Product Specifications

X500KT-E/A

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Revision Records

Revision	Date	Reasons for Revision	Revised by	Released by
1	April 14, 2025	First edition	QC.Yan	V2.0

Table of Contents

1. Scope of use

This product specification sheet is applicable to ROYPOW's X500KT-E/A intelligent portable energy storage system. The specification describes the overall system performance indicators of the product and defines and describes specific parameters. ROYPOW reserves the right to modify and update this specification based on product upgrades and optimizations, without further notice.

2. Product model

X500KT-E/A.

3. Terms and Definitions

1) Cell

The most basic unit that provides direct current, containing a positive electrode, negative electrode, electrolyte, separator, and shell. It can be used individually or assembled into a battery module.

2) Battery PACK

Housed in a dedicated enclosure, this unit comprises multiple lithium-ion cells connected in series and parallel. It includes a Battery Management Unit (BMU) for gathering battery data.

3) Battery Cabinet

An assembly of several low-voltage battery packs connected in series, equipped with a Battery Cluster Unit (BCU).

4) Battery Stack

A comprehensive power input and output system, created by connecting multiple battery cabinets in parallel to a single energy conversion system, managed by a backend monitoring system.

5) Battery Management Unit (BMU)

This unit oversees the voltage and temperature of individual cells within a battery module. It safely regulates the module's charging and discharging process and serves as a communication interface for the storage battery. System (BCU) via a communication interface. As the smallest component of the Battery Management System (BMS), the BMU supplies internal battery pack data to the Battery Cluster Management (BCU).

6) Battery Cluster Management System (BCU)

A real-time electronic monitoring and management system that efficiently controls the charging and discharging of battery clusters. It provides alerts and emergency responses to potential issues, ensuring the battery's safety, reliability, and stability. The BCU, functioning at an intermediate level in the battery management system, gathers information from the Battery Management Unit (BMU) and

relays it to the higher-level Battery Stack Management System (BAU).

7) Battery Management System (BMS)

This system manages the charging and discharging of storage batteries to enhance their lifespan and provide user-relevant information. Comprising BMU, BCU, BAU, and other units, it can be structured in two or three tiers, depending on the system's configuration.

8) Special Bidirectional Converter (PCS)

Enables two-way energy transfer between DC batteries and the AC grid, supporting both charging and power feedback.

9) Microgrid Energy Controller (MEMS)

Manages and schedules energy within the microgrid system. It collects and processes information from lower-tier devices and interacts with local human-machine interfaces and digital cloud platforms.

4. System Introduction

4.1 System Composition

The X500KT-E/A intelligent mobile energy storage station consists of a lithium iron phosphate battery, a special bidirectional inverter, a battery management system, a microgrid energy controller, a distribution system, a container, and auxiliary systems (firefighting, emergency lights, air conditioning, etc.). The system schematic diagram is illustrated in Figure 4-1:

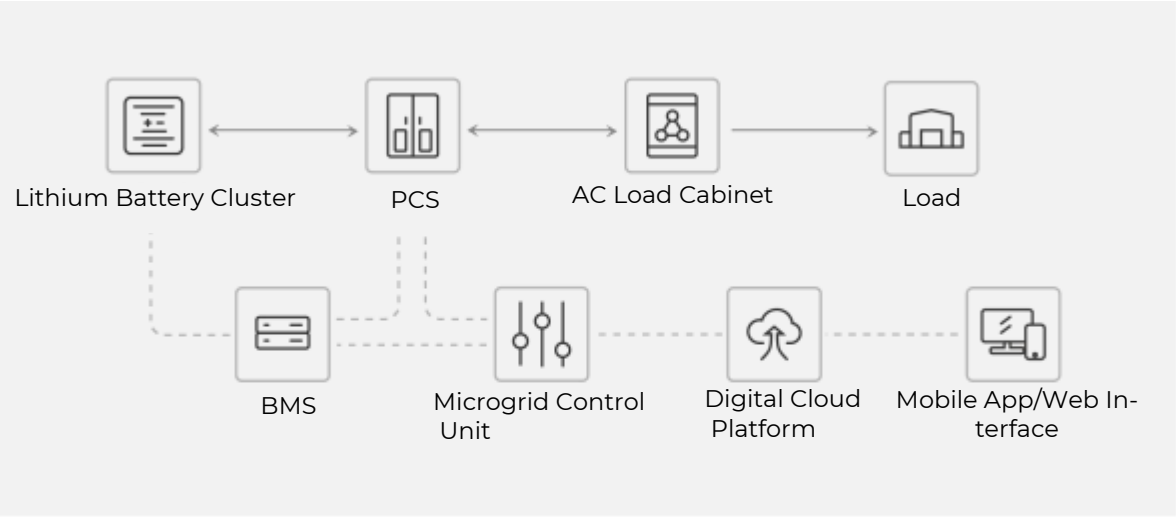

Figure 4-1: System Schematic Diagram

4.2 System Configuration

The core equipment of the system includes a 500KW/465.9kWh energy storage setup, featuring a 465.9kWh lithium iron phosphate battery and a 500KW specialized bidirectional inverter, alongside an intelligent microgrid control cabinet. The container is additionally equipped with temperature and smoke sensors, fire extinguishing systems, air conditioning, and emergency lighting. These auxiliary components are crucial for maintaining a secure and stable operational environment for the lithium batteries and facilitate remote monitoring capabilities.

SN	Device name	Specifications	Unit	Set
1	Lithium Iron Phosphate Battery	832V/232.96kWh	Set	2
2	Energy Storage Bidirectional Inverter	500KW	unit	1
3	Liquid cooling	Cooling capacity 10000W; Heating capacity 2300W	unit	1
4	Container	Includes an external wiring box, 2900*2300*2400 (mm)	Set	1
5	Intelligent Microgrid Control Cabinet	Equipped with an energy management system	unit	1
6	Firefighting	Aerosol	Set	1

5. Energy Storage System Specifications

5.1 Battery

This product uses mature and reliable lithium iron phosphate batteries, with specifications of 3.2V/280Ah. The battery is shown in Figure 5-1:

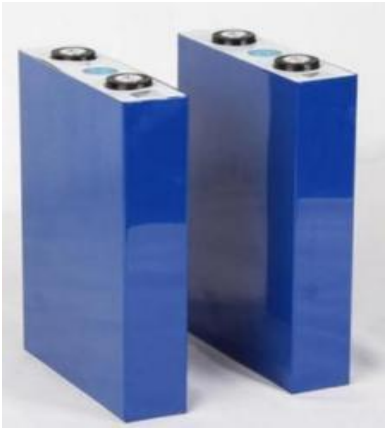

Figure 5-1: Battery Cell

5.2 Battery PACK

The Battery PACK consists of 52 lithium iron phosphate single cells arranged in 1 parallel and 52 series configurations, integrated with a BMU. The nominal voltage of the Battery PACK is 166.4V, with a capacity of 46.592kWh. The BMU collects data from all 52 cells within the module and uploads it to the MBMS. It also balances individual cells within the module based on instructions from the MBMS. The battery module is shown in Figure 5-2:

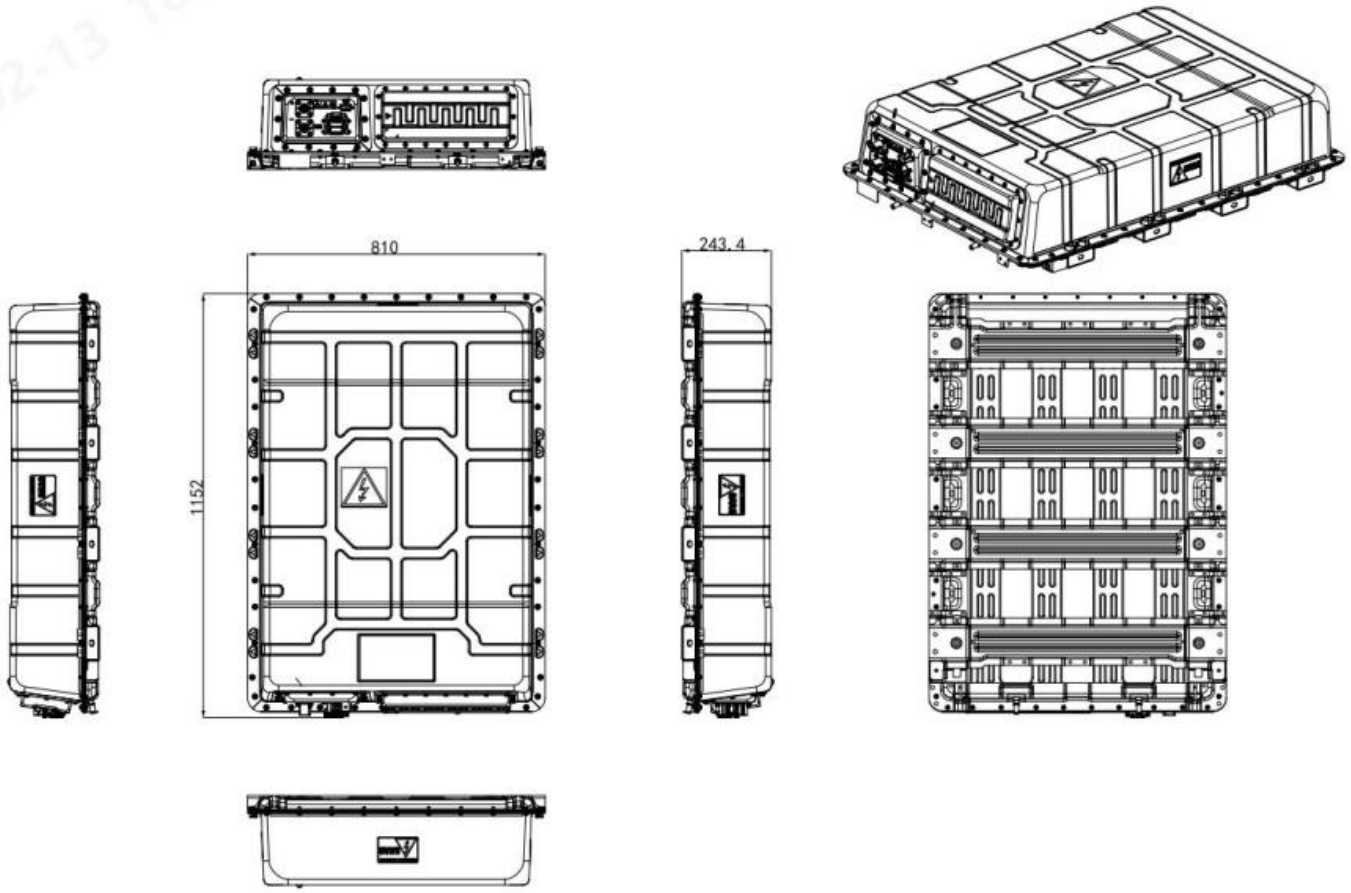

Figure 5-2: Battery Module

5.3 Battery Cabinet

The battery cabinet is composed of 2x5 battery packs connected in series, integrated with a high-voltage control box. The nominal voltage of the battery cabinet is 832V, and its capacity is 465.9KWh. The BCU, located inside the high-voltage control box, manages the battery cabinet, receiving detailed data from the 2x5 BMUs inside, sampling voltage and current of the battery cluster, calculating and adjusting SOC and SOH, managing pre-charging and charging/discharging of the battery cluster, and interacting with PCS and EMS systems. The battery cabinet is shown in Figure 5-3:

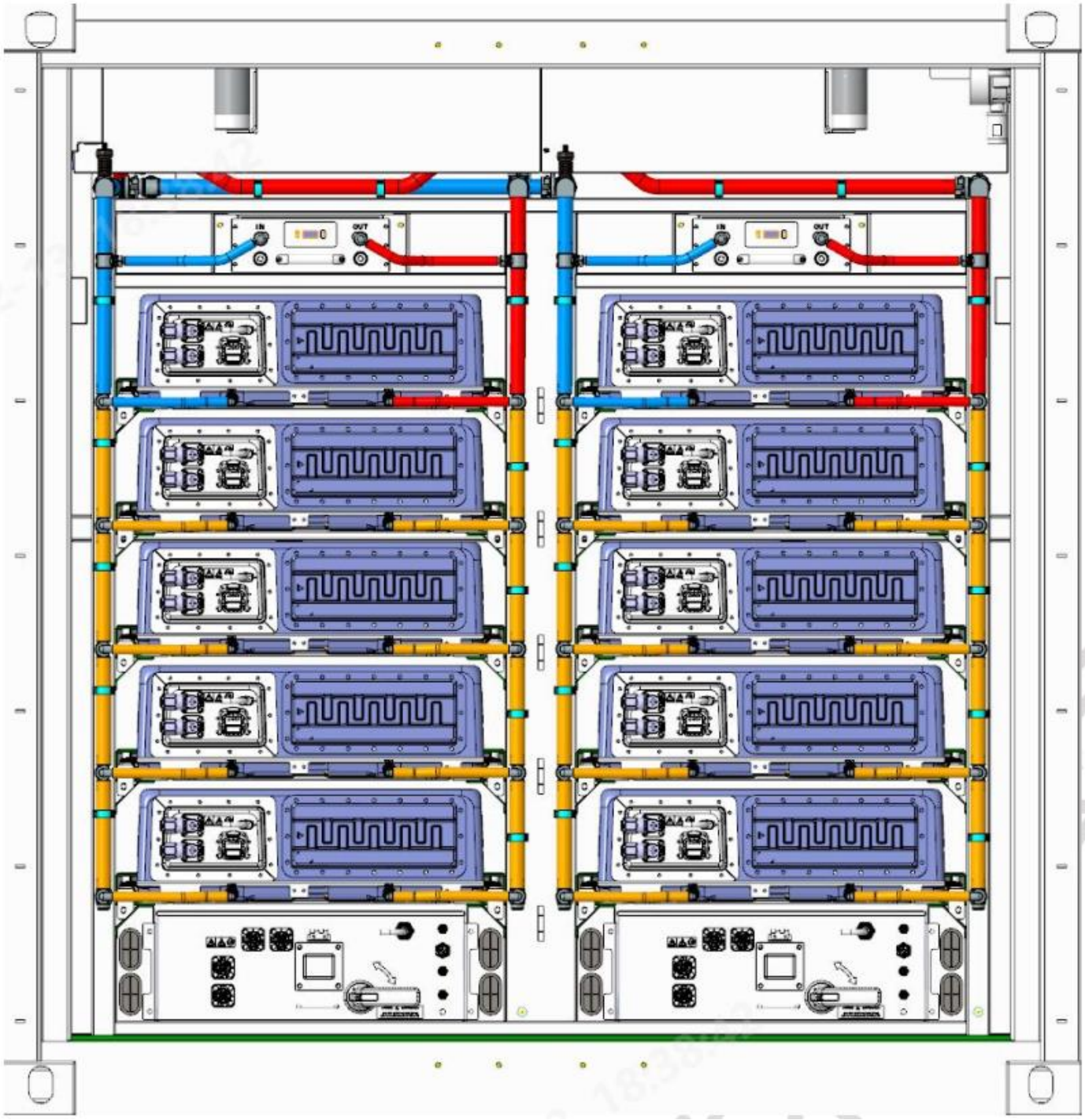

Figure 5-3: Battery Cabinet

5.4 Battery System

The battery system consists of one set of battery cabinets, with a nominal voltage of 823V and a total capacity of 465.9kWh. The main performance parameters of the energy storage battery are as follows:

SN	Name	Performance parameters	Remark
1	Battery configuration capacity (kWh)	465.9kWh	

2	Rated capacity (Ah)		280	
3	Rated voltage (V)		823V	
4	Operating voltage range (V)		650V-949V	
5	Maximum continuous charge/discharge rate (C)		0.5C/1C	
6	System charge/discharge efficiency (%)		>90%	
7	Cell discharge depth (%)		90%	
8	System discharge depth (%)		90%	
9	Number of individual cells (pieces)		520	
10	Number of battery modules (units)		10	
11	Series and parallel connection method of the battery cluster		(1P52S)x5Sx2P	
12	Cell Parameters	Rated capacity (Ah)	280	
		Rated voltage (V)	3.2	
		Operating voltage range (V)	2.5V-3.65V	
		Cycle Life	≥6000 cycles at 100% DOD	Under Standard Conditions
13	Battery Module Parameters	Rated capacity (Ah)	280	
		Rated voltage (V)	166.4V	
		Operating voltage range (V)	130V-189.8V	
		Number of cells contained (pieces)	52	
		Dimensions(mm)	1152× 810× 243.4	Length × Width × Height (mm)
14	Battery Cluster Parameters	Rated capacity (Ah)	280	
		Rated voltage (V)	832V	
		Operating voltage range (V)	650V-949V	
		Number of battery modules contained (units)	5	Total 2

		Dimensions	1906X1069X1780	Height × Width × Depth (mm)
		Weight (kg)	5 x 320	
15	Temperature	Operating Temp. Range (℃)	Charging: 0℃~55℃ Discharging: -20℃~55℃	
		Storage Temp. Range (℃)	Short-term (within 1 month) : -20~40; Long-term (more than 1 month) : 0~35	
16	Communication	With PCS	One dry contact/CAN	
		With MEMS	RS485, ETH	
		With Diesel Engine	RS485, ETH	

5.5 Special Bidirectional Converter

The special bidirectional converter is designed to enable efficient two-way energy transfer between DC batteries and the AC power grid. Its key roles include managing the battery system's charging and discharging, as well as providing power feedback. The converter is adept at monitoring and adjusting the power flow to and from grid-side loads, ensuring optimal control of the energy storage system's charge and discharge cycles. Additionally, it maintains stable grid-side voltage under both standard operating conditions and in islanding modes. Key parameters for the 500KW energy storage converter are as follows:

Model	PCS-500KTL (Includes Isolation Transformer)
AC Grid Parameters	
Rated output capacity	500kVA
Rated output power	500kW
Rated grid voltage	400V
Grid voltage range	± 10%
Rated grid frequency	50Hz/60Hz
Grid frequency range	±2.5Hz
AC rated current	650A

Output THD	≤3%
Grid-tied power factor	-1~+1
Isolation transformer	Yes
AC Off-Grid Parameters	
AC off-grid voltage	400V
Adjustable range of AC voltage	± 10%
AC off-grid frequency	50Hz/60Hz
Off-grid output THD	≤3% (linear load)
DC Side Parameters	
DC voltage range	600~1000V
Maximum DC current	750A
Maximum DC power	500kW
DC voltage accuracy	≤1%
DC current accuracy	≤1% (rms)
System Parameters	
Maximum overall efficiency	≥97.2%
Isolation method	Frequency isolation
Cooling mode	Forced air cooling
Noise level	65dB
Temperature range	-20℃~50℃
Protection grade	IP20
Altitude	5000m (derating above 3000m)
Humidity range	0~95%
Dimensions (W×H×D)	1450mm× 950mm× 2000mm
Weight	2000kg
Grid/off-grid switching	≤10ms for diesel grid, ≤20ms for utility grid
110% overcurrent capacity	Long term

/	/
Communication method	
Display	Touchscreen
Upper-level communication method	Modbus TCP/IP
Communication interface	Ethernet, RS485, CAN

5.6 Diesel-Storage Hybrid Energy Controller

In this system, the MEMS communication topology is structured into two layers. The top layer is the centralized monitoring system (local monitoring and remote cloud platform monitoring), while the bottom layer consists of devices like diesel generators, special bidirectional inverters, Battery Management System (BMS), environmental monitoring equipment, fire systems, air conditioning, and access control systems. A dedicated video surveillance unit is also part of this system. It provides visual monitoring of the containerized energy storage setup, all accessible through the cloud platform. A detailed schematic of the energy management communication system is shown in Figure 5-6:

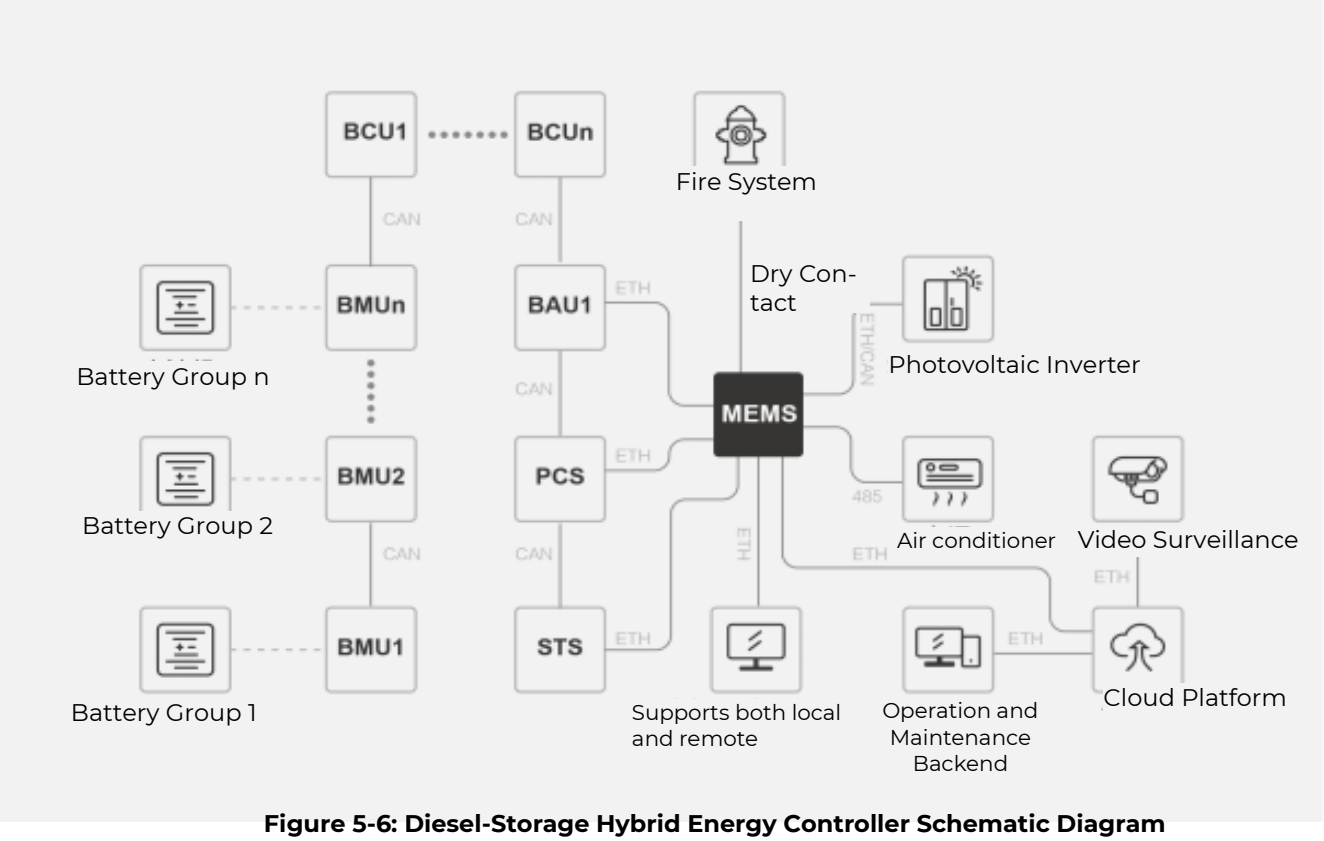

Figure 5-6: Diesel-Storage Hybrid Energy Controller Schematic Diagram

5.7 Product Parameters

Model	X500KT-E/A

Energy Storage Parameters	
Battery capacity	465.92 kWh
Rated voltage	832V
Voltage range	650V-949V
Energy Storage Grid-Connected Mode (connected to diesel generator or utility power)	
AC Rated power (KW/KVA)	500/500
AC Rated voltage	400V
AC Voltage range	400±15% (adjustable)
Output Overload Capacity	1.1 (long-term)
Rated frequency	50Hz
Frequency Range	50±3Hz
Power Factor	-1~+1
Energy Storage Independent Off-Grid Mode (diesel generator & utility power outage)	
AC Rated power (KW/KVA)	500/500
Rated voltage	400V
Voltage range	400±10% (adjustable)
Rated frequency	50±1Hz
Power Factor	-1~+1
Independent charging interface	
Rate Power	80Kw(400V/160A) Mains/diesel generator set (≤100kVA)
System Parameters	
Max current output	Long-term current 721A
Battery output capacity	Rated current 2 x 280A
AC Connection Mode	Three-phase four-wire
Container Size (Depth × Width × Height)	2900 x 2300 x 2400mm
Weight	8.5 tons
Protection grade	IP54

Noise level	＜65B
Operational Environmental Temperature	-20℃~50℃
Storage Environment Temperature	-40℃~65℃
Usage Altitude	<2000m
Permitted Relative Humidity	5%~95%
Communication method	Ethernet, RS485, CAN2.0, 4G Wireless

5.8 Product Features

1) Modular Integration

The product is designed with an external containerized approach, with modules supporting parallel connection for flexible and easy capacity expansion anywhere, anytime.

2) High Load Capacity

Equipped to handle significant overloads, the system is well-suited for a wide range of fluctuating and inductive loads.

3) Versatile Connectivity

With built-in interfaces for solar power, utility grids, and diesel generators, the product offers customizable networking options tailored to customer requirements.

4) Simple Installation

Featuring standardized, plug-and-play interfaces, the system is designed for quick and effortless installation and deployment.

5) Intuitive Human-Machine Interface

The system includes an externally accessible control screen for maintenance, enabling straightforward switching between automatic and manual modes. Its simple one-touch power operation is designed for ease of use, eliminating the need for specialized personnel.

5.9 Layout of the Containerized System

The container includes the battery system, PCS, control cabinet, air conditioning, and other auxiliary systems. The system arrangement is illustrated in Figure 5-9:

Figure 5-9: System Arrangement

6. Application Scenarios

7. Digital Energy Operation and Maintenance Platform

Local data from MEMS connects to our company's intelligent digital monitoring cloud platform via wired or wireless networks. Users can access and monitor the operational status of power station facilities and electrical equipment via the cloud platform's web portal, mobile app, or mini-program.

This setup enables data analysis and management, providing vital support for power safety, energy efficiency management, and operational maintenance. The operation of the intelligent cloud platform is shown in Figure 7-1:

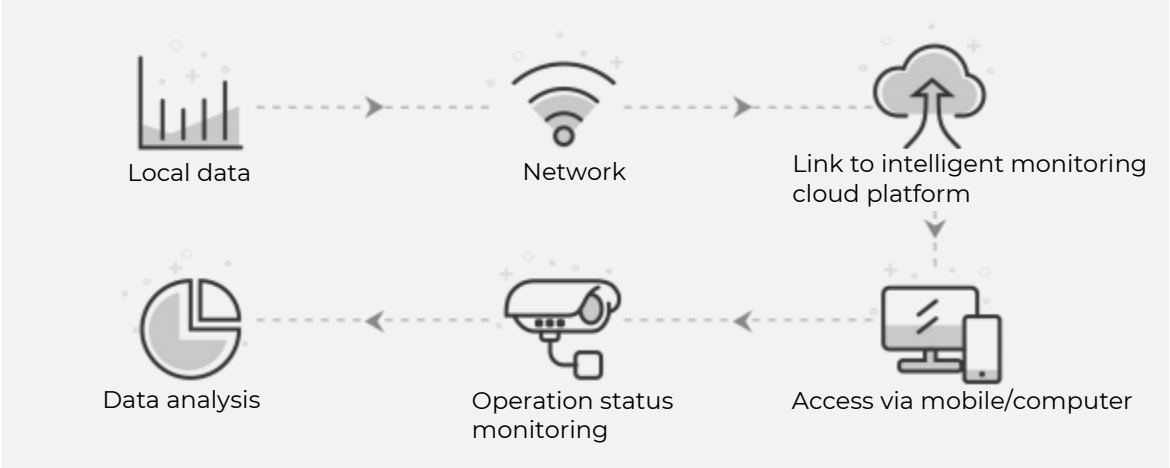

Figure 7-1: Peration Diagram of the Digital Energy O&M Platform

The cloud platform offers comprehensive monitoring and alarm management, operational maintenance management, and data statistical analysis functions. Users can log in through the web portal or mobile mini-app (App) to view the operating status and related information of their equipment. The system features comprehensive data display capabilities for monitoring, allowing users to swiftly access detailed operating information for specific equipment. Its backend system is capable of automatically sending maintenance instructions to responsible personnel based on alarm levels, ensuring timely resolution of on-site faults. Additionally, the data analysis module supports horizontal and vertical data comparison, allowing customers to compare different dimensions of data according to on-site equipment configurations, obtaining key data. This data enables equipment energy efficiency management, safety and health management, and optimizing power supply solutions, providing a strong scientific basis for these activities. The user interface of the intelligent digital monitoring cloud platform is shown in Figure 7-2.

Figure 7-2: User Interface of the Digital Energy Operation and Maintenance Platform

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