105kW/215kWh
ESS PRODUCT MANUAL

Product Name	COMMERCIAL AND INDUSTRY ENERGY STORAGE SYSTEM
Specification	105kW/215kWh
Project Code	EP100K-215-02B
Type/Mode	CS215KWH768V105K3P-P54A
Created Date	2024-04-17

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No：V02

Change History

NO	Description/Modify Content	Compiler	Date
V01	Initial release	Ming	2024-04-17
V02	Battery Pack increase aerosols	Ming	2024-05-30

Contents

1. General principles

1.1 Safety Information

（1）Ensure that the battery or battery system is kept away from dangerous goods or hazardous materials, such as corrosive chemicals, hazardous machinery and equipment, high-temperature environments, etc.;

（2）Improper use of this series of products may lead to smoke, such as external short circuit, overcharge, excessive ambient temperature, etc. In the event of smoke, cut off the power supply in time, dispose of it with a carbon dioxide or dry chemical fire extinguisher, and bury it with sand or soil. Crowds must be evacuated in a timely manner throughout the process and the police must be called in a timely manner (if necessary)

（3）Unreasonable use of this series of products may lead to the swelling of the single battery, and in serious cases, it may lead to the cracking of the shell or cracks, at this time, the use of the battery should be stopped immediately, please contact the relevant technical department or after-sales service department of our company in time to obtain the treatment method;

（4）It is forbidden to disassemble, squeeze, puncture, shelve or bake the battery at high temperature, and avoid the battery being subjected to excessive vibration, external impact, and falling from a height, which may lead to personal injury or property damage;

（5）It is forbidden to directly short circuit the positive and negative poles of the battery, and avoid any metal or other conductive objects other than the battery pole compression bolt and conductive belt from touching the positive and negative poles of the battery, which may lead to personal injury or property damage;

（6）It is forbidden to directly short circuit the positive and negative poles of the battery, and avoid any metal or other conductive objects other than the battery pole compression bolt and conductive belt from touching the positive and negative poles of the battery, which may lead to personal injury or property damage；

（7）It is forbidden to charge the battery without installing a reasonable charging protection device (lithium-ion battery protection circuit board, battery management system, etc.) or using non-polyfluorinated charging equipment (charger, DC power supply, etc.), which may cause personal injury or property damage;

（8）It is forbidden to immerse the battery in water or other conductive liquids, as this may result in personal injury or property damage

（9）Children and other persons who lack knowledge of the safe use of lithium-ion batteries are prohibited from using this series of products, which may result in personal injury or property damage;

（10）It is forbidden to use this series of products in series or parallel with other models or types of batteries, which may result in personal injury or property damage; It is forbidden to operate the entire battery system containing a lithium-ion battery protection circuit board or battery management system in series or parallel, which may cause personal injury or property damage, if necessary, please contact the relevant technical department of the company for correct technical support.

1.2 Definition of Terms

1) BMU：Battery Management Module；

2) BCU : Battery Cluster Module；

3) ESMU: Energy Storage Management Unit；

4) PCS: Power Conversion System;

5) EMS: Energy Management System;

6) SOC: State-Of-Charge;

7) SOP: State-Of-Power;

8) SOE: State-Of-Energy;

9) SOH: State-Of-Health;

2. Product Overview and Main Technical Parameters

2.1 Product Overview

The energy storage battery is intended to use lithium iron phosphate batteries, and the operation mode is "Self-consumption and peak-valley arbitrage ", The energy storage system meets the requirements of 0.5C/2 charging and discharging per day, and the grid-connected voltage level is 0.4kv.

Liquid-cooled outdoor energy storage cabinet (hereinafter referred to as energy storage cabinet) is an energy storage device based on lithium-ion batteries, which uses lithium-ion batteries as energy storage components internally, and has the characteristics of high energy density, high charging and discharging power, and long cycle life.

The product adopts an integrated design, which integrates the battery cell, BMS, PCS, fire protection system, power distribution system, thermal management system and energy management system in a standardized outdoor cabinet, forming an one-stop integrated product that can be plugged and played. It is suitable for independent energy storage power stations, industrial and commercial users, microgrids and other application situation.

The energy storage cabinet adopts a modular design, which is evolved from the energy storage cell, battery module, rack-mounted battery, battery system. Its design is hierarchical, clearly structured and functional, including perfect rack-mounted battery, battery management system (BMS), temperature control system, fire detection and automatic fire extinguishing system.

2.2 Main Technical Parameter Requirements

No.	Item	Specifications	Note
1	Rated discharge/discharge power	105kW	
2	Nominal energy	215kWh	
3	Composition	1P240S	No parallel connection
4	Battery type	LFP	GF 280Ah
5	Rated voltage	768V	Dc side

6	Operating voltage range	650~864V	
7	Cycle efficiency	≥93%	0.5C, DC side efficiency
8	Cycle Life	Discharge rate: 0.5C EOL70%	
9	Dimensions	D1420*W1380*H2200mm	Hanging rings not included
10	IP Class	IP54	
11	Anti-corrosion Class	C4	
12	Altitude	≤3000m	More than 2000m derating use
13	Weight	About 2.5T	±50kg
14	Fire Protect	Fire protection in the cabinet	
15	Minimum operating distance	In front of the cabinet≥1500mm Behind the cabinet≥800mm	
16	Communication protocols	Support IEC104, modbus-RTU, DL/T645, etc	
17	Life cycle	10 years	25℃, 0.5C, 90%DOD，EOL≥70%

2.3 Nameplate

3. System technical requirements

3.1 Overview of the battery-side system

The energy storage project is a 215.04kWh battery pack energy storage project of Huizhou Epever Technology Co., Ltd. The single battery pack is 215.04kWh and is composed of 5 battery boxes connected in series, and the battery box is composed of 3.2V, 280Ah battery cells combined with 1P48S.

No.	Item	Diagram	Rated voltage (V)	Rated capacity (Ah)	Store power (kWh)	Note
1	Cell		3.2	280	0.896	LiFePO4
2	Rack-mounted Battery (with BMU)		153.6	280	43.008	1 battery pack includes 48 cells, 1P48S
3	Battery pack (with BCU)		768	280	215.040	Five battery pack are connected in series to form a battery pack
4	Battery stack (with ESMU)		768	280	215.040	One battery pack forms a set of battery pack units

3.1.1 Cell specifications

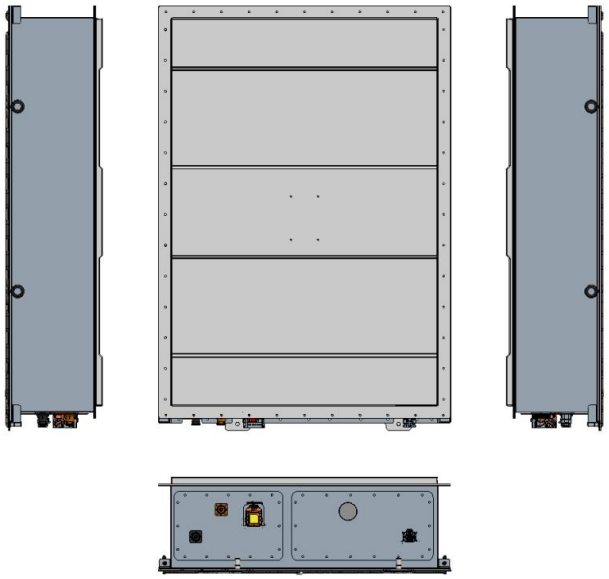
Cell Technical Parameter

No.	Item	Specifications	Note
1	Battery type	LFP	
2	Nominal capacity	280Ah	EVE/DS
3	Nominal voltage	3.2V	
4	Resistance	≤0.1mΩ	5% SOC status
5	Maximum continuous discharge rate	0.5C	
6	Maximum pulse discharge rate	1C	
7	Rate discharge capacity ratio	≥90%	
8	Normal temperature (25°C) cycle life	≥8000次	70%SOH

3.1.2 Specifications of the Rack-mounted battery pack

NO.	Item	Parameter	Note
1	Series-parallel system	48S1P	
2	Nominal Capacity	280Ah	
3	Nominal Voltage	153.6V	
4	Nominal Energy	43.008kWh	
5	Maximum sustained discharge rate	0.5C	
6	Maximum pulse discharge rate	1C	
7	Fire protection system	40g hot aerosols	5-year warranty
8	Dimension	1172*808*240mm	tolerance：±5mm
9	Weight (kg)	~300kg	tolerance：±15kg
10	IP Class	IP67	
11	Operating Temperature	10℃~35℃	
12	Storage Temperature	-30℃~55℃	
13	Storage RH	5%RH～95%RH	No condensation

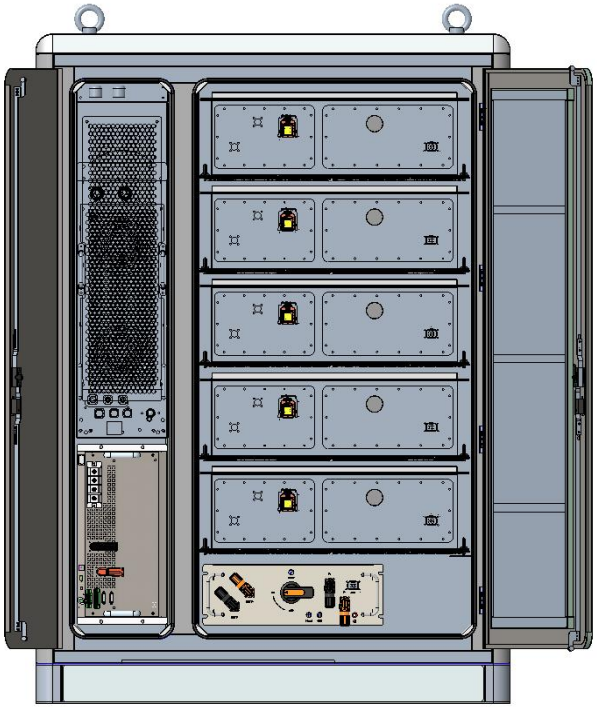
The rack-mounted battery consists of 4 battery modules in series, a single battery module is composed of 12S1P, and the whole rack-mounted battery is 48S1P.There is 1 BMU unit inside each battery pack, which can collect the temperature and voltage of the battery cells inside the battery pack. The battery is liquid-cooled, equipped with 1 liquid cooling plate, 1 hot aerosol, MSD service switch, explosion-proof valve, and communication terminals.The reference image is as follows (the details are subject to the actual product)



3.1.3 Battery cluster specifications

No	Technical Specifications	Parameter	Note
1	Nominal Capacity	280Ah	
2	Nominal Voltage	768V	
3	Voltage Range	650V-864V	
4	Nominal Energy	215.04kWh	

The battery cluster consists of 5 battery boxes connected in series and arranged on a battery rack in the cabinet by 5 layers. It is connected by an EV power cable and a daisy-chain communication cable connected in series to the main control box. At the same time, the liquid cooling pipe is connected to the subrack and connected to the liquid cooling unit, which constitutes the battery system.



3.2 Overview of the BMS system

The battery management system (BMS) is a two-level architecture. For each battery socket, BMU manages 48 strings of cells and is responsible for the management of cell voltage, temperature measurement, equalization and other functions. The BMU uses CAN bus to communicate, and the cell information of the battery (cell voltage, cell temperature, cell SOC, cell SOH, and equilibrium status, etc.) is transmitted by the BMU to achieve data pairing.

The battery cluster is equipped with 1 battery pack control unit (BCU), which collects the total voltage and current of the battery cluster, controls the battery pack contactor, and communicates data (daisy chain communication) on the battery cluster

The entire system will be equipped with a battery management system human-machine interface (ESBMU) to process the battery information uploaded by the battery cluster control unit (BCU). With display, parameter setting, fault alarm, data recording and other functions.

3.2.1 BMU specifications

It can provide real-time monitoring of the voltage and temperature of a single string of cells, as well as thermal management and passive balancing capabilities, and can form a highly flexible battery management system (ESBMS) with the main control unit (ESBCU) through cascaded communication. It supports passive balancing, adopts energy consumption balancing technology, and can simultaneously discharge balance multiple single cells in the battery pack, with an equalization current of 100mA, and the balancing energy of the single cell can be

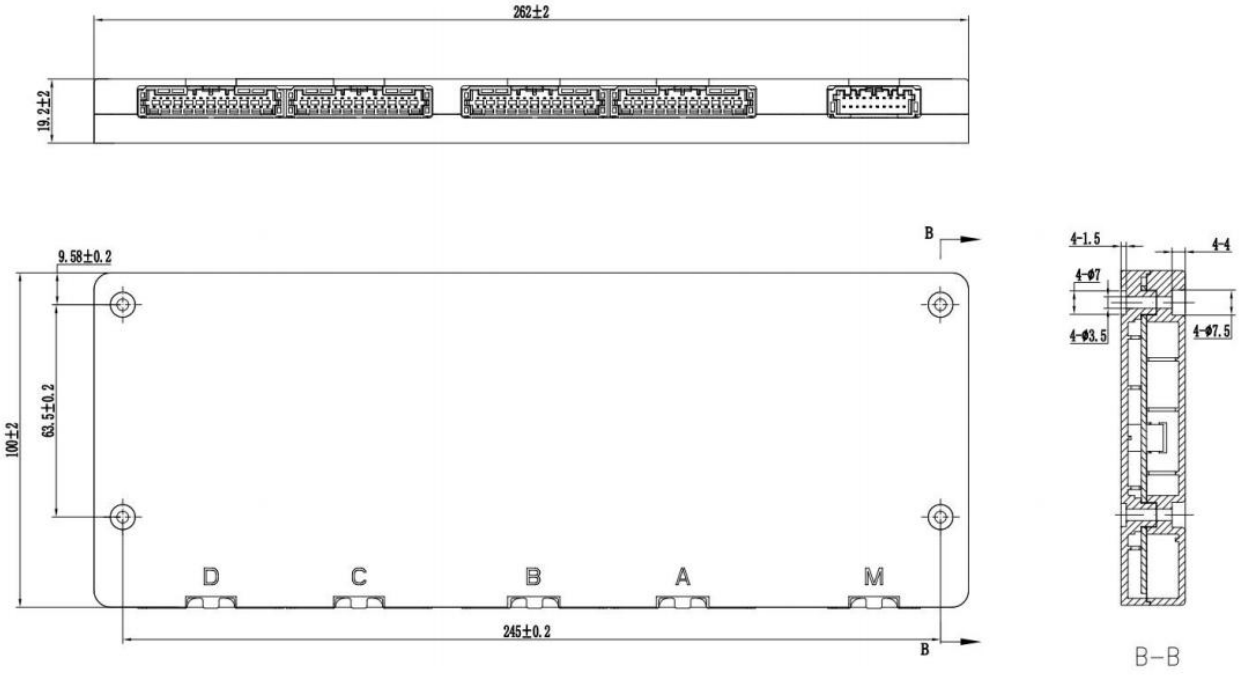
measured. Support power supply/single voltage (over-voltage, under-voltage), temperature (over-temperature), communication fault and other alarm functions; Balanced fault detection is supported.

3.2.2.1 Specifications

No	Item	Condition	Standard	Note
1	Environment	Operating temperature	-20~+55℃	
		Running humidity	<90%	
		Altitude requirements	<3000m	
2	Balanced management	Voltage balance range	2V~5V	
		Battery balance method	Passive equilibrium	
		Battery balance current	100mA nominal	Average current (non-peak)
3	Temperature acquisition	Temperature acquisition range	-40~125℃	
		Temperature acquisition precision	±1℃	±1℃@-25℃~65℃ ±2℃@-40℃~-25℃ or 65℃~125℃
4	Safety regulation		UL60950,IEC 60730-1:2013, GB/T36276-2018,IEC 62477-1	

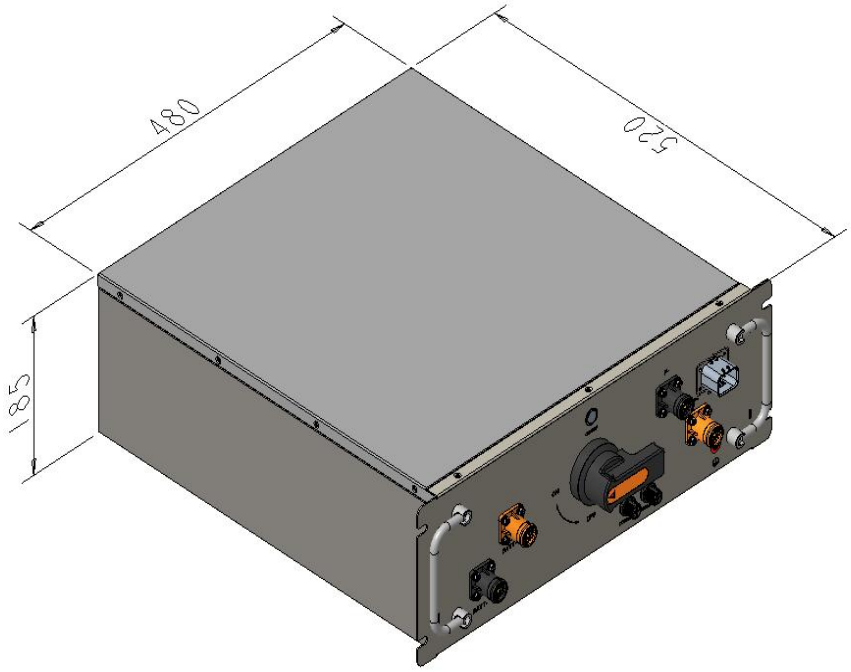
3.2.2.2 Dimension

Exterior dimensions are for reference only. The details are subject to the actual product.



3.3 PDU（Power Distribution Unit） Introduction

The PDU contains the ESBCU control unit and electrical components for the management and protection of the operating status of the entire battery cluster. Refer to the following figure for the size (subject to the actual product)：



(PDU is for reference only)

3.3.1 Function

It supports AC~220V (or DC-24V power supply) and battery pack DC/DC dual power supply (mains priority);

It supports the power supply of the energy storage battery management module ESBMU, and the power supply power can be configured according to the number of ESBMU modules;

It supports the CAN communication function with the energy storage battery management module ESBMU to realize the aggregation and management of battery cluster information;

It supports LAN and CAN communication functions with the battery management system host ESMU to realize information interaction;

It supports communication control and dry contact control with energy storage converter, and supports CAN communication and RS-485 communication mode;

It supports ESBCU auto-addressing;

It supports digital signal input detection, and can detect switching status signals, etc;

It supports battery pack voltage detection, battery pack current detection, and battery pack insulation state detection;

PDU size (width * depth * height): 500 * 600 * 200mm (The details are subject to the actual product, excluding bracket);

It supports IP54 protection；

The PDU supports the allowable parameters of the system: battery cluster overall voltage ≤ 1500V, maximum current of the battery cluster ≤ 200A.

3.3.2 Specifications of the main control module ESBCU

This module manages the battery packs in the energy storage battery system. It is mainly responsible for the voltage collection, current collection, and summary of the voltage and temperature information of the single battery in the battery pack; Calculate the SOC/SOH status of the battery pack, and perform the balancing strategy judgment and battery fault diagnosis functions; Based on the battery fault information, the battery pack can be protected on the spot and controlled by relays.

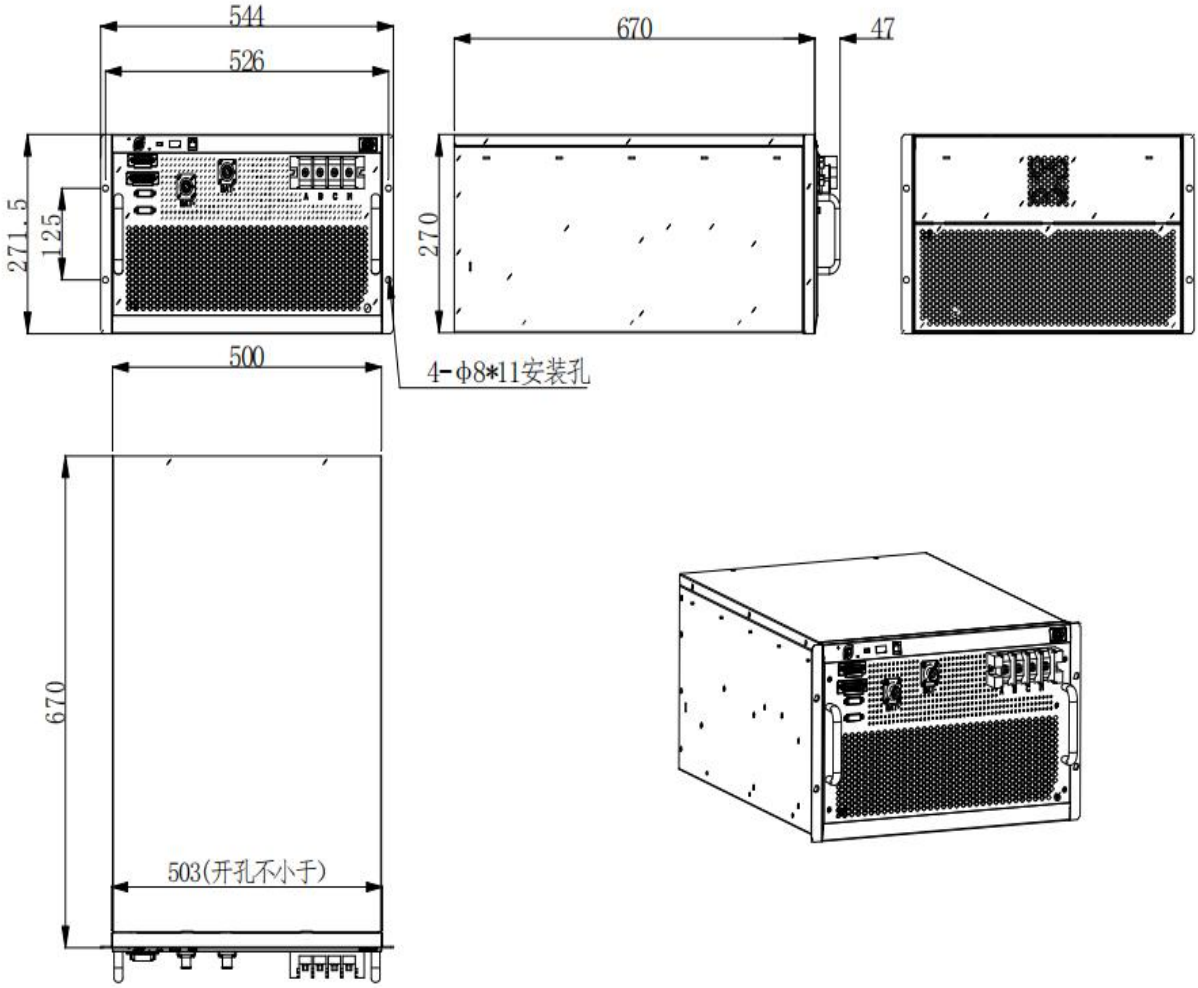
It has calculation functions such as insulation acquisition function and individual SOC/SOH. CAN communication interface, RS-485 communication interface and Ethernet communication interface for communication with external devices. ESBCU is the core module of the energy storage battery management system, and it is also an important equipment to ensure the safety, reliability, efficiency and operation of the energy storage system. The main specifications are as follows:

Voltage acquisition	Acquisition range	0~1500V	
	Acquisition precision	<±0.2% FS	
Current acquisition	Acquisition range	-500~500A	
	Acquisition precision	±(0.5% FS+0.5%RD)	
Temperature acquisition	Acquisition range	-40~125℃	
	Acquisition precision	±1℃	±1℃@-25℃~65℃ ±2℃@-40℃~-25℃ or 65℃~125℃
Communication	CAN/LAN/RS485		
Safety regulation	UL60950,UL60730,GB/T 36276-2018,IEC62477,IEC62619		

3.4 Technical parameters of PCS（Power Conversion System）

PCS is a bidirectional controllable current conversion device that connects the energy storage battery system and the power grid. Its main function is to realize the energy exchange between the battery and the power grid, and to control and manage the charge and discharge of the battery.

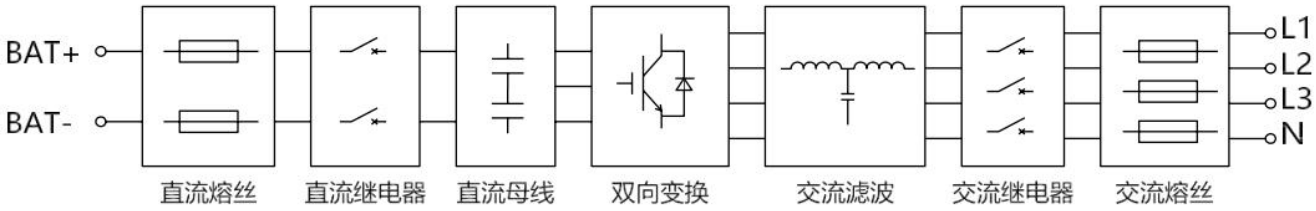
3.4.1 Dimension



3.4.2 PCS Technical parameters

Item	Parameters	Note
Maximum DC power(kW)	162	
Maximum input current(A)	171	
DC operating voltage range（V）	615~950(3P3L)/650-950(3P4L)	
AC side parameters (grid-connected)		
Rated AC power(kW)	105	
Maximum apparent load power（kVA)	115	
Maximum current(A)	167	
AC access mode		
Isolation method	No isolation	
Rated power factor	0.99	
Power factor adjustable range	-1~+1	
Cross-side grid operation parameters		
Rated operating voltage(Vac)	240/400	
Allowable grid voltage range	-10%~10%	
Rated network frequency(Hz)	50/60	
Total harmonic distortion rate of voltage(THD)	<3%（Rated power）	
Off-side grid operation parameters		
Rated output voltage	230/400	
Ac voltage harmonics	<3%（Linear load）	
Rated output frequency(Hz)	50/60	
Rated output power(kW)	105	
Maximum apparent power（kVA）	115.5	
Maximum output current(A)	167	
Main protection characteristics		
Main protection characteristics	Ac over-current protection, AC over-voltage protection, AC surge protection, AC short circuit protection, anti-island protection, DC reverse connection protection, straight surge protection	
Population parameter		
Ac phase number	Three-phase four-wire	Compatible three phase three wire
Overload capacity	110% long-term	
Maximum discharge efficiency	98.2%	
Communication protocol	CAN、RS485	
Normal operating conditions		
Class of protection	IP20	
Operating ambient temperature	-25℃~+60℃（> 45℃ derated operation）	
Relative humidity	0%～95%，non-condensing	
Altitude	≤3000m	（Derated over 2000m）

3.4.3 Principle process diagram



3.5 Fire protection system

3.5.1 General overview

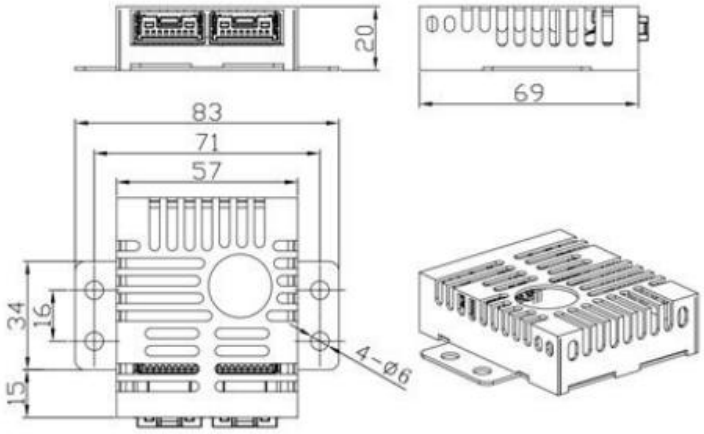
The aerosol (optional perfluorohexanone) fire extinguishing system has high fire extinguishing efficiency and low fire extinguishing concentration, and can extinguish class B, C and E fires. Non-conductive, volatile leaves no trace residue, can be used to protect valuable devices and storage places, use it without any damage to equipment and goods.

3.5.2 Main technical parameters

Item	Parameter
ambient temperature range	-20℃~+70℃
Size	83mm×69mm×20mm(subject to actual product)
Ambient relative humidity	≤95％RH
VOC alarm value	Threshold alarm
Operating pressure	55~106KPa
Smoke alarm value	0.3db/m
Spray time	≤10s
Output interface	Active output
Extinguishing agent	Aerosol (perfluorohexanone optional)
Installation mode	bolting
Design life	8 years

3.5.3 Product size appearance

The product size and appearance reference is as follows. The details are subject to the actual product.



3.6 Liquid cooling system

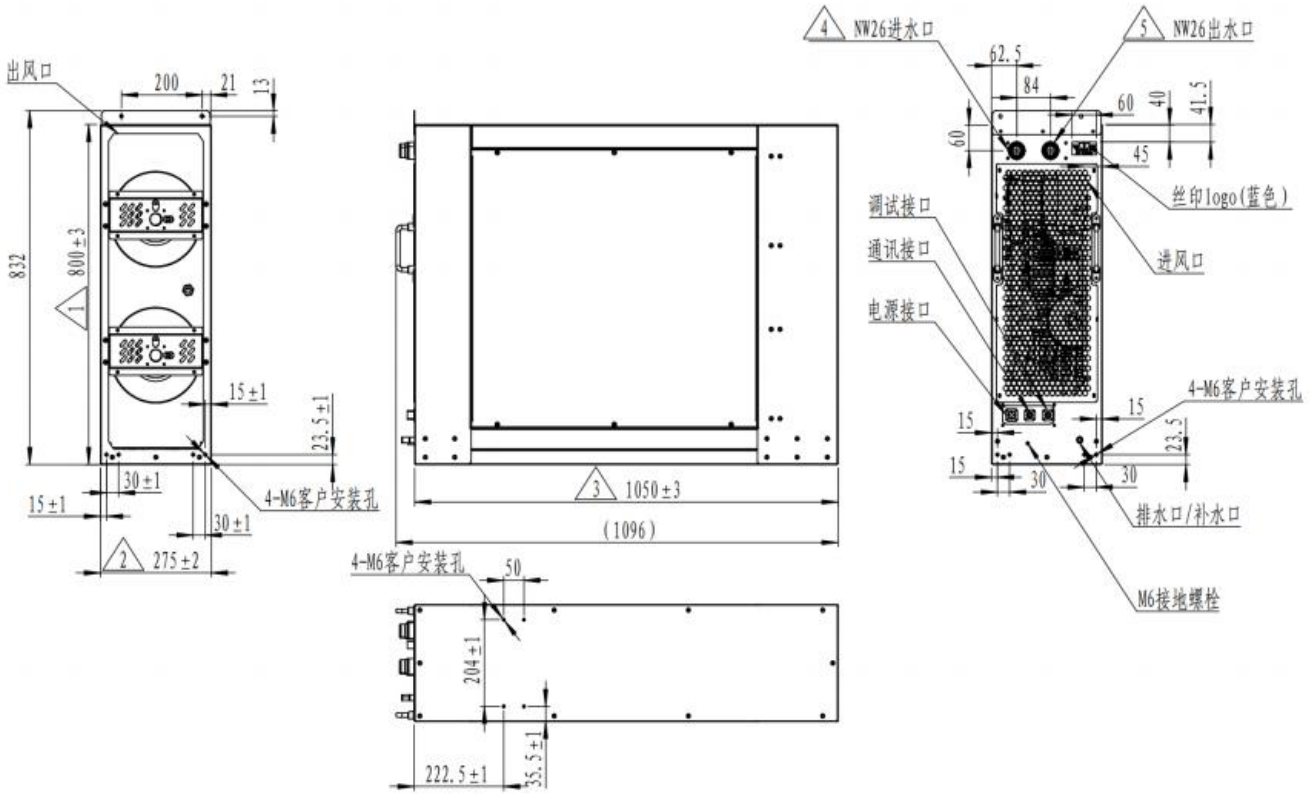
3.6.1 Function description

The liquid cooling system can realize the cooling function and heating function. Cooling function: can effectively solve the battery in the charge and discharge process due to high temperature caused by slow charge and discharge speed, life attenuation, safety hazards and other thermal runaway problems. Heating mode: It can effectively solve the problem of battery failure to start and performance attenuation in low temperature environment, and ensure the efficient operation of the battery in the appropriate temperature range.

3.6.2 Main technical parameters

Item	Unit	Parameter
Operating ambient temperature	℃	-30~+55
Storage humidity range	RH	5%~95%
Noise level	dB(A)	75
Anti-corrosion Class	/	C4
Waterproof and dustproof Class	/	IP20
refrigerant	/	R410A
Secondary refrigerant	/	Pure water containing 50% glycol solution
Design Life	year	10
Cooling/heating capacity		
Refrigerating capacity	kW	5
Heating capacity	kW	2
Power consumption		
Rated refrigerating power	kW	2.5
Power supply form and communication		
Rated AC input power supply	V/Hz	220±15% 50±5Hz
Maximum working current	A	16
Communication mode	/	RS485,CAN
Communication protocol	/	Modbus RTU

3.6.3 Overall Dimensions (subject to actual product)



3.7 Energy System Management Unit（ESMU）

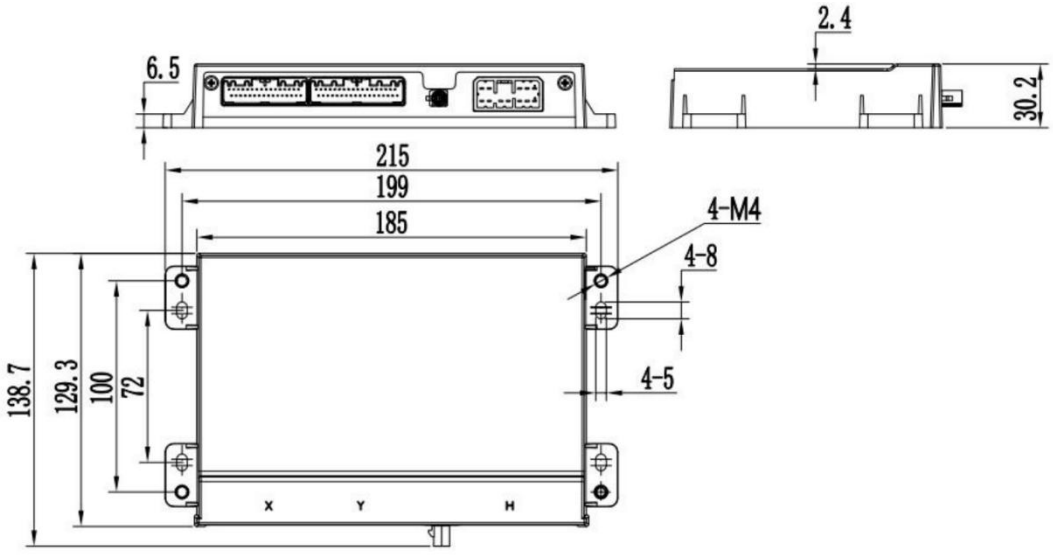
3.7.1 **Function introduction**

ESMU, also known as Level 3 BMS, is a control and management host suitable for energy storage battery management systems. It performs numerical calculation, performance analysis, alarm processing and record storage of real-time battery data uploaded by ESBCU (Level 2 BMS) and ESBMU (Level 1 BMS). In addition, it can also realize linkage control with PCS host and energy storage management system (EMS). Optimize the load control strategy according to the output power requirements and SOC status of each battery cluster to ensure the safe, stable and efficient operation of the battery system.

3.7.2 Technical parameter

Processor	ARM platform, quad-core, main frequency up to 2.0GHz
Storage	16GB
Operating system	Linux
LCD	10.1 "Color LCD screen (optional)
Alarm mode	Support sound and light alarm, and display the alarm content, the fault node output closed
Communication interface	LAN/CAN/RS485
Operating environment	Ambient temperature: -10 ~ +60℃, Relative humidity: < 95% (no condensation) Ambient magnetic field: < 400A/m, no corrosive flammable and explosive gases are allowed around

3.7.3 Product appearance size (The details are subject to the actual product)



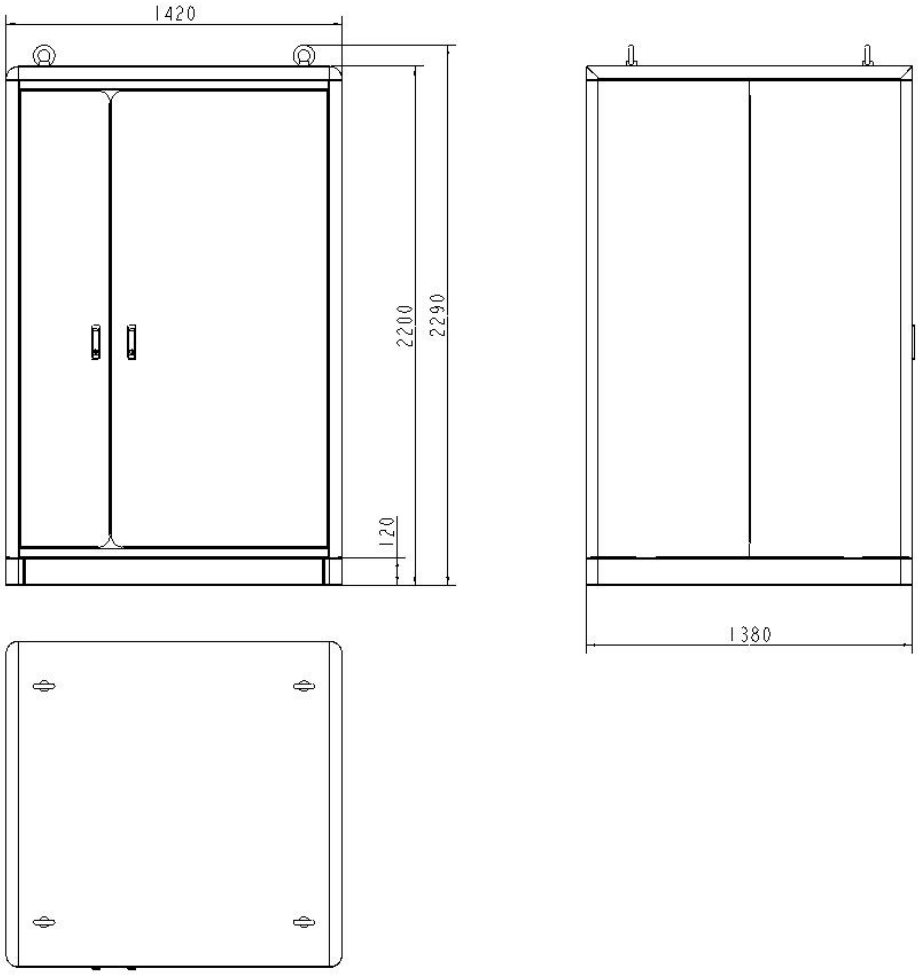
4. Supply List

Master supply list

No.	Device	Specification	Unit	Number	Note
1	ESS cabinet	Refer to specification requirements	Table/seat	1	Includes: 5 battery box, running indicator (3), emergency stop switch
2	PCS	105kW	Set	1	Meet the grid and off-grid use
3	Battery pack	215kWh	Set	5	Single battery pack 43kWh
4	Battery management system	BMS	Set	1	
5	Fire protection system	/	Set	1	
6	Liquid cooling machine	/	Set	1	
7	Piping system	Special customization	Set	1	

5. Product Size

The following 2D figure is for reference only.The details are subject to the actual product.



6. Packing and transportation

1) All goods comply with the regulations of the competent national authorities and have strong packaging suitable for long-distance transport and handling. The packaging shall be in good condition during transportation and loading and unloading, and shall have anti-vibration, anti-impact and anti-wear application

2) For unpacked goods, the relevant content should be noted on the metal label, and should be equipped with sufficient cargo support or packaging wood. Special tools (if any) are packaged separately and enclosed as described above

3) The battery cabinet should be packed for transportation, and the power should not be higher than 30%. During transportation, it should be protected from severe vibration, impact or extrusion, and protected from sun and rain. In the process of loading, unloading and transportation, large external impact should be avoided, and throwing, rolling, inverting, squeezing and stacking should be prohibited.

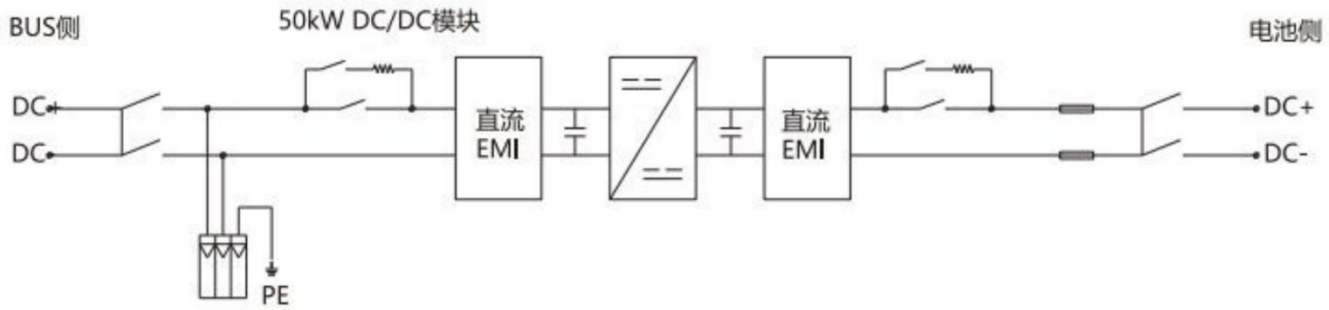
7. System optional function

7.1 DCDC

7.1.1 DCDC Introduction

Two-way DC/DC conversion module, using three-level topology, has the advantages of more efficient, smaller size and less EMI interference, can realize DC high and low voltage switching, support MPPT mode access photovoltaic panel to achieve maximum power tracking or access AC/DC to power the load.

7.1.2 System topology



7.1.3 Technical specification parameter

Electrical parameter		Note
Power	50KW	Maximum continuous
High side voltage	300V-1000V	
Low side voltage	0-900V	
High voltage side current	80A	Maximum

Low voltage side current	100A	Maximum
Peak power	＞99%	High voltage side 720V, low voltage side 550V, and the power can reach 46.6KW
Operating mode	Constant voltage, bidirectional constant voltage, constant current, constant power, boost MPPT, step-down MPPT	settable
Communication	RS485/Modbus RTU	
Operating temperature	-25℃-55℃	Derate > 45°C
Power port	PCS、PV、BAT	
Product size	440*500*88（mm）	
Short-circuit current	273A	
Certification standard	IEC/EN 62477-1:2012;IEC/EN 62109-1:2010	

7.2 STS

7.1.1 STS Introduction

When the energy storage system needs to provide backup power for important loads, the energy storage system needs to be equipped with STS to disconnect the energy storage system and important loads from the grid in the event of a power outage. In this way, energy storage can provide uninterrupted backup power for critical loads.

7.1.2 Features

Intelligent: Intelligent operation, with CAN, 485, Ethernet and other communication interfaces.

Response: intelligent and rapid separation of power grid and micro-grid, switching power supply circuit (≤20ms).

Reliable: High-reliability back-up design (fast switch and bypass switch parallel design) ensures that critical loads are not interrupted.

Convenient: Designed for front maintenance, easy to operate and maintain.

7.1.3 Specification parameter

No.	Parametric performance	Parameter
1	Maximum efficiency	＞99.5%
2	Grid connection	Three-phase four-wire
3	Rated power	200KW
4	Rated voltage	220V/380V,230V/400V
5	Maximum current	318A
6	Off-grid switching time	＜20ms
7	Operating temperature	-25℃-60℃
8	Maximum working altitude	4000m（> 2000m Derated）
9	Communication	RS485/CAN
10	Dimension	440*425*232
11	IP Class	IP20

8. Disclaimer

All battery product delivery projects must complete the product installation confirmation procedure, and our company assumes warranty responsibility for the battery products that have fulfilled the completion of the installation confirmation procedure. The Company shall not be liable for any loss or accident caused by improper use by the user or as determined by the following facts:

（1）Replace the BMS system without permission when using the battery pack or conducting a charge and discharge test on the battery system, resulting in overcharging or over-discharging of part or the whole group of batteries;

（2）The installation process is not operated in accordance with the operation manual, and the battery pack battery cannot be used due to bump and damage;；

（3）Dismantling the battery pack without permission and making changes to the battery pack structure

（4）Due to the wrong self-connection, the battery is reversely charged, resulting in the early scrapping of part or the entire group of batteries；

（5）Failure to effectively control the charge of the battery system resulted in some or the entire group of batteries being overcharged；

（6）Failure to effectively control the discharge of the battery system resulted in partial or entire group of batteries being over-discharged；

（7）Due to the improper specification selection of electrical components such as cables, connectors, and terminals in the electrical circuit, major safety accidents such as fires caused by overheating and spontaneous combustion of the circuit are caused；

（8）The power main circuit is not equipped with appropriate high-voltage safety protection devices, which causes a short circuit in the pool system or damage to the on-board equipment due to line aging and damage；

（9）Individual batteries are over-discharged due to connections that affect the balance of charge of the battery system (e.g., power lines are separately drawn from individual batteries to supply power to low-voltage electrical appliances).；

（10）The connection reliability between the cable terminals and conductive strips of the main power circuit and the battery pole is poor. Due to the loosening of the connecting bolts, the connection is seriously heated, resulting in the attenuation of battery life and even safety accidents；

（11）Failure to regularly inspect and maintain the battery usage, failure to discover and eliminate potential accidents in time, and eventually lead to accidents

（12）Unauthorized replacement of key components (such as PCS, liquid cooler, etc.) causes damage to the battery system or safety accidents

9. Revision

In order to improve product quality and performance, the Company reserves the right to make any changes/revisions to the product specifications and instruction manuals without notifying previous customers. Due to the continuous improvement and updating of the product in technology, there may be a situation where the actual product is slightly different from the manual, please refer to the actual product.

The company has the final right to interpret the specifications or instruction manuals of this product.

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