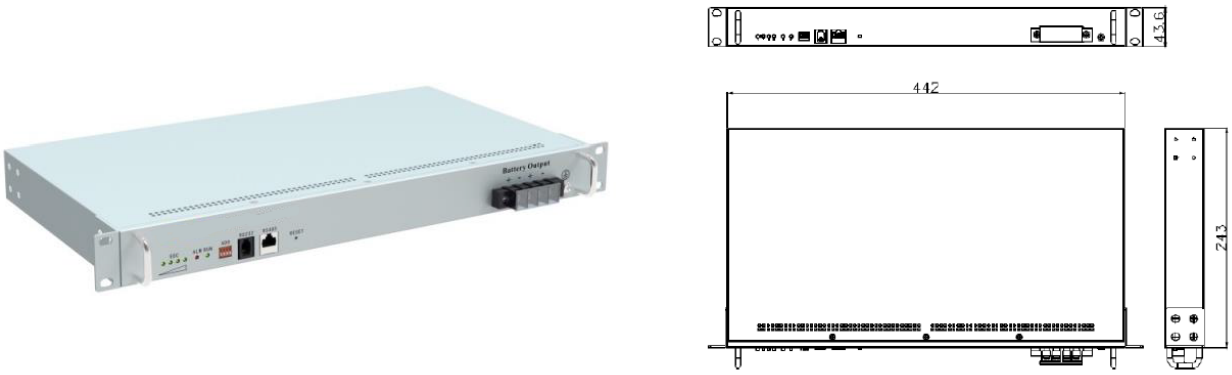


Figure 2-5 Appearance and Mechanical Drawing of U3C-10P-48V-A

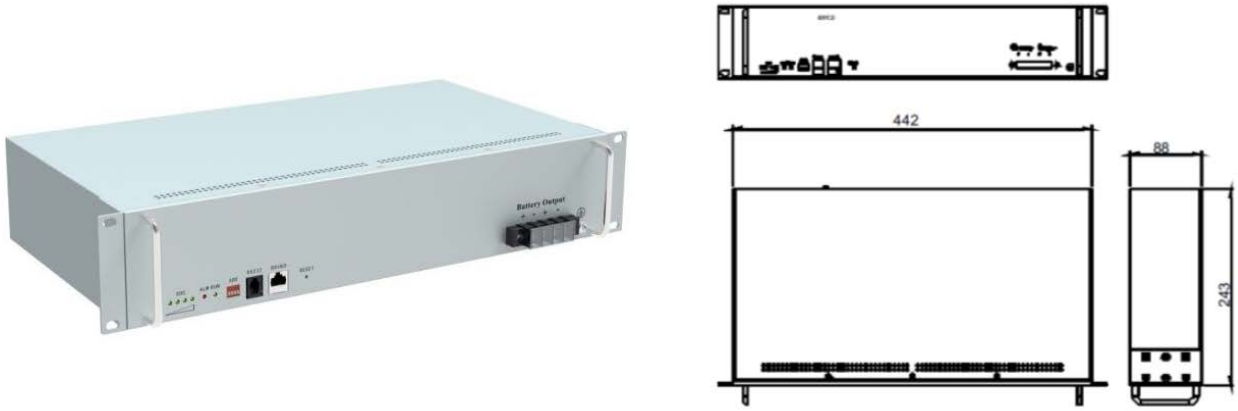


Figure 2-6 Appearance and Mechanical Drawing of U3C-20P-48V-A

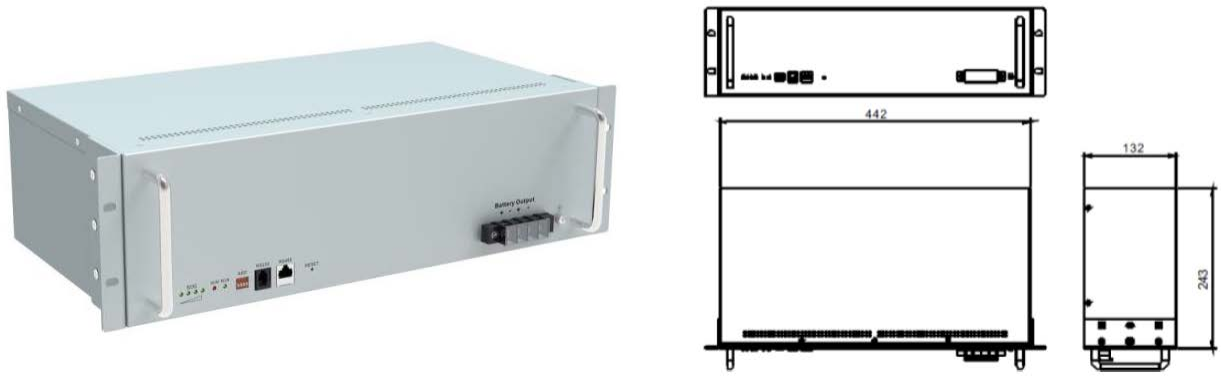


Figure 2-7 Appearance and Mechanical Drawing of U3C-30P-48V-A

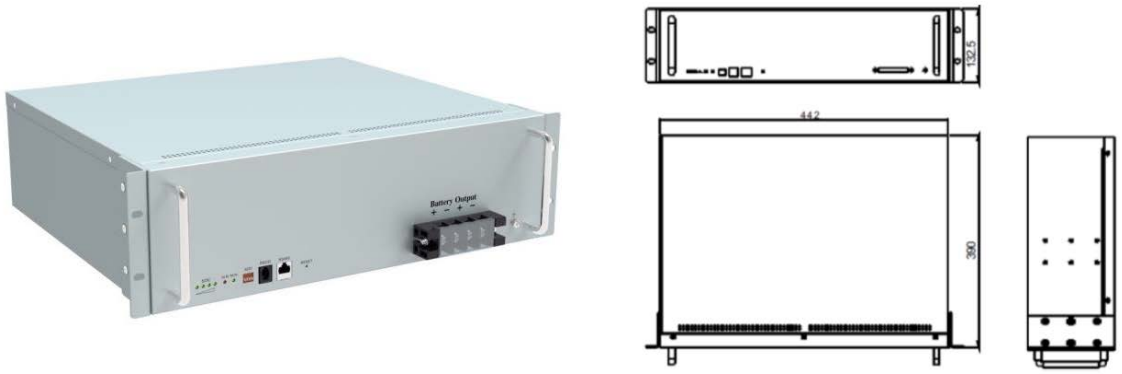


Figure 2-8 Appearance and Mechanical Drawing of U3C-50P-48V-A

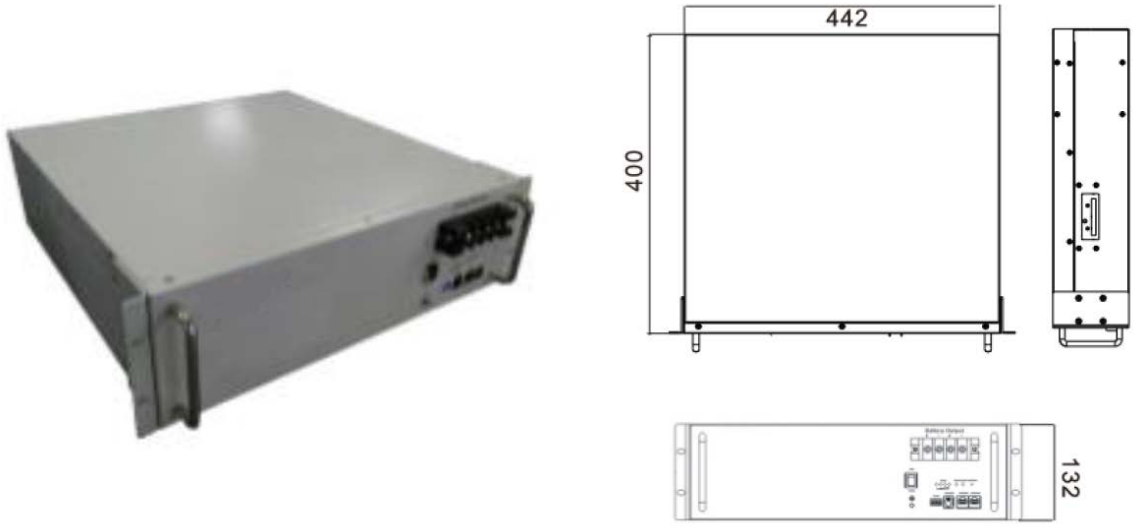


Figure 2-9 Appearance and Mechanical Drawing of U3C-70P-48V-A

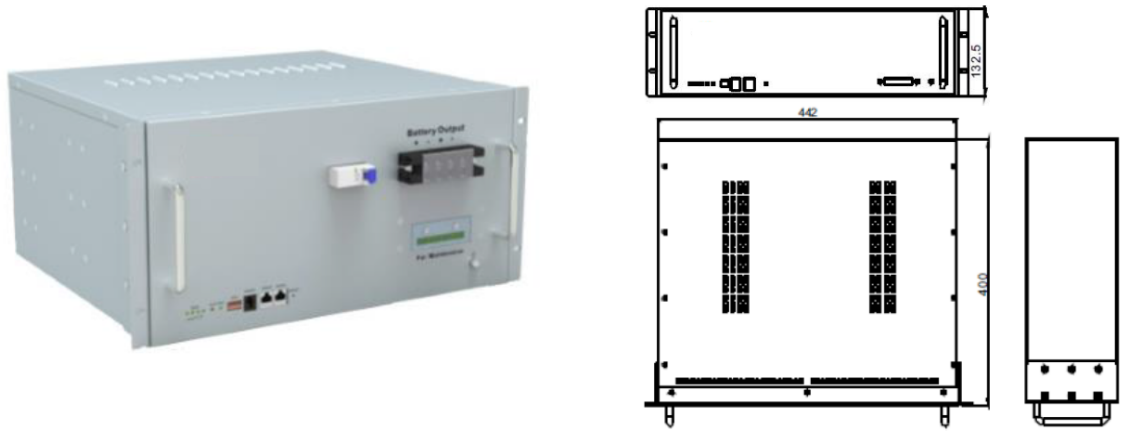


Figure 2-10 Appearance and Mechanical Drawing of U3C-75P-48V-A

Chapter 3. Technical Characteristics

3.1 Discharge Performance

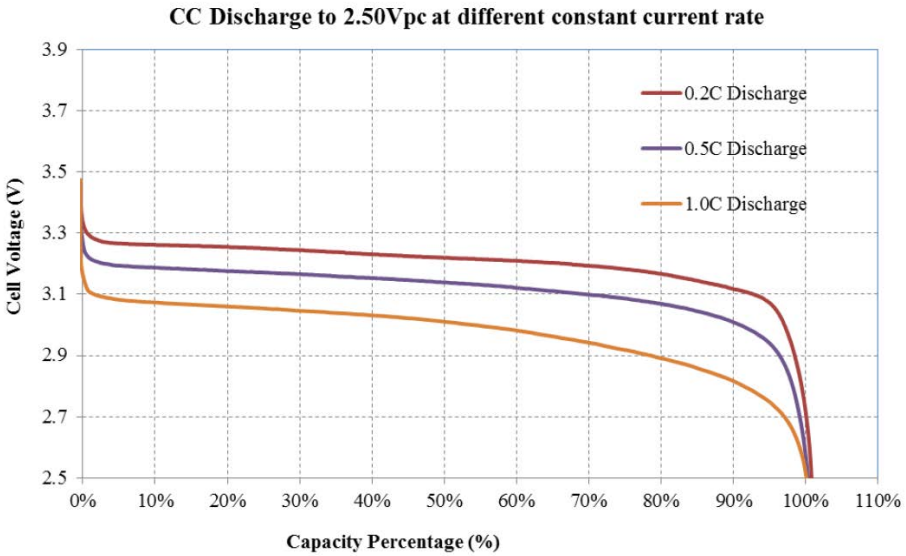


Figure 3-1 Constant Current Discharge Curve of U3 Series

3.2 Charge Performance

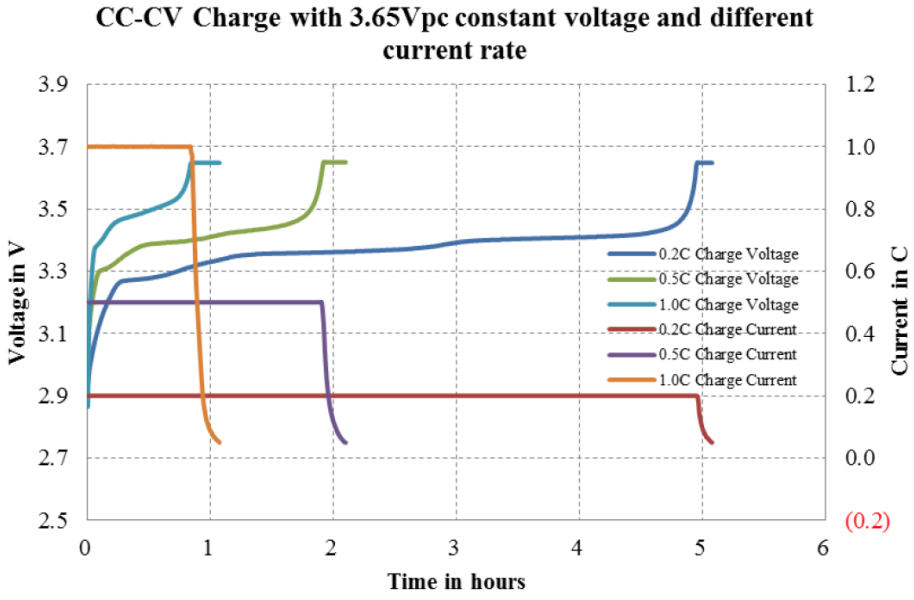


Figure 3-2 Charge Characteristics with Various Current Limitations of U3 Series

3.3 Constant Current/Power Discharge Datasheet

Table 3-1 Constant Current Charging Discharge Datasheet of U3 Series

Battery Model		U3C-10P-48V-A									
	Current	0.1 C	0.15 C	0.2 C	0.25 C	0.3 C	0.4 C	0.5 C	0.6 C	0.8 C	1.0 C
End Volt.		h									min
46.5 V		9.61	6.36	4.74	3.80	3.14	2.21	1.68	1.31	1.02	41.3
45.0 V		9.79	6.49	4.85	3.89	3.23	2.39	1.88	1.53	1.17	52.6
43.5 V		9.91	6.59	4.93	3.98	3.27	2.45	1.94	1.60	1.21	55.7
42.0 V		10.00	6.65	4.97	3.97	3.30	2.48	1.97	1.63	1.23	57.0
40.5 V		10.05	6.69	5.00	4.00	3.33	2.50	1.99	1.65	1.24	57.9
39.0 V		10.07	6.71	5.02	4.02	3.34	2.50	2.00	1.66	1.24	58.3

Battery Model		U3C-20P-48V-A									
	Current	0.1 C	0.15 C	0.2 C	0.25 C	0.3 C	0.4 C	0.5 C	0.6 C	0.8 C	1.0 C
End Volt.		h									min
46.5 V		9.61	6.36	4.74	3.80	3.14	2.21	1.68	1.31	1.02	41.3
45.0 V		9.79	6.49	4.85	3.89	3.23	2.39	1.88	1.53	1.17	52.6
43.5 V		9.91	6.59	4.93	3.98	3.27	2.45	1.94	1.60	1.21	55.7
42.0 V		10.00	6.65	4.97	3.97	3.30	2.48	1.97	1.63	1.23	57.0
40.5 V		10.05	6.69	5.00	4.00	3.33	2.50	1.99	1.65	1.24	57.9
39.0 V		10.07	6.71	5.02	4.02	3.34	2.50	2.00	1.66	1.24	58.3

Battery Model		U3C-30P-48V-A							
	Current	0.1 C	0.15 C	0.2 C	0.25 C	0.3 C	0.4 C	0.5 C	0.6 C
End Volt.		h							
46.5 V		9.61	6.36	4.74	3.80	3.14	2.21	1.68	1.31
45.0 V		9.79	6.49	4.85	3.89	3.23	2.39	1.88	1.53
43.5 V		9.91	6.59	4.93	3.98	3.27	2.45	1.94	1.60
42.0 V		10.00	6.65	4.97	3.97	3.30	2.48	1.97	1.63
40.5 V		10.05	6.69	5.00	4.00	3.33	2.50	1.99	1.65
39.0 V		10.07	6.71	5.02	4.02	3.34	2.50	2.00	1.66

Battery Model		U3C-50P-48V-A								
	Current	0.1 C	0.15 C	0.2 C	0.25 C	0.3 C	0.4 C	0.5 C	0.6 C	0.8 C
End Volt.		h								
46.5 V		9.56	6.35	4.75	3.78	3.12	2.29	1.79	1.45	1.02
45.0 V		9.76	6.49	4.85	3.87	3.21	2.39	1.89	1.57	1.15
43.5 V		9.89	6.58	4.92	3.92	3.25	2.42	1.93	1.60	1.19
42.0 V		9.98	6.64	4.96	3.96	3.29	2.45	1.94	1.61	1.21
40.5 V		10.04	6.68	5.00	3.99	3.31	2.46	1.96	1.63	1.22
39.0 V		10.08	6.70	5.02	4.01	3.33	2.48	1.97	1.64	1.22

Battery Model		U3C-70P-48V-A							
	Current	0.1 C	0.15 C	0.2 C	0.25 C	0.3 C	0.4 C	0.5 C	0.6 C
End Volt.		h							
46.5 V		9.59	6.34	4.71	3.70	3.02	2.21	1.70	1.34
45.0 V		9.78	6.49	4.85	3.87	3.20	2.39	1.89	1.55
43.5 V		9.91	6.57	4.92	3.92	3.26	2.44	1.95	1.61
42.0 V		9.99	6.64	4.97	3.96	3.29	2.47	1.97	1.64
40.5 V		10.05	6.68	5.00	3.99	3.32	2.49	1.98	1.66
39.0 V		10.08	6.71	5.03	4.01	3.34	2.50	2.00	1.66

Battery Model		U3C-75P-48V-A								
	Current	0.1 C	0.15 C	0.2 C	0.25 C	0.3 C	0.4 C	0.5 C	0.6 C	0.8 C
End Volt.		h								
46.5 V		9.59	6.34	4.71	3.70	3.02	2.21	1.70	1.34	0.87
45.0 V		9.78	6.49	4.85	3.87	3.20	2.39	1.89	1.55	1.13
43.5 V		9.91	6.57	4.92	3.92	3.26	2.44	1.95	1.61	1.19
42.0 V		9.99	6.64	4.97	3.96	3.29	2.47	1.97	1.64	1.22
40.5 V		10.05	6.68	5.00	3.99	3.32	2.49	1.98	1.66	1.24
39.0 V		10.08	6.71	5.03	4.01	3.34	2.50	2.00	1.66	1.24

Table 3-2 Constant Power Discharge Datasheet of U3C Series

Battery Model		U3C-10P-48V-A								
	Power	45 W	90 W	135 W	180 W	225 W	270 W	315 W	360 W	540 W
End Volt.		h								min
46.5 V		10.89	5.34	3.50	2.55	1.96	1.57	1.29	1.07	/
45.0 V		11.09	5.45	3.59	2.65	2.07	1.70	1.44	1.24	0.5
43.5 V		11.22	5.52	3.63	2.68	2.12	1.76	1.47	1.27	33.1
42.0 V		11.30	5.56	3.66	2.71	2.13	1.76	1.49	1.30	43.2
40.5 V		11.35	5.59	3.68	2.73	2.15	1.78	1.50	1.30	46.5
39.0 V		11.38	5.60	3.69	2.74	2.16	1.79	1.51	1.32	47.9

Battery Model		U3C-20P-48V-A								
	Power	90 W	180 W	270 W	360 W	450 W	540 W	630 W	720 W	1080 W
End Volt.		h								min
46.5 V		10.89	5.34	3.50	2.55	1.96	1.57	1.29	1.07	/
45.0 V		11.09	5.45	3.59	2.65	2.07	1.70	1.44	1.24	0.5
43.5 V		11.22	5.52	3.63	2.68	2.12	1.76	1.47	1.27	33.1
42.0 V		11.30	5.56	3.66	2.71	2.13	1.76	1.49	1.30	43.2
40.5 V		11.35	5.59	3.68	2.73	2.15	1.78	1.50	1.30	46.5
39.0 V		11.38	5.60	3.69	2.74	2.16	1.79	1.51	1.32	47.9

Battery Model		U3C-30P-48V-A					
	Power	135 W	270 W	405 W	540 W	675 W	810 W
End Volt.		h					
46.5 V		10.89	5.34	3.50	2.55	1.96	1.57
45.0 V		11.09	5.45	3.59	2.65	2.07	1.70
43.5 V		11.22	5.52	3.63	2.68	2.12	1.76
42.0 V		11.30	5.56	3.66	2.71	2.13	1.76
40.5 V		11.35	5.59	3.68	2.73	2.15	1.78
39.0 V		11.38	5.60	3.69	2.74	2.16	1.79

Battery Model		U3C-50P-48V-A						
	Power	225 W	450 W	675 W	900 W	1125 W	1350 W	1575 W
End Volt.		h						
46.5 V		10.35	5.11	3.36	2.46	1.92	1.53	1.27
45.0 V		10.55	5.22	3.45	2.55	2.02	1.66	1.40
43.5 V		10.66	5.28	3.49	2.58	2.06	1.69	1.43
42.0 V		10.75	5.32	3.52	2.61	2.07	1.70	1.45
40.5 V		10.79	5.35	3.54	2.62	2.09	1.72	1.46
39.0 V		10.82	5.37	3.55	2.63	2.09	1.73	1.47

Battery Model		U3C-70P-48V-A						
	Power	315 W	630 W	945 W	1260 W	1575 W	1900 W	2200 W
End Volt.		h						
46.5 V		9.76	4.72	3.00	2.18	1.65	1.31	1.05
45.0 V		9.94	4.86	3.16	2.35	1.84	1.51	1.26
43.5 V		10.05	4.93	3.22	2.40	1.89	1.57	1.33
42.0 V		10.12	4.97	3.25	2.42	1.91	1.59	1.35
40.5 V		10.17	5.00	3.26	2.44	1.93	1.60	1.36
39.0 V		10.20	5.01	3.28	2.46	1.94	1.62	1.37

Battery Model		U3C-75P-48V-A						
	Power	338 W	675 W	1020 W	1350 W	1700 W	2025 W	2360 W
End Volt.		h						
46.5 V		10.46	5.06	3.21	2.34	1.76	1.40	1.13
45.0 V		10.65	5.21	3.39	2.52	1.97	1.62	1.35
43.5 V		10.77	5.28	3.45	2.57	2.03	1.68	1.43
42.0 V		10.85	5.32	3.48	2.60	2.05	1.71	1.45
40.5 V		10.90	5.35	3.50	2.61	2.07	1.71	1.46
39.0 V		10.93	5.37	3.51	2.63	2.08	1.73	1.47

Chapter 4. Operation and Maintenance

4.1 Operational Environment Requirements

Table 4-1 Requirements for Operation Environment

Temperature Range	Discharge	-20 to +60 °C
	Charge	0 to +60 °C
	Storage	0 to +40 °C
Recommended Temperature	Discharge	+15 to +35 °C
	Charge	+15 to +35 °C
	Storage	+15 to +30 °C
Humidity		5 % to 95 %

4.2 Power Plant Parameter Settings

Lead-acid batteries can be replaced by lithium battery of U3 series if power is matched. Table 4.2 is new parameter settings of power plant for lithium battery.

Table 4-2 Parameter Settings of Power Plant for U3 Series Batteries

No.	Parameter	Unit	Defaults
1	Float charge voltage	V	54.0
2	Equalization charge voltage	V	N/A or 54.1
3	Standard charge current	A	0.2 C
4	Charge current limitation	A	0.5 C to 1.0 C
5	Equalization charge interval	Day	N/A
6	Equalization charge duration	h	N/A
7	Condition to equalization charge	A	N/A
8	Condition to float charge	A	0.05 C
9	LVLD (low voltage load disconnection)	V	>43.2
10	LVBD (low voltage battery disconnection)	V	>40.5
11	Restore voltage for LVBD	V	N/A
12	Temperature compensation for float charge	-mV/°C	N/A
13	Temperature compensation for equalization charge	-mV/°C	N/A

Note: Equalization charge is requested to switch off for U3 series batteries.

4.3 Layout of Front Panel

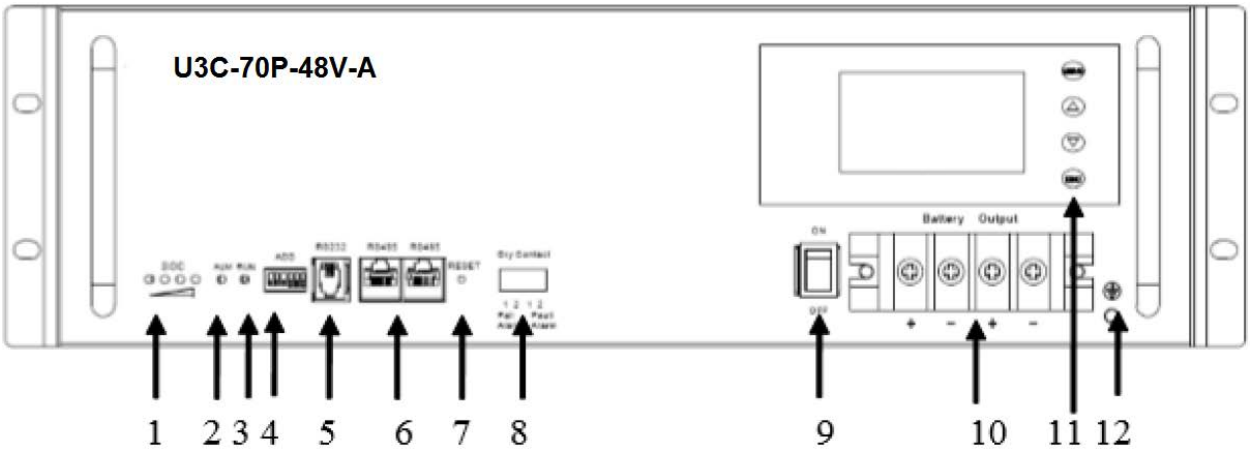


Figure 4-1 Layout of Front Panel for U3C Series Batteries

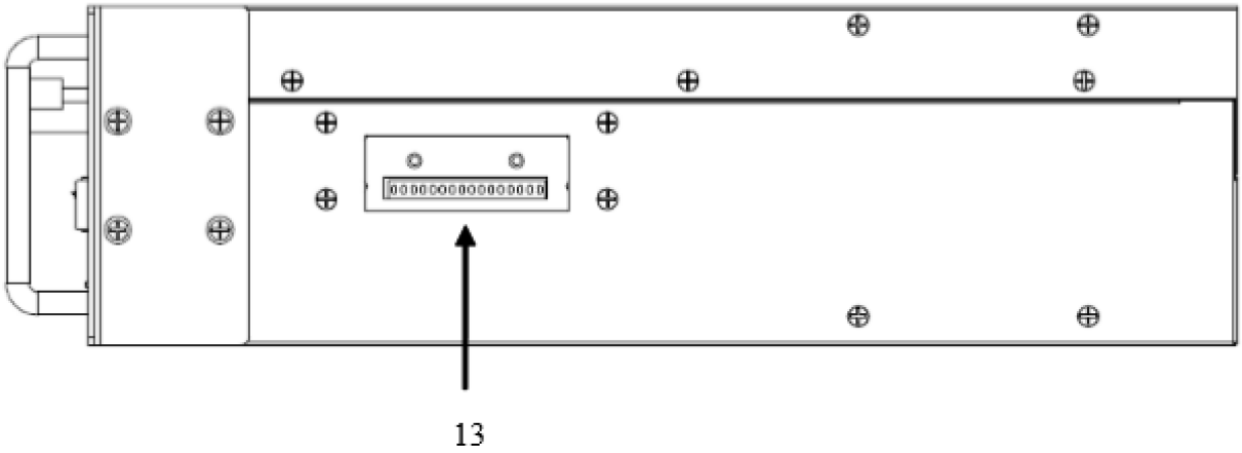


Figure 4-2 Layout of Right Side Panel for U3C Series Batteries

Table 4-3 Instruction for Layout of Front Panel

No.	Marks	Functions	Detailed Information
1	SOC	Indicators for capacity	There are four green LED lights in front panel indicating SOC. SOC is short for state of charge. Each SOC LED light represents 25% of rated capacity. Detailed information is shown in Annexed Table 1.1.
2	ALM	Indicators for alarms	There is one red LED light in front panel indicating alarms. Detailed information is shown in Annexed Table 1.2.
3	RUN	Indicators for running status	There is one green LED light in front panel indicating running status. Detailed information is shown in Annexed Table 1.3.
4	ADD	Address of communication	ADD is applicable to modules connected in parallel. ADD consists of four binary bits, and maximum quantity of batteries connected in parallel is 16pcs (2^4). Detailed information is shown in Annex 2.

5	RS232	Up-link communication port	It is adopting RS-232 series port to upload data. Contents of data transmit include BMS parameters, battery running status, alarms, etc. Generally, speed rate of RS-232 is 1200bps. RS232 up-link communication can be available for the battery module with a binary communication address of 0000 (Master PACK). Protocol for RS232 communication is shown in Annexed Table 3.1
6	RS485	Cascading communication port	It is adopting RS485 series port communication pattern to upload data. Communication of modules connected in parallel (Slave PACKs) is available through RS 485. Data of slave PACKs will be transmitted to Master PACK. Protocol for RS232 communication is shown in Annexed Table 3.2
7	RESET	Reset button	Press RESET button when abnormity occurs to assure stability of battery performance.
8	Dry Contact	Dry contact indicators	Failure Alarm: indicate BMS or battery fail including but not limited to charge and discharge MOS fail, cell voltage under 0.5V, NTC disconnect. Fault Alarm: Output short circuit, charge and discharge over current, charge and discharge over temperature/low temperature.
9	Power Switch	ON/OFF switch	When turn-off, battery get into sleep mode, and cut-off output, the alarm output also will be stopped.
10	Battery Output	Terminals for battery output	Using terminals with four cores. Polarities are +, -, +, - from left to right. The two '+' and '-' are equal relatively. Detailed information is shown in Fig. 2.4.
11	LCD (optional)	Display battery information	Detailed information is shown in Annexed Table 3.3
12	GND	Ground screw	Connect earth by flexible cable above 16AWG through earth connecting hole on right side of cabinet back, assure well connection.
13	Maintenance Interface[1]	Used for battery maintenance	Measuring single cell or cells physical voltage and resistance without disassembling battery case Charge single cell or cells with lower than 2A current directly.

Note 1: For U3C-70P-48V-A and U3C-75P-48V-A only

4.4 Installation

4.4.1 Unboxing and Inspection

- Please study this manual before installation.
- Please inspect the package before unboxing, if any destroy with appearance, contact with the supplier as soon as possible.
- This device shall be installed and operated by professionals.

4.4.2 Preparation for Installation

- Batteries shall not be placed in direct sunshine or close to heat source.
- Batteries shall be installed in place with good ventilation to assure enough heat dissipation.
- Batteries shall be placed in are with clean ambient and low humidity.
- Heavy weight shall not be placed on any cable.
- Following are the tools possibly but not limited be use for installation:

No.	Tool Items	Remarks for Use
1	Insulated gloves	Insulation protection for body
2	Insulated taps	Insulation protection for tools
3	Screwdrivers	Fix the cables of the batteries and power plant
4	Multimeter	Measure the module voltage in commission
5	Current meter	Measure the module current in commission
6	USB to RS485 cable	For communication between the batteries and laptop
7	Laptop	Operate the software

4.4.3 Installation of Battery Modules

1) Installation and fixation

Battery modules of U3C series are applicable to installation in 19inches cabinets and wall-hanging.

- 19inch cabinet installation

Insert battery module into 19 inch cabinet, and fix two handles of battery module with cabinet rack using 4pcs M6 screws.

- Wall-hanging installation

Wall-hanging installation also can be adopted, fix two handles of battery module with triangle rack on the wall using 4pcs M6 screws.

2) Ground connection

- GND screw in front panel of battery is connected with ground through a flexible cable above 16AWG.

3) Battery output connection

- Connect '+' of battery output with positive female copper bar of power plant, and '-' with negative female copper bar or breaker (optional).
- If multi battery modules will be connected in parallel, connect '+' of battery output of each battery module with positive female copper bar of power plant, and '-' with negative female copper bar of power plant or breaker (optional) separately, see Fig4.3.

- Length of cable between battery module and power plant shall be less than 2.0m. To make sure similar voltage drop of cable for each battery, length of all positive and negative cables should be the same.
- Color for cable between '+' and positive female bar is suggested as red, and cable between '-' and negative female bar or breaker as black.

Figure 4-3 Layout of paralleling connection for U3 series batteries

4) Power on for battery module

- When installation is accomplished, battery module is in dormant state. Once power on for the power plant and battery module, battery will go into normal running status, and discharge/charge can be available.
- Parameter settings for lithium battery modules in power plant are shown in Table 4.2.

5) RS232/RS485 connection

- If there is only one battery module in operation, communication between battery module and computer can available through both RS232 and RS485.
- If there are more than one battery modules in operation, parallel communication can be available using RS485.
- Communication protocols for RS232 and RS485 are shown in Annex 3.

6) Discharge with dummy load

- Dummy load cannot be larger maximum discharge current of each battery model in Table 2.1, and LVBD is larger than 40.5V.
- Voltage drop on cable between battery module and power plant shall be less than 0.5V. Method of calculation for cross sectional area of cable is shown as below.

$$A=\Sigma I \times L/(K \times \Delta U)$$

In the above formula, A is across sectional area of wire (mm2), ΣI is the total current (A),

L is length of cable, △U is the permit voltage drop on cable (V), and K is electrical

4.5 Maintenance

- The battery shall be recharged every three months if in long time storage
- Please clean the dust by the dust collector when dust is accumulated on vent
- Please use clean and dry cloth/fabric to clean up the cabinet, if need further cleaning, please use neutral cleanser. Alcohol or ammonia synthesis is forbidden.
- Carrying shall be handled gently, prevent from severe compact
- Prevent battery from splashing liquid
- Suggest inspect the tighten of output screw every two years

Chapter 5. BMS Software Operation

5.1 Guideline of Connection to PC

STEP1: Using RS485 to USB communication cable as shown in the figure 1 below. The cable converts 485 signal to USB signal for PC. Connect USB to RS485 communication cable to laptop.

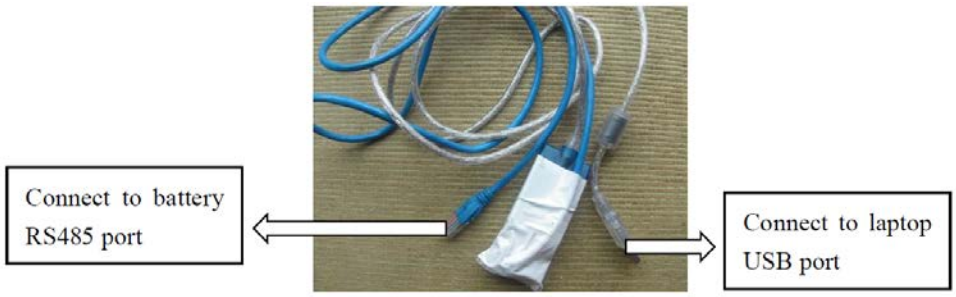
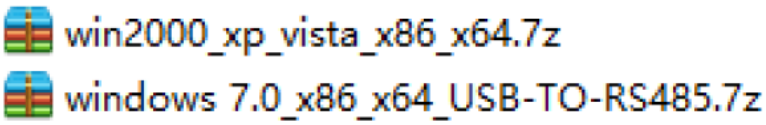


Figure 5-1 RS485 to USB communication cable

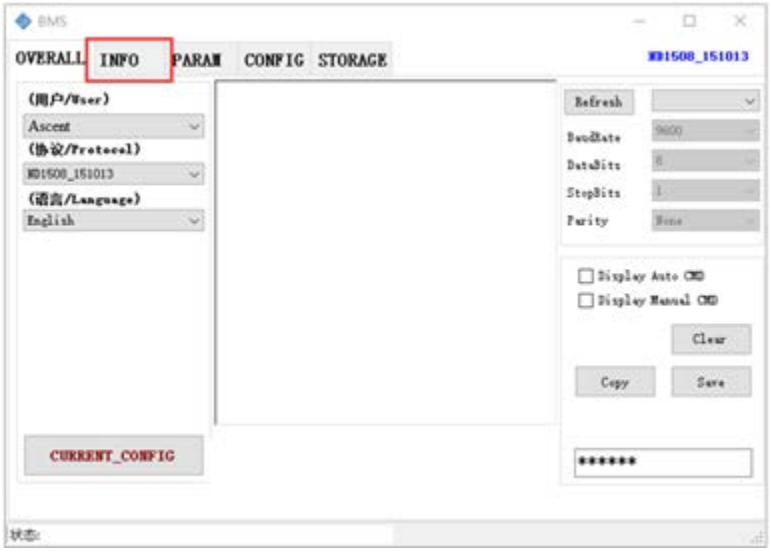
STEP2: According to different operating system, install different USB to 485 drives accordingly.



STEP3: According to different battery models, open PC software accordingly. If using WIN7/WIN8/WIN10 system, must be open as administrator account, click right mouse on software icon and select 'run by administrator'.

STEP4: Turn to INFO page --- Click 485 --- Choose pack numbers and ADD accordingly.

STEP5: Communication successfully.



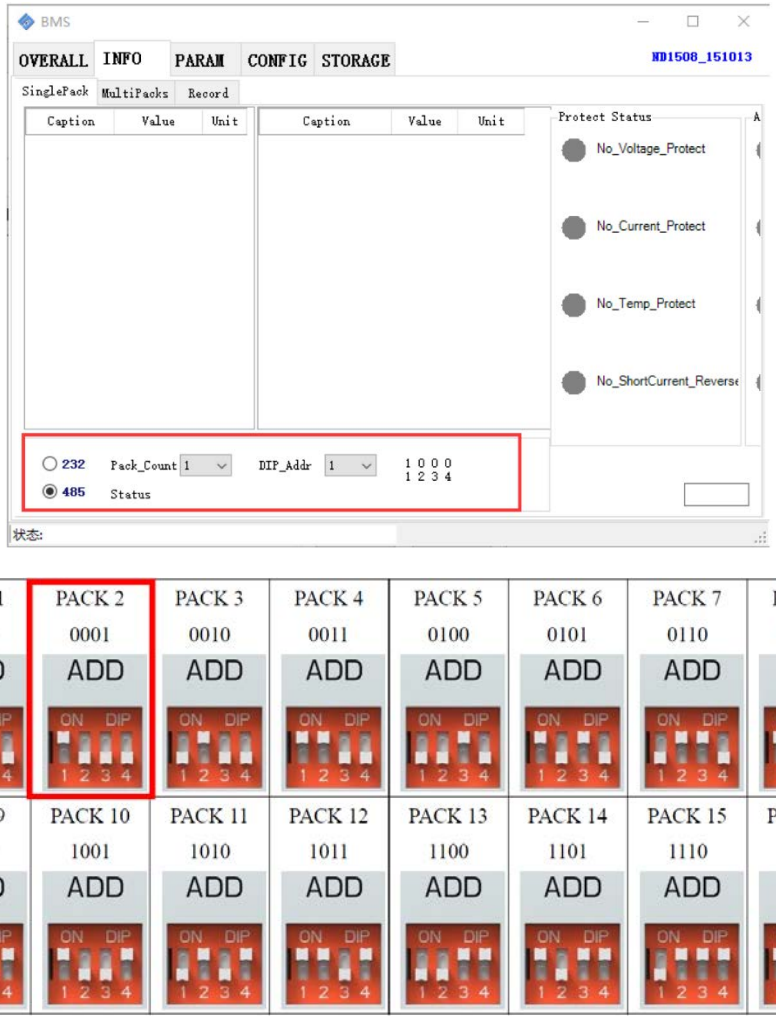


Figure 5-2 Choose correct ADD number

5.2 Introduction of PC Software

PC software include 5 General Tabs: including 'OVERALL', 'INFO', 'PARAM', 'CONFIG', 'STORAGE'.

1. OVERALL page: Basic information of BMS and PC software

- Manufacture name and PC software version;
- Communication data information: COM port, Baud rate, Data bits, Stop bits, Parity Check;
- Communication status: show battery communicate with PC is OK or not.

Figure 5-3 OVERALL page

2. INFO page --- single pack

- Shows 15 Cell voltage;
- V_SUM: module voltage;

V_AVG: average cell voltage;

V_MAX: maximum cell voltage;

V_MIN: minimum cell voltage;

V_DIFF: gap voltage between V_MAX and V_MIN;

Loop count: finished cycles

Capacity_Full: fully capacity;

Capacity_Surplus: remaining capacity;

Remain_Chg_Time: remaining charging time;

Remain_Disg_Time: remaining discharging time;

CELL_TEMP1-4: 1-4 Cell sub-packs terminal temperature;

PCB_TEMP: BMS temperature;

ENV_TEMP: ambient temperature inside battery;

Current: charge/discharge current, positive current means charging, negative current

means discharging.

- Protect Status:

  Show protection information

- Alarm Status:

  Show alarming information

- Normal Status:

  Show battery SOC and SOH

- Communication: Connect to PC software is OK or not;

- Communication port:

  RS232: apply to single battery communication

  RS485: apply to multiple batteries communication

  Pack_Count: numbers of battery paralleling connection;

  DIP_Addr: Choose the address number same as battery accordingly.

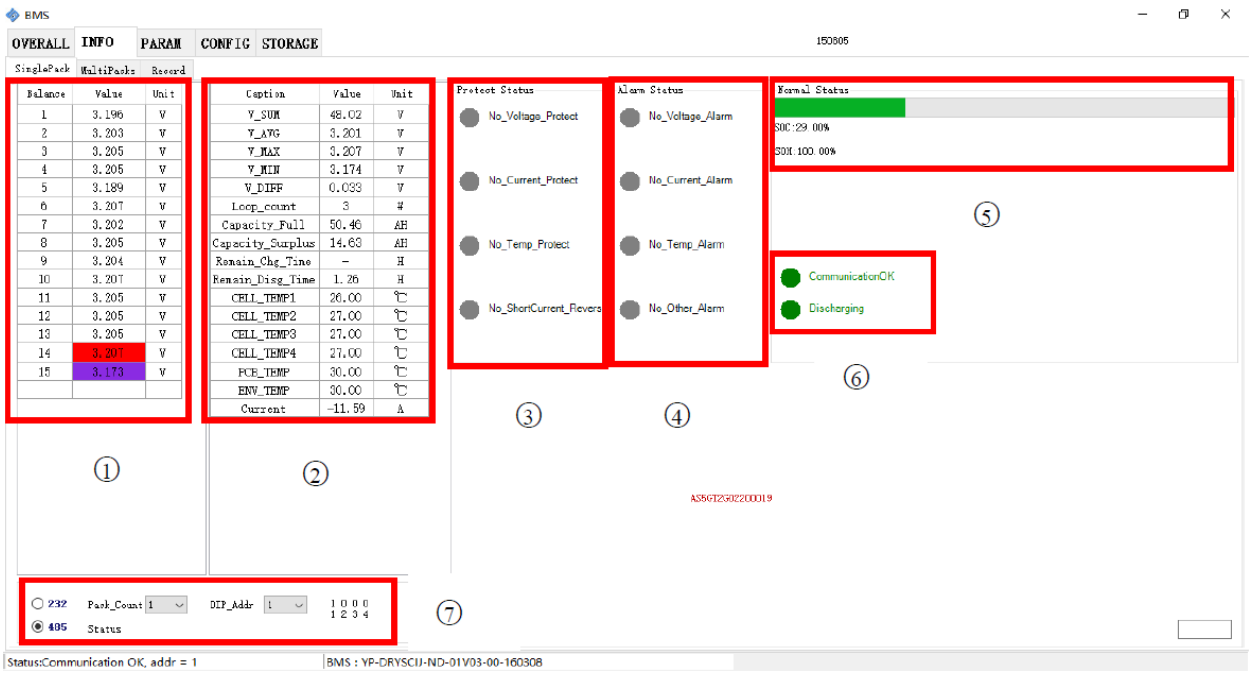


Figure 5-4 INFO page single pack

3. INFO page --- Multipacks

Show all batteries information, including cell voltage, module voltage, current, temperature.

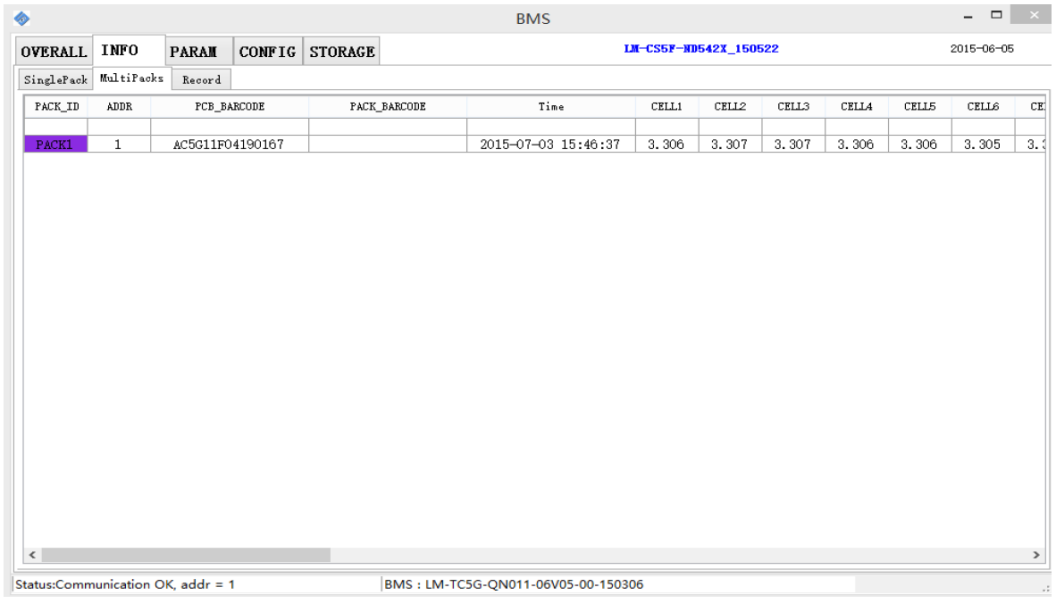


Figure 5-5 INFO page multi packs

4. INFO page --- Record

- Display: Click display button, show battery information.
- Clear: Click clear button, remove battery information.
- Save: Click save button, save shown battery information on the screen as '.xls' format.
- Auto save: Click auto save button, save battery information automatically for every 1/10/50/100/200 items.

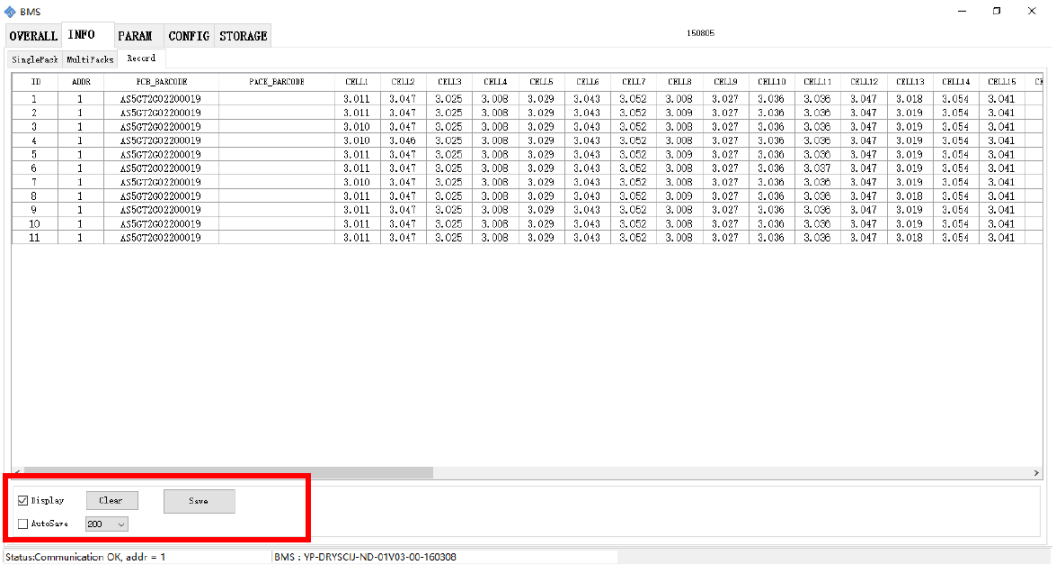


Figure 5-6 INFO page record

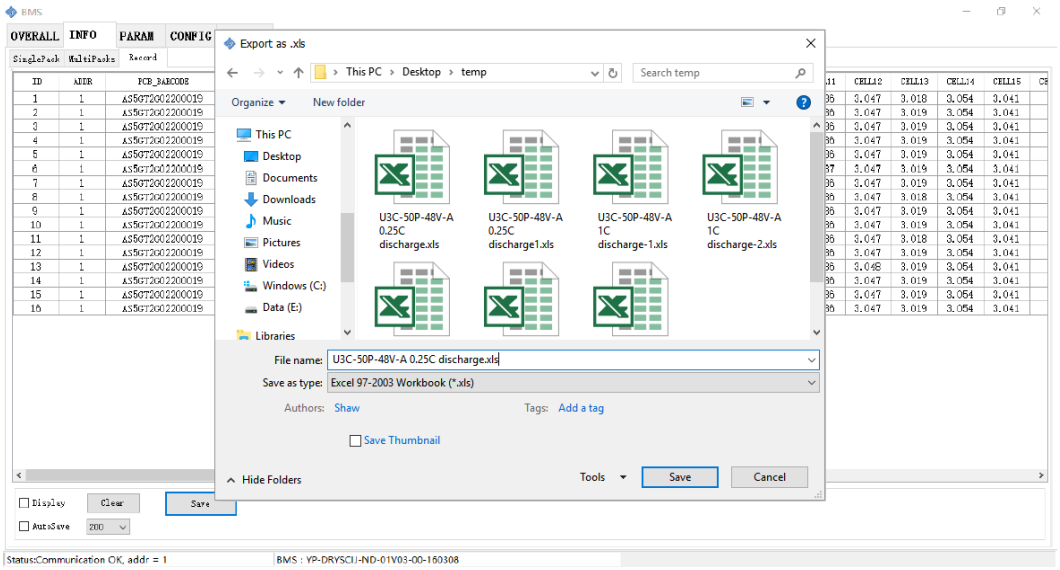


Figure 5-7 INFO page Record as .xls format

5. PARAM page

- Parameter column: shows all protection/alarm threshold and recovery values.
- LoadBak Params: load '.xml' parameter setting.
- BackUP Params: save the current parameter setting as '.xml' format.
- Load Origin: load factory parameter settings.
- Read: read current protection and alarm parameter. If the value is different with factory parameter settings, it will display in red color.

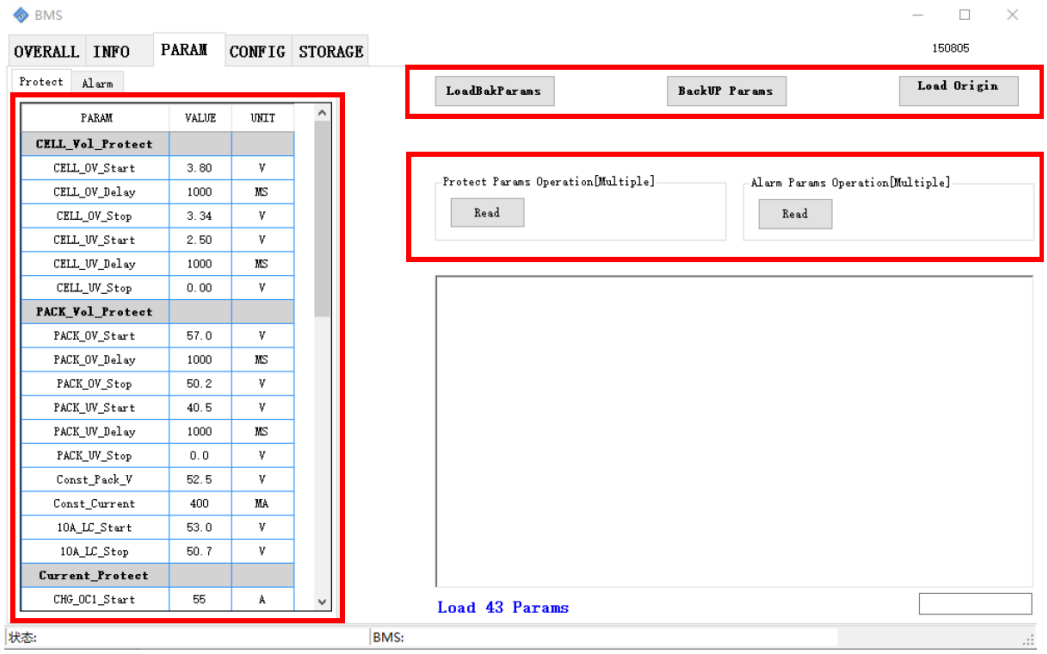


Figure 5-8 PARAM page

6. CONFIG page

- For operation and maintenance staff debugging and testing purposes only.

7. STORAGE page

- For operation and maintenance staff debugging and testing purposes only.

Chapter 6. Troubleshooting and Solutions

Table 6-1 Troubleshooting and Solutions

Troubles	Troubleshooting	Solutions
Battery cannot discharge	Protection against under-voltage	Charge battery
	Protection against over-temperature or under-temperature (Ambient temperature is lower than -25 °C or higher than 75 °C)	Regulate ambient temperature in the range of -20 °C to 60 °C for discharge
	Battery output is short circuit	Relieve short circuit and charge battery
	Protection against overcurrent	Remove some unimportant load and charge battery
	System failure	Shutdown system and call maintenance service
Battery cannot charge	Battery is fully charged. Normal charge management	Do not need to solve
	Protection against overvoltage	Do not need to solve
	Protection against over-temperature or under-temperature (Ambient temperature is lower than -10℃ or higher than 65℃)	Regulate ambient temperature in the range of 0 °C to 55 °C for charge
	System failure	Shutdown system and call maintenance service
All LED indicators on	System failure	Shutdown system
		Call for maintenance service
Communication failure	Fault of communication cable	Inspect communication cable
	Halt of SCM	Press RESET button
	System failure	Shutdown system
		Call for maintenance service

Different flash status of LED indicators represents corresponding running status or alarms.

Detailed information is shown Annex 1.

Annex 1 – Instructions for LED Flicker

Annex Table 1-1 SOC LED Indicators Description

●	●	●	●	SOC
☼	☼	☼	☼	75 % to 100 %
☼	☼	☼	○	50 % to 75 %
☼	☼	○	○	25 % to 50 %
☼	○	○	○	0 % to 25 %

NOTE ☼ mean light on, ○ mean light off

Annex Table 1-2 RUN Indicators Description

Flash Status	Running Status of Battery
Flash 1	Activation state, but neither charge nor discharge
Flash 2	Charging state
Continue light	Discharging state
Extinguish	Dormant state

Annex Table 1-3 ALM Indicators Description

Flash Status	Alarm Information of Battery
Flash 1	Minor Alarm (Various Alarm Status)
Flash 2	Fail (Various fail)
Flash 3	Major Alarm (Various protection status)
Extinguish	Normal, no alarm

Annex Table 1-4 Flash Instruction of LED Indicators

	ON	OFF
Flash 1	0.25 s	3.75 s
Flash 2	0.5 s	0.5 s
Flash 3	0.5 s	1.5 s

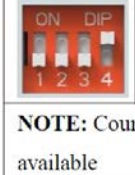
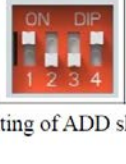
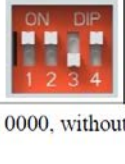
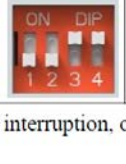
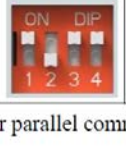
Annex 2 – Instructions for Dialing of ADD

ADD is applicable to modules connected in parallel. ADD consists of four binary bits, and maximum quantity of batteries connected in parallel is 16pcs (2^4).

Annexed Table 2-1 Instruction for Addresses of Communication

Instructions for ADD Dialing				Module No.	Binary Code	Remarks
1	2	3	4			
OFF	OFF	OFF	OFF	Pack 1	0000	Master PACK, supports RS232
ON	OFF	OFF	OFF	Pack 2	0001	Slave PACK
OFF	ON	OFF	OFF	Pack 3	0010	Slave PACK
ON	ON	OFF	OFF	Pack 4	0011	Slave PACK
OFF	OFF	ON	OFF	Pack 5	0100	Slave PACK
ON	OFF	ON	OFF	Pack 6	0101	Slave PACK
OFF	ON	ON	OFF	Pack 7	0110	Slave PACK
ON	ON	ON	OFF	Pack 8	0111	Slave PACK
ON	ON	ON	OFF	Pack 9	1000	Slave PACK
ON	OFF	OFF	ON	Pack 10	1001	Slave PACK
OFF	ON	OFF	ON	Pack 11	1010	Slave PACK
ON	ON	OFF	ON	Pack 12	1011	Slave PACK
OFF	OFF	ON	ON	Pack 13	1100	Slave PACK
ON	OFF	ON	ON	Pack 14	1101	Slave PACK
OFF	ON	ON	ON	Pack 15	1110	Slave PACK
ON	ON	ON	ON	Pack 16	1111	Slave PACK

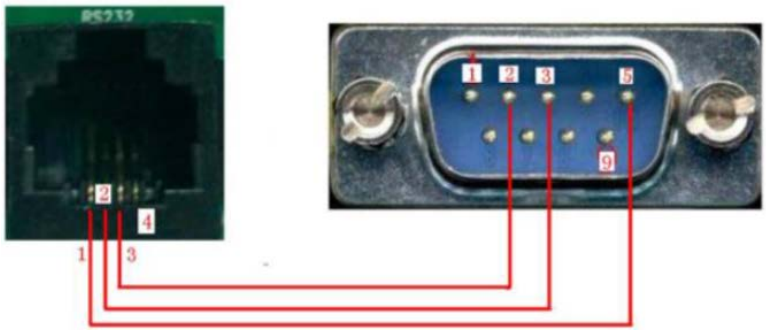
Annexed Table 2-3 Instruction of ADD for Parallel Communication

PACK 1 0000 	PACK 2 0001 	PACK 3 0010 	PACK 4 0011 	PACK 5 0100 	PACK 6 0101 	PACK 7 0110 	PACK 8 0111 
PACK 9 1000 	PACK 10 1001 	PACK 11 1010 	PACK 12 1011 	PACK 13 1100 	PACK 14 1101 	PACK 15 1110 	PACK 16 1111 
NOTE: Counting of ADD shall begin from 0000, without interruption, or parallel communication cannot be available							

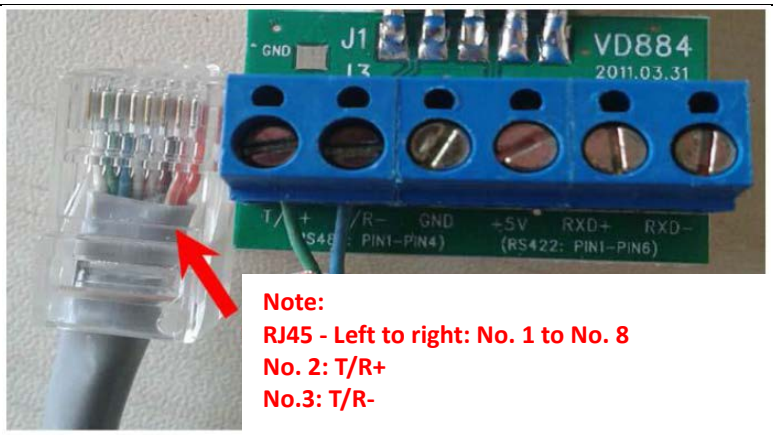
Annex 3 – Communication Protocol for RS232 and RS485

There is one RS232 port in front panel for up-link communication between batter module and upper computer, and one RS485 port in front panel for cascade communication for battery modules connected in parallel.

Annex Table 3-1 RJ11 Pins Assignment (RS232)

RJ11 Pins	Definition	Sketch
1	GND	
2	Pack receipt, computer delivery	
3	Pack delivery, computer receipt	
4	No connection	

2 RXD Receiver – direction: terminal to PC
3 TXD Receiver – direction: PC to terminal
5. GND Earth signal

RJ45 Pins	Definition	Sketch
1	GND	
2	RS485_A	
3	RS485_B	
4, 5, 6, 7, 8	No connection	

Note:
RJ45 - Left to right: No. 1 to No. 8
No. 2: T/R+
No.3: T/R-

Annex 4 – LCD Menu Instruction

Press “MENU” to enter the following interface

Welcome

Battery manage system

Press “MENU” next

Press “MENU” to enter the following interface

Battery parameters query

Battery status

Battery parameter settings

Version Information

1. The “Battery Parameters” subdirectory

——Voltage: xxxx V

——Current: xxxx A (charge:+, discharge:-)

2. The “Battery Temperature” Subdirectory

——Temperature01:xx℃

——Temperature02:xx℃

——Temperature03:xx℃

——Temperature04:xx℃

——PCB Temperature: xx℃

——Environment Temperature: xx℃

——The “Cell Voltages” Subdirectory

——Cell01: xxxx mV

——Cell02: xxxx mV

——Cell03: xxxx mV

——Cell04: xxxx mV

——Cell05: xxxx mV

——Cell06: xxxx mV

——Cell07: xxxx mV

——Cell08: xxxx mV

——Cell09: xxxx mV

——Cell10: xxxx mV

——Cell11: xxxx mV

——Cell12: xxxx mV

——Cell13: xxxx mV

——Cell14: xxxx mV

——Cell15: xxxx mV

——Cell16: xxxx mV

——SOC: xxxx%

——Nominal Capacity: xxxx Ah

——Remaining Capacity: xxxx Ah

——Battery Cycles: xxxx

The “Battery Status” Subdirectory

——Status: IDLE/CHARGE/DISCHARGE

——the “alarm status” Subdirectory

——Overvoltage alarm YES/NO

——under voltage alarm YES/NO

——Over temperature YES/NO

——under voltage alarm YES/NO

——under capacity alarm YES/NO

——Difference voltage YES/NO

——Overcurrent YES/NO

——Charger Reverse alarm YES/NO

——the “protection status” Subdirectory

——Overvoltage protect YES/NO

——under voltage protect YES/NO

——over temperature protect YES/NO

——under temperature protect YES/NO

——over current protect YES/NO

——Short current protect YES/NO

——the “Fail alarm” Subdirectory

——Sampling line: OK/ERROR

——Charge MOSFET: OK/ERROR

——Discharge MOSFET: OK/ERROR

——Sampling chip: OK/ERROR

——Short current times: xxxx

——Temperature protect times: xxxx

——over protect times: xxxx

——Over current times: xxxx

——under voltage times: xxxx

The “Battery parameter settings” Subdirectory Non-manufacturers cannot enter

10 U3C series LiFePO 4 Battery System for Telecommunication Operation manual V1.0

The “Version Information” Subdirectory

——the “BMS version” Subdirectory

——BMS software version

——BMS hardware version

——the “LCD version” Subdirectory

——LCD software version:

——LCD hardware version:

LCD Instructions BMS under sleep mode please press“MENU”wake the BMS and LCD With in one minute without operating LCD into turn off: Please press “MENU” wake the BMS and LCD

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Specifications and product availability are subject to change without notice.

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