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|  | Guangdong Longwei New Power Technology Co., Ltd. | File Number    |           |
|   |  | Version Number | A02       |
|   | 261kWh Energy Storage Outdoor Cabinet            | Effective Date | 2024/9/20 |

261kWh Energy Storage Outdoor Cabinet

### Product Specification

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# 1. Product introduction

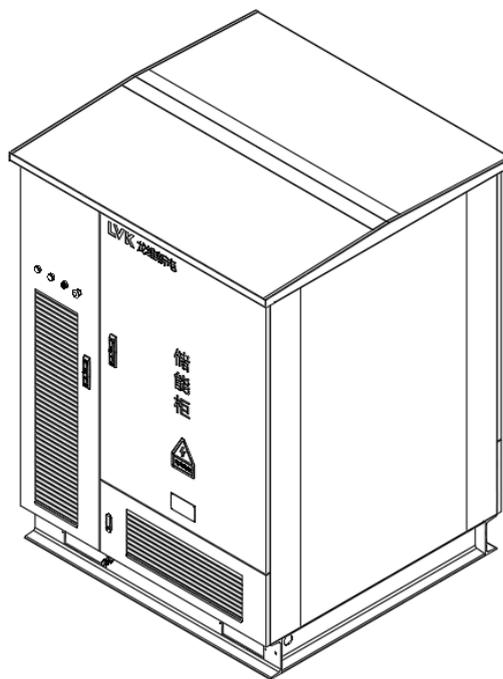
## 1.1 Overview

The 261 kWh energy storage outdoor cabinet developed by our company, as a new generation of industrial and commercial energy storage solutions, fully integrates advanced technologies such as "high efficiency, full, long life, and easy expansion" to form a modular, standardized, and intelligent outdoor energy storage system.

Energy storage adopts the design concept of "safe and reliable". Parts are self-developed or sourced from first-tier suppliers to provide customers with

Provide safe, reliable, affordable, high-quality, easy-to-install, easy-to-expand, simple, and easy-to-use energy storage products, making the construction of energy storage projects simpler,

Use is simpler, and operation and maintenance are easier.



Isometric drawing

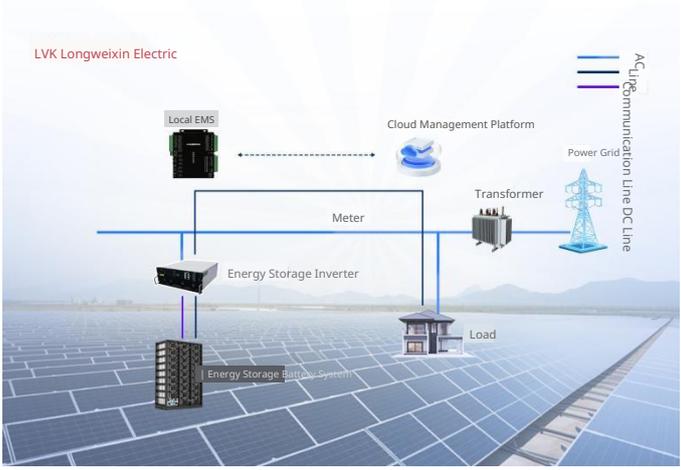
Figure 1-1 261kWh energy storage outdoor cabinet schematic diagram

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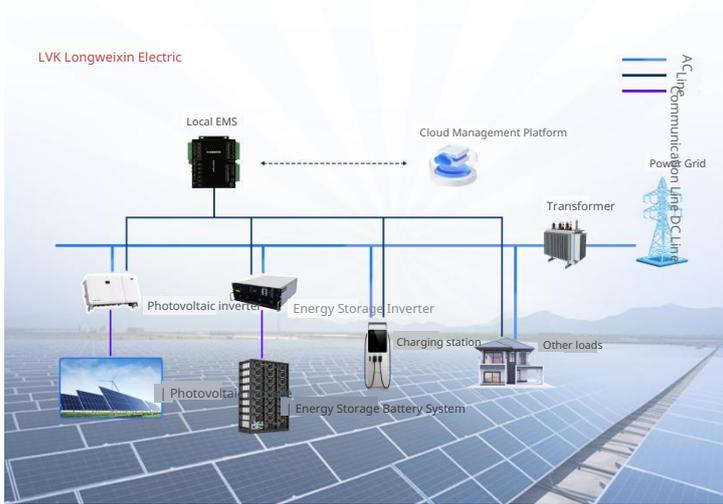
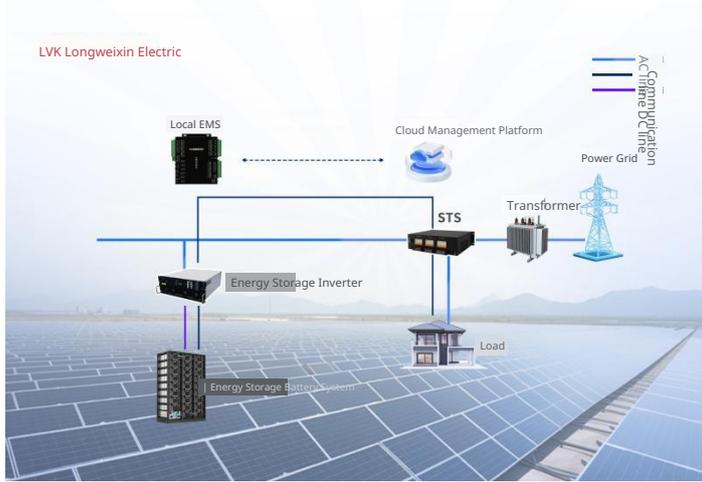


Figure 1-2: 261kWh energy storage outdoor cabinet parallel topology (battery-PCS-grid-connected cabinet)

## 1.2 Product application scenario 1

|                |                           |  |
|----------------|---------------------------|--|
| <b>Scene 1</b> | Application scenario name | User-side energy storage   |
|                | Schematic diagram display |    |
|                | Main function description | <p>The user-side energy storage system is mainly charged during electricity price troughs or flat periods, and discharged during electricity price peaks or peak values to obtain electricity price difference benefits; it can also manage the maximum demand, eliminate short-term peak electricity consumption loads, and reduce the user's basic electricity expenses; it can also use energy storage for power supply during peak electricity load, supporting dynamic capacity expansion function.</p> |

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|            |                           |   |
|------------|---------------------------|---|
| Scene 2    | Application scenario name | <b>PV-ESS-Charging</b>  |
|            | Schematic diagram display |   |
|            | Main function description | <p>Due to the large short-term capacity increase pressure of the distribution network in the city, the insufficient power supply capacity leads to some charging stations being unable to operate normally, and the operating income is limited. In the PV-ESS-Charging system, energy storage can absorb the surplus of photovoltaic power generation or charge during the low electricity price period, and discharge during the peak electricity consumption and peak electricity price period, which can alleviate the tight capacity of the urban distribution network and</p> |
| Scene 3    | Application scenario name | <b>Backup power function (single unit 125kW/261kWh)</b>   |
|            | Schematic diagram display |   |
|            | Main function description | <p>In industrial and commercial enterprises, for power consumption places with high requirements for power supply reliability, STS modules can be selected to improve power supply reliability. When the mains power is off, switch to energy storage power supply, and the STS switching time does not</p>   |
| Scenario 4 | Application scenario name | <b>Microgrid</b>  |

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|  |                           |  |
|--|---------------------------|--|
|  | Schematic diagram display |    |
|  | Main function description | <p>Supports power consumption scenarios in remote areas where mains power is unstable or there is no mains power access. The energy storage system is connected with other distributed power sources to form a small microgrid to ensure power supply.</p> |

## 1.3 Product Features

### 1.3.1 Product Capacity

Energy storage outdoor cabinet capacity 125kW/261kWh (0.5P), the outdoor cabinet can be freely expanded and matched according to user needs, supporting up to

Expand 10 units, capacity range 125~1250kW/261kWh~2610kWh, to meet the needs of different scale energy storage projects.

### 1.3.2 Product composition

The energy storage outdoor cabinet integrates 7 core systems, which can provide stable and reliable performance under different application scenarios and environmental conditions. The core systems are introduced as follows:

- 1) Energy storage battery system ----- for storing and releasing electricity;
- 2) Battery Management System BMS ----- for battery data acquisition, status monitoring and control protection;
- 3) Energy Management System EMS ----- Configure power management strategies, monitor, control and power flow;
- 4) Fire safety system ----- provides effective means for fire safety protection;
- 5) Energy storage converter system PCS----Bidirectional current conversion between battery DC power and grid AC power;
- 6) Liquid cooling system ----- provides efficient temperature control for the cells;

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7) Electrical system ----- provides reliable power supply, lighting, grounding and other functions for cabinet equipment.

### 1.3.3 Product Advantages

The main advantages of this series of products are as follows:

1) Using high-safety, high-energy density, long-cycle life lithium iron phosphate polymer cells, it can adapt to various scenarios with a 0.5P rate of rate;

2) Adopting an efficient liquid cooling solution to effectively optimize the temperature difference between batteries and improve battery cycle life;

3) Adopting an active safety fire protection solution, equipped with a PACK-level D single-package water injection fire extinguishing system, which can timely and effectively conduct early fire detection, alarm and fire extinguishing, firmly guarding the lifeline of product safety;

4) Adopting a modular and standardized design scheme, a single outdoor cabinet occupies a small area, is convenient for transportation and installation, and has high installation site adaptability. Outdoor cabinets are easy to expand, each group can expand 1-10 units (261kWh-2610kWh), and multiple groups of outdoor cabinets can also be configured according to project needs.

5) Adopting an AC side parallel connection scheme fundamentally eliminates the circulating current between batteries and further improves battery life.

6) Adopting an intelligent design concept, it has cloud remote operation and maintenance functions, full life cycle system maintenance, and can predict the impact of operating conditions on battery SOC and SOE, continuously selecting generation control strategies, so that the system is always running in the best state, reducing battery performance and life loss.

7) Adopting the design concept of active system security, 7\*24 hours of real-time cloud monitoring, predicting security risks in advance, issuing security warnings in advance, and providing timely and effective protection in the event of a failure.

8) The outdoor cabinet has multiple protection functions such as "anti-corrosion, fire prevention, waterproof, dustproof, shockproof, and anti-ultraviolet", and the structural strength and space can provide favorable protection for the stable operation of the energy storage battery system.

9) Users can choose STS module according to their needs. After selection, the outdoor cabinet has backup power function, which improves the power supply reliability of important places.

10) Users can select photovoltaic MPPT module according to their needs. After selection, the outdoor cabinet has photovoltaic DC coupling function, which stores photovoltaic power into the energy storage cabinet.

11) Users can select photovoltaic energy storage dynamic regulation system according to their needs to maximize the value of photovoltaic power generation.

### 1.3.4 Internal layout

In order to improve system safety, reduce the probability of equipment misoperation, reduce fire safety risks, save operation cost investment, and realize the long-term stable operation of energy storage outdoor cabinet, the energy storage outdoor cabinet is divided into equipment compartment and battery compartment. High-grade thermal insulation and flame-retardant materials are used for isolation between the compartments. The equipment compartment integrates liquid cooling unit, PCS equipment, etc., and the battery compartment mainly integrates battery system. The "temperature control", "fire safety" and "function operation" of the equipment compartment and the battery compartment are three functional zoning types.

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Table 1-1: Outdoor cabinet function zoning description

| Compartment name      | Main installation equipment               | Fire safety   | Function operation                                       | Temperature control                 |
|-----------------------|---|---|--|-------------------------------------|
| Equipment compartment | Name: PCS, liquid cooling unit            | External configuration water injection system                                   | Local operation, fault repair                            | Liquid cooling, natural air cooling |
| Battery compartment   | Name: Battery pack, high-voltage box, EMS | Active fire protection, PACK level<br>Aerosol + water injection fire protection | System control, on-site operation, fault troubleshooting | Liquid cooling                      |

## 1.4 Product Configuration List

The main equipment configuration of a single outdoor energy storage cabinet is as follows:

| Serial number | System name                 | Main equipment name   | Description   | Unit   | Quantity |
|---------------|-----------------------------|-----------------------|---|--------|----------|
| 1             | Battery system              | 52kWh battery pack    | Adopting 3.2V/314Ah LFP battery cell  | Pieces | 5        |
| 2             | Battery Management System   | Slave control module  | Each battery pack is equipped with 1 slave control  | Pieces | 5        |
| 3             |                             | Master control module | Every 5 battery packs are equipped with 1 master control  | Pieces | 1        |
| 4             | Electrical box              | High voltage box      | Each outdoor cabinet is equipped with 1 high voltage box  | Pieces | 1        |
| 6             | AC/DC converter system      | PCS                   | 125kW   | set    | 1        |
| 7             | Energy Management System    | EMS                   | Supports peak shaving and valley filling, demand control and other functions, and is only configured in the main cabinet. | set    | 1        |
| 8             | Fire extinguishing system   | /                     | PACK level water injection fire or aerosol fire extinguishing system  | set    | 1        |
| 9             | Liquid cooling system       | Cooling capacity 8kW  | Cold plate, liquid cooling, etc.  | set    | 1        |
| 10            | Electrical auxiliary system | /                     | Low-voltage electrical appliances, DC, grounding, wiring, etc.  | Unit   | 1        |
| 11            | Cabinet                     | /                     | Sheet metal structure of the cabinet and its installation accessories.  | set    | 1        |
| 12            | Photovoltaic MPPT module    | 120kW                 | Select configuration according to actual situation  |        |          |
| 13            | Photovoltaic inverter       | Power self-allocation | Select configuration according to actual situation  |        |          |

Note: Equipment name/specification and corresponding quantity are subject to actual delivery.

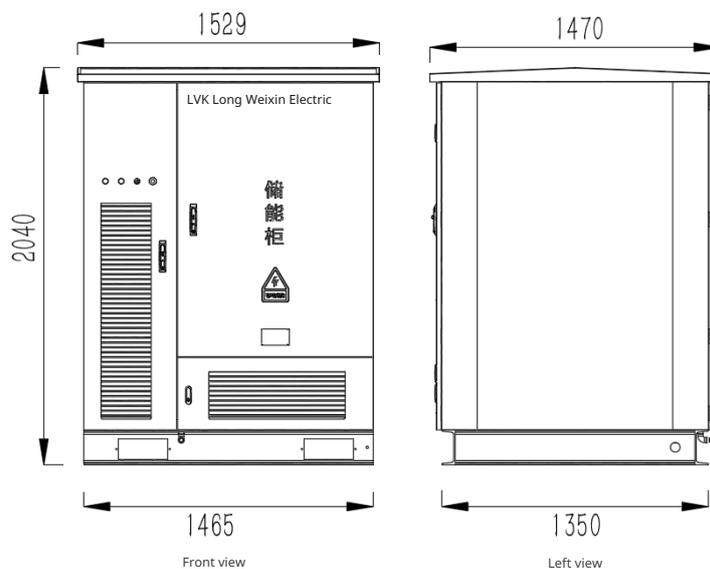
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### 1.5 Product parameter table

|   |  |
|---|--|
| System parameters                             |  |
| Single outdoor cabinet capacity               | 125kW/261kWh   |
| Maximum number of units in parallel per group | 10 unit  |
| Maximum parallel capacity per group           | 1250kW/2610kWh   |
| Discharge operating temperature               | -15℃~45℃   |
| Charging work stable                          | 0℃~45℃   |
| Storage temperature(℃)                        | Within one month: -20℃~45℃   |
|   | Within six months: 0℃~35℃  |
| <b>Noise</b>                                  | <75db  |
| Cooling method                                | Liquid cooling   |
| Number of cycles                              | 8000 Times @25℃, 0.5P, 70%EOL  |
|   | 4200 Times @25℃, 0.5P, 80%EOL  |
| Fire extinguishing system                     | Active fire warning, Pack-level aerosol fire extinguishing + water injection |
| <b>Detector type</b>                          | Temperature and combustible gas  |
| Reference dimensions (width*depth*height mm)  | 1465*1350. 8*2040mm  |
| <b>Weight (T)</b>                             | 2.53   |
| Anti-corrosion <b>Level</b>                   | C3/C4/C5 (optional)  |
| Protection level                              | Battery compartment: IP54  |
|   | Equipment bay: IP54  |
| Permissible relative humidity                 | 0~95%  |
| Permissible altitude                          | ≤4000m (Derating above 2000m)  |
| System efficiency                             | 85%  |
| Communication protocol                        | Modbus TCP/RTU   |
| System operation mode                         | Peak shaving and valley filling  |
|   | Demand control   |
|   | Dynamic expansion  |
|   | Photovoltaic storage   |
|   | Anti-backflow function   |
|   | Charging pile with energy storage  |

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|                                       |                        |
|---------------------------------------|------------------------|
| Authentication                        | Battery: GB/T36276     |
|                                       | BMS: GB/T 34131        |
|                                       | PCS: GB/T 34120        |
| AC side parameters                    |                        |
| Rated AC power (KVA)                  | 125                    |
| AC overload capacity (KVA)            | 137.5                  |
| Wiring method                         | Three-phase four-wire  |
| Permissible grid voltage range (V.ac) | 400 (-5%~5%)           |
| Permissible grid frequency range (Hz) | 50/60 (-2.5~2.5)       |
| Power factor                          | -0.99~0.99             |
| Maximum conversion efficiency         | ≥98%                   |
| Cooling method                        | Liquid cooling         |
| Unbalanced load capacity              | 100%                   |
| DC side parameters                    |                        |
| Battery type                          | Lithium iron phosphate |
| Combination Mode                      | 1P260S                 |
| Nominal Capacity (Ah)                 | 314                    |
| Nominal Energy (kWh)                  | 261                    |
| Nominal Voltage (V)                   | 832                    |
| Rated charge and discharge rate       | 0.5P                   |
| Operating voltage range (V)           | 676~936                |



Outdoor cabinet dimension drawing

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## 2. Core System Introduction

### 2.1 Energy Storage Battery System

The grouping form of the prefabricated energy storage battery system is as follows:

Table 2-1 Battery System Grouping Form

| Serial number | Level                         | 261kwh energy storage outdoor cabinet |
|---------------|-------------------------------|---------------------------------------|
| 1             | Series-parallel grouping form | 1P260S                                |
| 2             | Number of cells               | 260                                   |
| 3             | Number of battery packs       | 5                                     |
| 4             | Number of battery clusters    | 1                                     |
| 5             | Number of high-voltage boxes  | 1                                     |

Note: In the grouping form, "S" represents series connection, and "P" represents parallel connection.

#### 2.1.1 Energy storage cell

This product uses long-life 3.2V/314Ah lithium iron phosphate polymer cells, which have high safety, high energy density, long cycle life, and low cost. Currently, this cell has passed the test conducted by a third-party authority according to the GB/T 36276-2018 standard. The basic parameters of the cell are as follows:

Table 2-23144h Basic Parameters of Battery Cell

| Serial number | Item                        | Specification | Remarks                            |
|---------------|-----------------------------|---------------|------------------------------------|
| 1             | Cell model                  | LFP           | LFP                                |
| 2             | Cell weight (kg)            | 5.6 ± 0.15    | After wrapping with blue film      |
| 3             | Rated capacity (Ah)         | 314           | 25°C standard charge and discharge |
| 4             | Nominal energy (Wh)         | 1004.8Wh      |                                    |
| 5             | Rated voltage (V)           | 3.2           |                                    |
| 6             | Charge limit voltage (V)    | 3.6           |                                    |
| 7             | Discharge limit voltage (V) | 2.6           |                                    |
| 8             | Rated charging power        | 0.5P          |                                    |

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| Serial number | Item                        | Specification | Remarks                  |
|---------------|-----------------------------|---------------|--------------------------|
| 9             | Maximum charging power      | 0.5P          |                          |
| 10            | Rated discharge power       | 0.5P          |                          |
| 11            | Maximum discharge power     | 0.5P          |                          |
| 12            | Number of cycles            | ≥8000 times   | @25 °C,0.5P/0.5P, EOL70% |
| 13            | AC internal resistance (mΩ) | ≤0.18         |                          |

### 2.1.2 Battery pack

The liquid-cooled battery pack used in this product is independently researched, designed, and manufactured by our company. Its interior is mainly composed of cells, connecting copper bars, box liquid cooling plates, acquisition communication harnesses, BMS and other components.

Each battery pack is equipped with 52 voltage acquisition points and 28 temperature acquisition points, which are connected to the BMU through the acquisition harness. The outdoor cabinet can accurately evaluate the cell status and reduce the probability of safety accidents through the temperature difference inside the battery pack.

1) Battery pack parameter table

Table 2-4 Battery Pack Parameter Table

| Serial number | Item                               | Parameter          | Remarks                     |
|---------------|------------------------------------|--------------------|-----------------------------|
| 1             | Grouping Method                    | 1P52S              |                             |
| 2             | Rated Energy (kWh)                 | 52                 |                             |
| 3             | Rated voltage (V)                  | 166                |                             |
| 4             | Working Voltage Range (V)          | 135~1187           | Single cell voltage 2.6~3.6 |
| 5             | Rated Power (kW)                   | 52                 |                             |
| 6             | Charging Temperature Range (°C)    | 0~45               |                             |
| 7             | Discharge temperature range (°C)   | -15~45             |                             |
| 8             | Recommended temperature range (°C) | 28±3               |                             |
| 9             | Protection level                   | IP67               |                             |
| 10            | Thermal management method          | Liquid cooling     |                             |
| 11            | Communication method               | CAN                |                             |
| 12            | Dimensions (W*D*H, mm)             | 1465*1350.8*2040mm |                             |

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### 2.1.3 Battery cluster

The battery cluster is mainly composed of battery packs and a high-voltage box. Each battery pack is installed in an outdoor cabinet and connected through a DC power cable and BMU communication wire harness to connect the modules.

The high-voltage box serves as the input and output window for energy flow and information flow of the battery cluster. It contains a BMU main controller, contactor, electrical appliances, fuse, pre-charge resistor, switching power supply, and other devices, and can be configured and modified according to project requirements.

Each energy storage outdoor cabinet battery compartment is arranged with 5 battery boxes and 1 high-voltage box to form 1 battery cluster. The basic parameters of the battery cluster are as follows:

Table 2-5 Battery Compartment Battery Cluster Parameter Table

| Serial number | Item                                      | Parameter                        |
|---------------|---|----------------------------------|
| 1             | Cell Selection                            | 3.2V/314AH                       |
| 2             | Grouping Method                           | 1P52S*5                          |
| 3             | Rated voltage (V)                         | 832                              |
| 4             | Working Voltage Range (V)                 | 676~936                          |
| 5             | Rated Energy (kWh)                        | 261                              |
| 6             | Rated charge and discharge rate           | 0.5P/0.5P @25°C                  |
| 7             | Thermal management method                 | Liquid cooling                   |
| 8             | Optimal cycle temperature (°C)            | 25                               |
| 9             | Temperature difference control range (°C) | ±3                               |
| 10            | Protection method                         | Fuse, contactor, circuit breaker |
| 11            | BMS configuration                         | BCU: 1                           |
|               |   | BMU: 5                           |
| 12            | High voltage box configuration            | 1 unit                           |

### 2.2 Battery Management System

The battery management system is an important foundation for the stable operation of energy storage batteries. It has various functions such as data acquisition, status monitoring, control protection, etc., and can realize comprehensive perception, early warning and precise control of battery status.

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### 2.2.1 BMS equipment composition

This product's BMS adopts a two-level architecture, featuring broad functional coverage, small size, strong anti-interference performance, and safety and reliability. Each battery pack has 1 built-in BMU (slave control unit), and each battery has 1 master control unit (BCU).

Table 2-6 Battery Management System Configuration Table

| Serial number | Equipment Name | Configuration Description                        | Function Description  | Installation Location       |
|---------------|----------------|--|---|-----------------------------|
| 1             | BMU            | Slave control unit, 1 built in each battery pack | Mainly responsible for the state parameter acquisition and monitoring of the battery pack   | Battery pack interior       |
| 2             | BCU            | Master Control Unit, 1 per battery cluster       | Mainly responsible for data monitoring, state calculation, charge and discharge management, etc. of a single cluster battery system, and communicates with other devices to implement system strategies | Inside the high-voltage box |

### 2.2.2 Introduction to Main BMS Functions

| Serial number   | Function Name  | Serial number | Function Name                        |
|---|--|---------------|--------------------------------------|
| 1   | Battery voltage and temperature measurement function | 7             | Operating parameter setting function |
| 2   | Online SOC diagnosis                                 | 8             | Active balancing function            |
| 3   | Battery system protection function                   | 9             | Storage function                     |
| 4   | Communication function                               | 10            | Battery state estimation             |
| 5   | Thermal management function                          | 11            | Time synchronization function        |
| 6   | Self-diagnosis and fault tolerance function          | 12            | Fault recording function             |
| .....More functional requirements can be discussed with our company |  |               |                                      |
|   |  |               |                                      |

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### 2.2.3 BMS Communication Architecture

The communication architecture of each BMS device in this product is as follows:

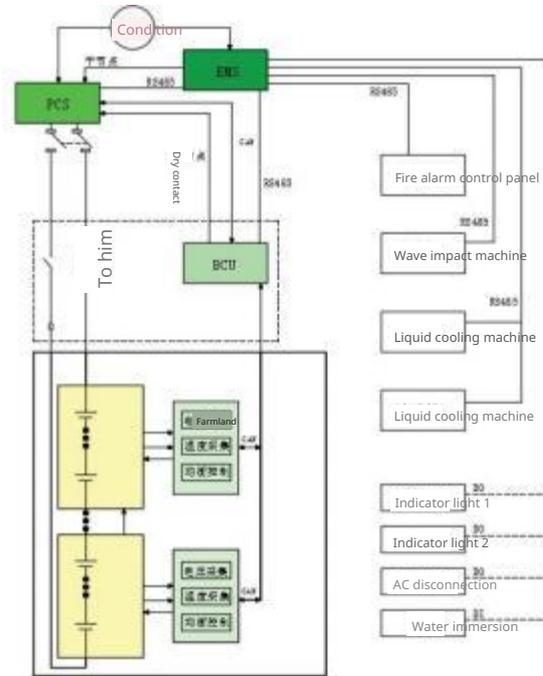


Figure 2-3 Schematic Diagram of BMS Communication Architecture

### 2.2.4 BMS Parameters

Table 2-6 BMS Parameter Table

| Serial number | Equipment Name            | Item                             | Parameter        |
|---------------|---------------------------|----------------------------------|------------------|
| 1             | BMU<br>Slave Control Unit | Working Voltage Range            | 9~32 V           |
| 2             |                           | Number of Battery Management     | 64 String (Max)  |
| 3             |                           | Balancing method                 | Active balancing |
| 4             |                           | Voltage acquisition range        | 0~5 V            |
| 5             |                           | Temperature acquisition quantity | -40~125℃         |
| 6             | BCU<br>Main control unit  | Working Voltage Range            | 9~32 V           |
| 7             |                           | SOC accuracy                     | ±5%              |
| 8             |                           | SOH accuracy                     | ±8%              |
| 9             |                           | Voltage acquisition range        | 0~1000 V         |
| 10            |                           | Current acquisition range        | -261~261 A       |
| 11            |                           | Temperature acquisition range    | -40~125℃         |
| 12            |                           | Communication interface type     | CAN\RS485        |

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## 2.3 Energy Management System

Energy Management System (EMS) is used to monitor, control, and optimize energy flows and energy consumption in energy systems. It is based on data acquisition, analysis, and decision support technologies, enabling real-time monitoring of the operating status of energy equipment, energy consumption, and environmental conditions, thereby achieving efficient management and optimization of energy.

### 2.3.1 Energy Scheduling and Control Strategies

The energy management system for outdoor energy storage cabinets has control strategies such as peak shaving and valley filling, demand control, dynamic expansion, photovoltaic storage and charging applications, energy storage and charging applications, and anti-backflow.

### 2.3.2 Main functions

(1) Data monitoring and collection: The energy management system can monitor the generation, storage, and consumption of energy in outdoor cabinets in real time; In addition, it can collect data from other equipment such as BMS, PCS, and dynamic environment systems, including battery charging and discharging status, temperature, voltage, current, etc.

(2) Data analysis and optimization: The energy management system relies on advanced data analysis technology to process and analyze the collected system data to understand the working status and performance of the energy system. By analyzing the data, potential problems in the energy system can be identified and optimization suggestions can be provided, such as adjusting charging and discharging strategies and optimizing energy utilization efficiency.

(3) Energy scheduling and control: The energy management system can intelligently perform energy scheduling and control based on real-time energy demand and system operation. It can reasonably arrange the charging and discharging operations of energy storage facilities based on factors such as demand forecasting, electricity price conditions, grid load, photovoltaic output, and charging pile response.

(4) Fault detection and safety protection: The energy management system can detect and alarm in a timely manner for faults in energy storage facilities, such as battery over-discharge and overcharge, abnormal temperature, etc., to ensure the safe operation of energy storage facilities. At the same time, it can also be linked with the distribution network system to achieve remote control and protection of energy storage facilities.

(5) Cloud remote operation and maintenance: The energy management system uploads the collected operation and fault data of the equipment to the cloud, which can accurately predict and locate faults remotely, greatly reducing the operation and maintenance work of engineers.

(6) Operation income display: The energy management system can display energy storage income and electricity information.

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### 2.3.3 EMS Communication Architecture Diagram



Figure 2-4 Schematic Diagram of EMS Communication Architecture

## 2.4 Energy Storage Converter System

The energy storage outdoor cabinet is equipped with two 125kW energy storage converters (PCS). The PCS is a device used to connect the battery system and the power grid (and/or load) to realize the bidirectional conversion of electric energy. It can control the charging and discharging process of the battery and perform AC/DC conversion. It adopts a three-phase four-bridge arm topology and has the ability to control single-phase and three-phase active and reactive power, which can accurately solve the three-phase imbalance problem.

### 2.4.1 Control function

PCS can be paired with EMS to realize various control functions such as peak shaving and valley filling, and demand control.

### 2.4.2 Protection function

The PCS can perform real-time fault protection according to the grid-connected side voltage, frequency and its own operating status. The protection functions include: grid over/under voltage, grid frequency over/under frequency, DC over/under voltage, AC over current, DC over current, phase loss, anti-islanding and other protection functions.

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## 2.5 Fire safety system

Disconnect the high voltage before the thermal runaway of the battery cell. This series of products adopts an active fire safety strategy to detect the temperature and voltage signals of the battery cell in real time, and electrical circuits. In addition, each energy storage outdoor cabinet is set as a protection zone, with two levels of protection - pack-level protection and cabinet-level protection; among them, pack-level protection uses a two-in-one composite detector as a detection device placed in each battery pack to detect the concentration of combustible gas and temperature in the pack, and an solenoid valve and pack-level nozzle are set on each PACK. The two-in-one composite detector is electrically connected to the cabinet-type energy storage non-pressure fire extinguishing device and forwards the control command of the corresponding solenoid valve. The outlet of the cabinet-type energy storage non-pressure fire extinguishing device is connected to the solenoid valve through a high-pressure hose and plug fittings. Once a thermal runaway occurs in a battery pack, the two-in-one detector transmits the alarm signal to the cabinet-type energy storage non-pressure fire extinguishing device and opens the corresponding solenoid valve. The cabinet-type energy storage non-pressure fire extinguishing device is activated, and the water injection system or aerosol fire extinguishing agent directly acts on the runaway battery pack through the quick connection pipeline and pack-level nozzle.

Cabinet-level protection adopts passive protection, and is used in combination with a non-pressurized water injection system fire extinguishing device and a temperature-sensitive magnetic power generation component. Once the temperature in the cabinet exceeds the starting temperature of the temperature-sensitive magnetic power generation, the temperature-sensitive magnetic power generation component will send a pulse current to start the non-pressurized water injection system or aerosol fire extinguishing device in the cabinet to provide full flooding protection for the energy storage cabinet and feed back the start signal to the cabinet-type energy storage non-pressure fire extinguishing device.

### 2.5.1 Main equipment

#### (1) Composite fire detector

Function: It integrates carbon monoxide and temperature two measurement parameters in a highly integrated way to comprehensively monitor and analyze the thermal runaway characteristic quantity of the battery

Installation position: 1 composite fire detector is arranged in each battery pack, and connected to the

cabinet-type energy storage non-pressure fire extinguishing device through CAN bus communication

#### (2) Cabinet-type energy storage non-pressure fire extinguishing device

Function: Integrated design of control and fire extinguishing, it is the data processing center and fire suppression main body of the entire fire extinguishing system.

On the one hand, it realizes communication with the fire detector through CAN communication, and on the other hand, the device has its own fire extinguishing agent bottle.

At the same time, the controller in the device also has the functions of fire detector fault detection and alarm signal output.

Installation position: In the energy storage outdoor cabinet.

#### 3) Pack-level water injection system or aerosol nozzle

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Each battery pack is equipped with a pack-level water injection system nozzle (installation holes need to be reserved on the battery pack in advance), and connected to the solenoid valve through TFEH hose and quick connector. The solenoid valve is then connected to the agent outlet of the cabinet energy storage non-pressure fire extinguishing device.

#### (4) Solenoid valve

Function: Receives commands from the control host and is opened by the detector to achieve single-pack injection of fire extinguishing agent into the thermal runaway battery pack.

Installation position: One solenoid valve is arranged on the outer panel of each battery pack.

## 2.5.2 Scheme logic control

### (1) Level 1 alarm:

Carbon dioxide concentration reaches 190ppm

Action: The detector increases the sampling frequency and focuses on monitoring battery packs with excessively high gas concentrations.

### (2) Level 2 alarm

-Carbon dioxide concentration  $\geq 890\text{ppm}$  or temperature rise  $\geq 1^\circ\text{C/s}$  for 10 consecutive seconds Action: The controller passes RS485 uploads Level 2 alarm information.

### (3) Level 3 Alarm

Carbon monoxide exceeds 1261ppm and (temperature  $\geq 65^\circ\text{C}$  or temperature rise greater than  $1^\circ\text{C/8}$  for 10 seconds) the controller opens Fire extinguishing agent bottle, the fire extinguishing agent suppresses the battery pack through pipelines and nozzles, and the controller performs the action: RS485 Uploads level 3 alarm information.

## 2.6 Liquid cooling system

### 2.6.1 Liquid cooling system

The liquid cooling system consists of a liquid cooling unit and supporting pipelines. When the cell temperature is too high or too low, the coolant circulates and exchanges heat with the battery system to achieve the optimal operating temperature conditions for the battery pack.

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## 2.7 Electrical system

The energy storage outdoor cabinet provides unified primary and secondary interfaces to standardize power grid connection, communication, and debugging work, improving the electrical construction efficiency of the product and reducing construction risks.

The wind inside the energy storage outdoor cabinet is powered by both mains and DC. The mains mainly supplies power to non-critical loads in the cabin, such as chillers and cooling fans; DC mainly supplies power to important equipment in the cabin such as BMS, fire protection, and EMS.

## 2.8 Environmental monitoring system

Temperature and humidity sensors and water immersion sensors are installed inside the energy storage outdoor cabinet. When the humidity inside the outdoor cabinet is detected to be too high, it will start to maintain a low humidity level inside the battery compartment; when abnormal temperature or water immersion is detected inside the outdoor cabinet, an alarm signal will be generated to promptly notify maintenance personnel for handling.

## 3 . Precautions

(1) Do not immerse the product in water.

(2) Improper use and storage of the product may result in fire, explosion, and burns. Do not disassemble, crush, incinerate, or heat the product.

(3) Do not throw the product into fire or expose it to high-temperature environments exceeding the temperature conditions specified in this specification for extended periods of time, as this may cause a fire.

(4) Keep the product out of reach of children. Do not remove the product from its original packaging before use. Dispose of used products promptly in accordance with local recycling or waste disposal regulations.

(5) Do not disassemble, remove, or modify the product in any way without authorization.

(6) Do not mix products from different brands.

(7) If the product emits an unusual odor, generates heat, becomes deformed, discolored, or exhibits any other abnormal phenomena, do not use it and move it to a safe location.

(8) It is strictly forbidden to make electrical connections with plastic. Incorrect electrical connections may cause the product to overheat during use.

(9) The product should be protected from mechanical vibration, impact, and pressure during use, otherwise, the internal components of the product may short-circuit, generating high temperatures and fire. The product has potential dangers, and appropriate protective measures must be taken during operation and maintenance; otherwise, serious personal injury and property damage may result. Failure to comply with the above warnings may cause various disasters.