

EMU700 Microgrid Energy Storage System Detailed Introduction

Detailed Introduction

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Shenzhen Feisijieyue Technology Co., Ltd.

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CATALOG

1. EMS TECHNICAL REQUIREMENT	1ST
1.1. GENERAL REQUIREMENT	1ST
1.2. RUN RULES	1ST
1.3. DATA ACQUISITION, DISPLAY, AND STORAGE	2ND
1.4. SYSTEM ARCHITECTURE DESIGN	3RD
2. RUNTIME ENVIRONMENT	4TH
2.1. HARDWARE EQUIPMENT	4TH
2.2. ENVIRONMENTAL REQUIREMENTS	5TH
2.3. INSTALLATION METHODS	5TH
2.4. SUPPORT SOFTWARE	5TH
2.5. PRODUCT VIEW	6TH
2.6. EMU PARAMETERS	7TH
2.6.1. Hardware Parameters	7th
3. FUNCTIONAL REQUIREMENT	8TH
3.1. STRATEGY INTRODUCTION	8TH
3.1.1. PV-Storage-Charging – Peak Shaving and Valley Filling	8th
3.1.2. Grid Connection–Self-Generation and Self-Consumption	9th
3.1.3. Off-grid – Self-consumption	9th
3.1.4. Reverse Flow Prevention	10th
3.1.5. Prevent Excess Demand	11th
3.1.6. Dynamic Scaling	12th

3.1.7. Reactive Power Compensation	13th
3.1.8. Dynamic SOC Balancing	13th
3.1.9. Derating Protection	14th
3.1.10. Scheduled Full Charging	14th
3.2. ENERGY STORAGE FUNCTION	16TH
3.2.1. Function List	16th
3.2.2. PCS	20th
3.2.3. BMS	21st
3.2.4. Battery	22nd
3.2.5. Auxiliary Control Monitoring	23rd
3.2.6. Alarm Analysis	23rd
3.2.7. Alarm Configuration	24th
3.2.8. Electricity Tariff Configuration	25th
3.2.8.1. Electricity Price Setting	25th
3.2.8.2. Time Template	25th
3.2.8.3. Electricity Price Template	26th
3.2.8.4. Type of Electricity Price	26th
3.2.9. Data Analysis	27th
3.2.9.1. Statement Analysis	27th
3.2.10. Operational Strategy	28th
3.2.10.1. Strategy Management	28th
3.2.10.2. Strategy History	28th
3.2.10.3. Smart Temperature Control	29th
3.2.10.4. Running Mode	29th
3.2.10.5. Main Unit Configuration	34th
3.2.10.6. EMU Monitor	35th
3.2.11. Device Management	35th
3.2.11.1. Device Analysis	35th

3.2.11.2. Device Ledger	36th
3.2.11.3. Device Model	36th
3.2.11.4. Real-time Control	37th
3.2.11.5. Control History	37th
3.2.12. System Settings	38th
3.2.12.1. User Management	38th
3.2.12.2. Audit Logs	39th
3.2.12.3. Power Station Information	39th
3.2.13. Meter Reading	40th
3.2.14. Meter Data	40th
3.3. DATA ACQUISITION FUNCTION	42ND
3.3.1. Home Page	42nd
3.3.2. Southbound Configuration	42nd
3.3.2.1. Device Configuration	43rd
3.3.2.2. All Device	43rd
3.3.2.2.1. Serial Port Device	43rd
3.3.2.2.2. Network Port Device	44th
3.3.3. Model Configuration	44th
3.3.3.1. Variable Details	45th
3.3.4. Operation Configuration	45th
3.3.4.1. Debug	46th
3.3.5. Subroutine Configuration	47th
3.3.6. Northbound Configuration	47th
3.3.6.1. Reporting Channel	47th
3.3.6.2. Report Nodes	48th
3.3.7. Alarm Rules	48th
3.3.7.1. Alarm Configuration	48th
3.3.7.2. Alarm History	49th
3.3.8. Configuration Management	49th
3.3.8.1. Configuration List	49th
3.3.8.2. Image Management	50th
3.3.9. System Configuration	51st

3.3.9.1. Storage Settings	51st
3.3.9.2. NTP Calibration	51st
3.3.9.3. Dictionary Management	52nd
3.3.10. System Management	52nd
3.3.10.1. User Management	52nd
3.3.10.2. Character Management	53rd
3.3.10.3. Menu Management	53rd
3.3.10.4. Log Management	54th
3.3.11. System Debugging	54th
3.3.11.1. Channel Debugging	54th
3.3.11.2. System Logs	55th
3.3.11.3. System Monitoring	55th
3.3.12. Rule Engine	56th
3.3.12.1. Rule Configuration	56th
3.3.13. Fault Waveform Recording	56th
3.3.13.1. Waveform Recording Configuration	56th
3.3.13.2. Record History	58th
3.3.13.3. Storage Configuration	59th
4. EMU HARDWARE REQUIREMENTS	60TH
4.1. PRODUCT FEATURES	60TH
4.2. SCREEN OPTIONAL	61ST

1. EMS Technical Requirement

The Energy Management System (EMS) for industrial and commercial energy storage primarily consists of modules including Power Conversion System (PCS), Battery Management System (BMS), battery cells, equipment monitoring, report analysis, auxiliary control, centralized control, load tracking, alarm history, and configuration center.

1.1. General Requirement

The equipment configuration and functional requirements of the Energy Storage Management System (EMS) are designed for unattended operation in industrial and commercial energy storage power stations.

The EMS monitoring system for industrial and commercial energy storage power stations covers data from batteries, power conversion systems (PCS), transformers, air conditioning units, fire protection systems, and switchgear. Battery data includes individual cells, battery clusters, and battery stacks. PCS information encompasses operational status, voltage, current, and active power.

It has the following main features:

- (1) The system provides real-time monitoring of all station equipment, tracking operational status, recording data, and supporting historical data queries.
- (2) It supports energy control strategies, including timed and power-controlled charging/discharging, to meet peak-valley arbitrage and load leveling requirements.
- (3) Through coordinated control of the battery management system (BMS), it collects BMS alarm information and supports controlling the power reduction or shutdown of the power control system (PCS) to ensure optimal battery operation.
- (4) It supports external communication and cloud transmission, accessible via a local switch or built-in 4G/5G module. The data features local caching and a resume capability.
- (5) Data can be viewed in the cloud and on mobile devices.

1.2. Run Rules

General Operating Principles of the Energy Storage System

- (1) The control objectives for the charging and discharging power of the energy storage system are to maximize the benefits of peak shaving and valley filling, prevent reverse power flow to the grid, and prevent transformer overload during charging.
- (2) During nighttime off-peak tariff periods and daytime shoulder periods when the load is relatively low, the EMS controls the energy storage PCS to charge according to the battery SOC. During peak tariff periods, the energy storage system discharges.

- (3) When the load power is less than or equal to the maximum discharge power of the energy storage system, the EMS controls the PCS discharge power to be less than or equal to the load power.
- (4) When the load power is greater than or equal to the maximum discharge power of the energy storage system, the EMS controls the PCS discharge power at its maximum level.
- (5) In the event of a sudden load change, the EMS tracks the load power in real time and controls the charging and discharging power of the energy storage PCS to ensure that the discharge power does not flow back to the grid.

Specific application scenarios include:

- 1) Peak Shaving and Valley Filling Strategy: During load-peak periods (high-tariff periods), the battery is controlled to discharge, keeping the load within a reasonable range. When the load is relatively low, the system charges during appropriate periods, typically off-peak tariff periods, using a suitable charging method.
- 2) Demand Control Strategy: The system monitors the power drawn from the grid at the grid connection point. When the power drawn increases and exceeds a specified threshold, the energy storage system automatically increases its output to ensure that the total power at the grid connection point remains below the configured threshold.
- 3) Anti-Reverse-Power-Flow Control Strategy: The system monitors the power drawn from the grid at the grid connection point. When the grid-import power decreases, the energy storage system automatically reduces its output to prevent power from being fed back into the grid. If reverse power flow occurs, the system immediately controls the corresponding grid-connection-point relay to trip.

1.3. Data Acquisition, Display, and Storage

- (1) Real-time acquisition and display of the operating status and fault alarm information of all system devices, including:

PCS operating data (power, voltage, current, etc.) and status;

BMS operating data (cell voltage, temperature, SOC, etc.) and status;

Power meter data (forward/reverse active power, reactive power, power factor, voltage, current, etc.);

Data and status information for the system access-control system, water ingress sensors, switches, air conditioners, fire protection system, and other equipment, transmitted by the BMS or directly connected via dry contacts.

- (2) Query and display the operating records of each device, including operating-data curves, operating-status curves, and other records stored in the database.
- (3) Provide time-of-use statistics for charge and discharge energy, searchable by year,

month, or day.

- (4) Data shall be stored for at least 90 days. Fault status information shall be collected, with each data-acquisition cycle completed within 3 seconds.

1.4. System Architecture Design

The scenario architecture is shown in Figure 1-1: Architecture Diagram.

Power / Renewable Energy: The system can be applied to power equipment monitoring, solar power generation systems, wind power generation systems, photovoltaic energy storage charging stations, microgrid scenarios, and more. It enables remote monitoring and control of energy equipment, thereby improving energy utilization efficiency.

The system composition is shown in Figure 1-2: Functional Composition Diagram.

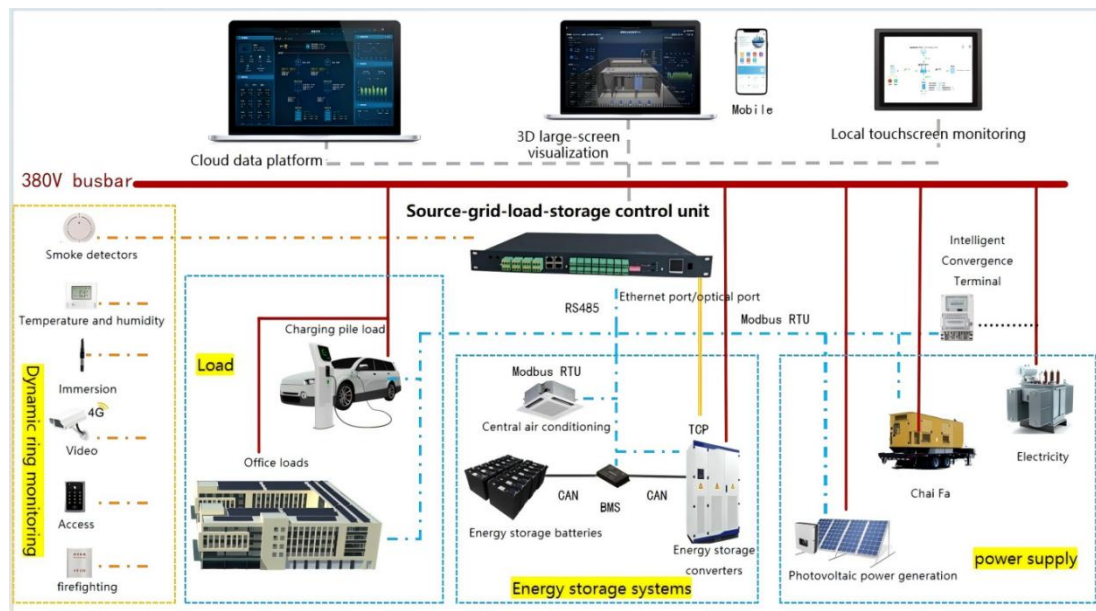


Figure 1-1 Architecture Diagram

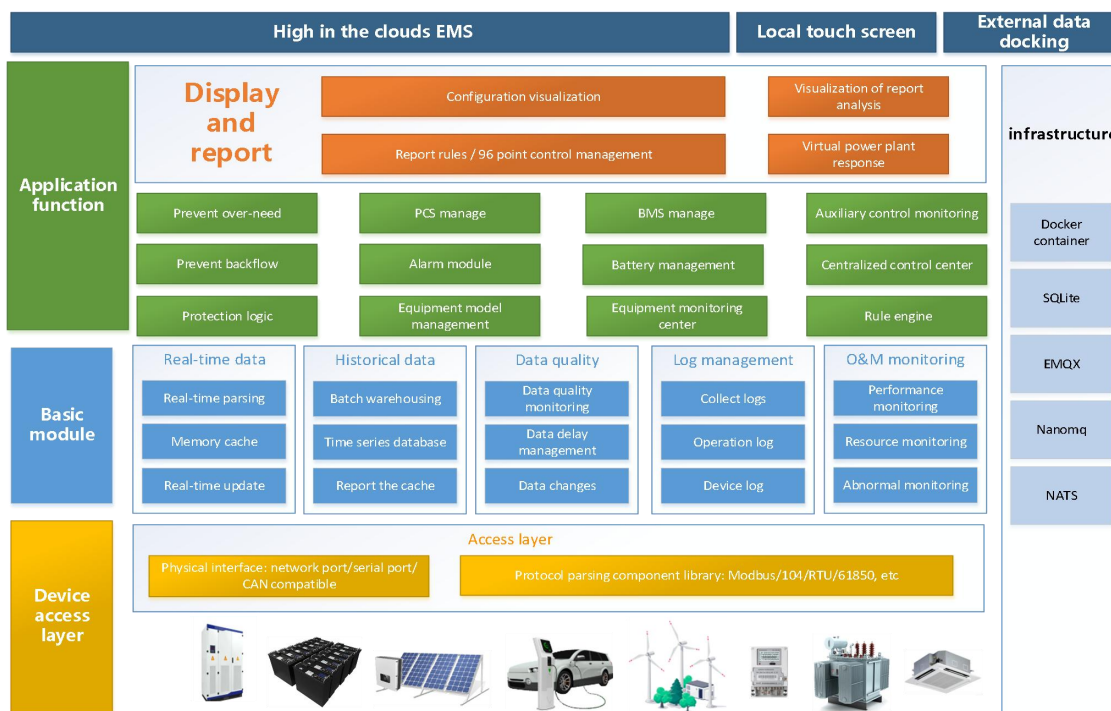


Figure 1-2 Functional Composition Diagram

2. Runtime Environment

2.1. Hardware equipment

Run EMU device: 4-core, 4GB RAM, 32GB storage—Domestic recommendation: RK3562.





2.2. Environmental Requirements

- Altitude: <4000m.
- Maximum ambient temperature (indoor or outdoor): 55°C;
- Minimum temperature: -25°C; Maximum daily temperature difference: 25°C;
- Maximum relative humidity: daily average: 95%; monthly average: 90%;
- Operating temperature: -30°C to +55°C;
- Seismic resistance: Seismic fortification intensity: 9 (0.2g)

2.3. Installation Methods

Pre-installed within prefabricated containers or outdoor cabinets; standard rack and cabinet installation; 1U height

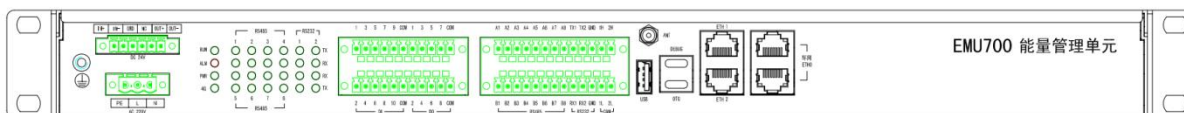
2.4. Support Software

Database: SQLite, TDengine;

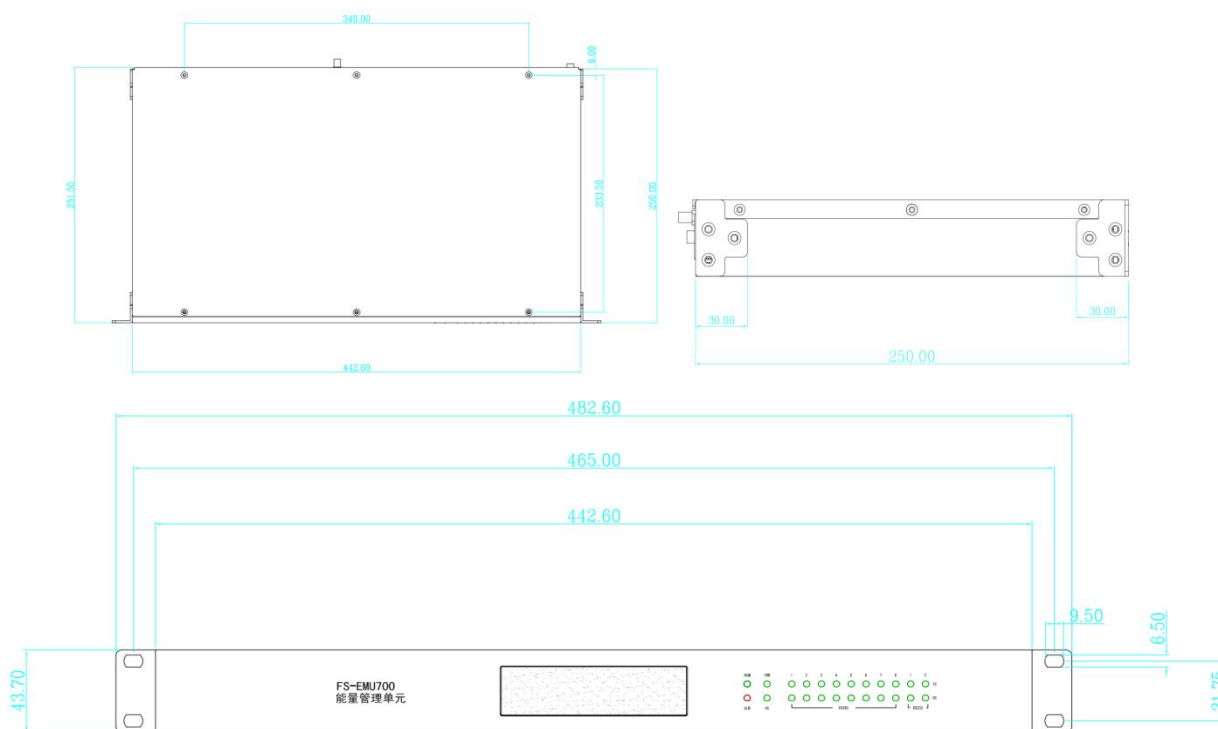
Development Languages: Vue-JavaScript, GO;

Middleware: EMQX, Nanomq

2.5. Product View



front view



Front panel dimensions: Length 442.60, Height 43.70, Width 251.50

2.6. EMU Parameters

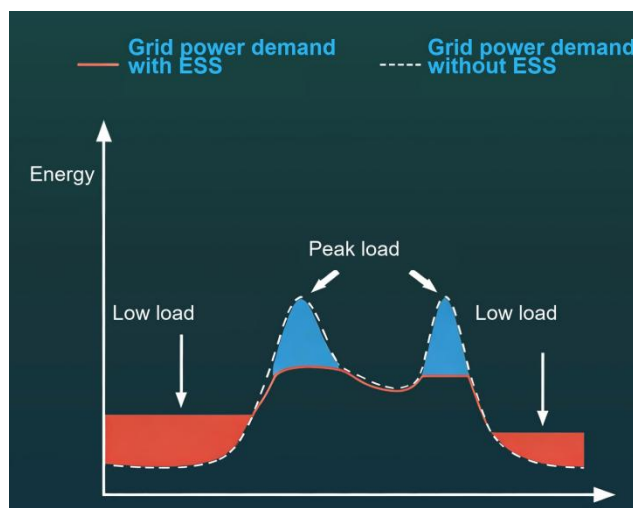
2.6.1. Hardware Parameters

Device	Detailed Description
CPU	ARM-based platform, quad-core ARM Cortex-A53 @ 2.0 GHz
RAM	4 GB DDR4
Storage	32 GB eMMC; supports an M.2-interface SSD, expandable up to 1 TB
Ethernet	4 external 10/100/1000M RJ45 ports with 4 indicator LEDs; 3 independent IP addresses; optional ring networking
4G	1 4G expansion interface supporting standard SIM cards and chip cards; 1 indicator LED
USB	1 port for connecting an external mouse/keyboard and transferring data with an external USB flash drive
RS-485	10 isolated ports, including 8 RS-485 ports and 2 RS-232 ports
CAN	2 isolated ports
DI	10 isolated digital inputs
DO	8 digital outputs
Watchdog	CPU-integrated watchdog
Debug Port	Type-C debugging port
Power	Supports AC 220 V (1 port) and DC 9–36 V (1 port)
Overall Dimensions	484 × 260 × 44 mm; standard 1U rack-mount installation
Operating Environment	Humidity: 5%–95% RH, non-condensing; operating temperature: –30°C to +55°C; storage temperature: –40°C to +85°C

3. Functional Requirement

3.1. Strategy Introduction

3.1.1. PV-Storage-Charging – Peak Shaving and Valley Filling



Time Interval	Strategic Operation	commercial value
Low point	charge	Low-cost energy storage
Standard section	Let stand	Maintain base load
peak	discharge	Selling stored electricity at a premium price
spike	discharge	Maximize revenue per kilowatt-hour

Set peak and off-peak usage periods along with corresponding charging and discharging power levels to reduce electricity costs by leveraging the price differential between peak and off-peak hours.

(1) When the PV power exceeds the load and there is excess electricity, and the battery SOC is below 90% (adjustable), the excess PV power is used to charge the battery.

(2) During charging (battery priority):

- 1) When $PV \text{ power} \geq \text{maximum battery charging power}$ and $\text{battery SOC} < 90\%$ (adjustable): The DCDC converter is turned on (the PV system prioritizes charging the battery; the load is powered by both the grid and the PV system). When $\text{battery SOC} \geq 90\%$ and the total battery SOC $< 98\%$, the battery stops charging; the control logic sets $PV \leq \text{Load}$ (the battery stops charging; the load is powered by both the PV

system and the grid). When battery SOC $\geq 98\%$, the DCDC converter is turned off (the battery stops charging; the load is powered by both the PV system and the grid).

(3) During discharge (load priority):

- 1) When the PV power exceeds the load power and the battery SOC is below 90% (adjustable), the DCDC converter is activated to charge the battery with the excess power; when the battery SOC is $\geq 90\%$ and the total battery SOC is $< 98\%$, and the PV power is limited to $\leq$ load power while the total battery voltage is ≥ 894 V, the DCDC converter is deactivated.

1) When the PV power is less than the load power, energy storage-based power generation is activated to supplement the grid supply, with both the energy storage system and the PV system contributing to powering the grid; when the battery State of Charge (SOC) falls below or equals the minimum discharge threshold (adjustable), the energy storage system ceases generating power, and the grid is powered solely by the mains electricity and the PV system.

3.1.2. Grid Connection–Self-Generation and Self-Consumption

1. Load Priority

1) PV power > load power:

PV power is preferentially used to supply the load, and any surplus PV power charges the battery. When the battery reaches the secondary overvoltage or SOC protection limit, charging stops. If PV surplus remains, the system determines whether it can be fed into the grid.

2) PV power < load power:

PV power and the energy storage system jointly supply the load. When the battery reaches the undervoltage or SOC protection limit, discharging stops, and the load is supplied by the grid and PV power.

3.1.3. Off-grid – Self-consumption

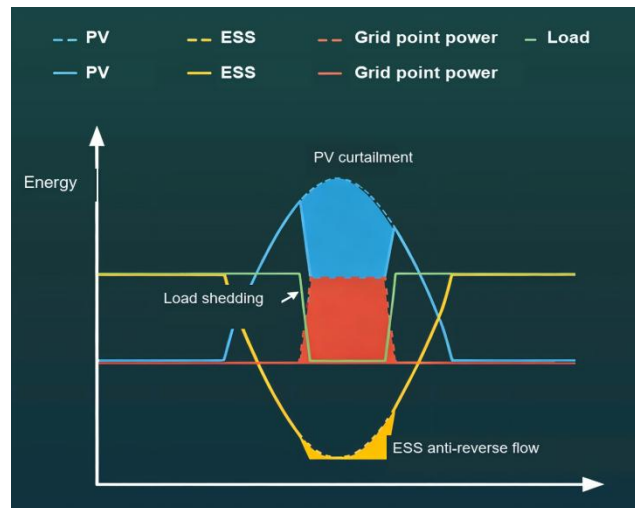
1. Load Priority

- 1) PV power > load power: PV power is preferentially used to supply the load, and any surplus PV power is used to charge the battery. When the battery reaches the secondary overvoltage or SOC protection limit, charging stops and the PV power is

curtailed.

- 2) PV power < load power: PV power and the energy storage system jointly supply the load. When the battery reaches the undervoltage or SOC protection limit, discharging stops.
 - a. If the diesel generator is enabled, single-power-source mode is selected, and the PV–energy storage connection is DC-coupled, start the diesel generator to supply the load. If the load power is lower than the diesel generator’s optimum-efficiency power, PV power and the diesel generator charge the battery. If the load power is higher than the diesel generator’s optimum-efficiency power, PV power charges the battery independently. When the battery reaches the secondary overvoltage or SOC protection limit, stop the diesel generator; the load is then supplied by PV power and the energy storage system.
 - b. If the diesel generator is enabled, single-power-source mode is selected, and the PV–energy storage connection is AC-coupled, start the diesel generator to supply the load. If the load power is lower than the diesel generator’s optimum-efficiency power, disable PV discharge; the diesel generator supplies the load and charges the battery. If the load power is higher than the diesel generator’s optimum-efficiency power, disable both battery charging and discharging.

3.1.4. Reverse Flow Prevention

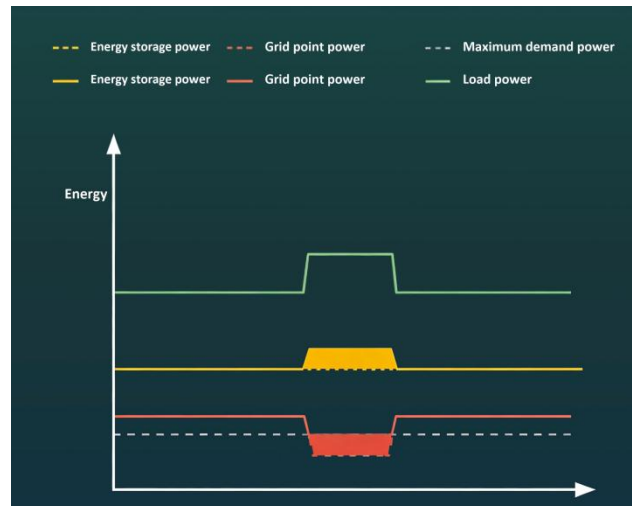


Real-time monitoring of the meter data at the grid interconnection point, with dynamic adjustment of the energy storage system to prevent the site from feeding energy back into the grid.

During the energy storage discharge cycle, the EMS monitors the power measured by the point-of-interconnection meter. When the meter power is less than or equal to the

anti-reverse-power-flow threshold plus the lower deadband limit, the EMS reduces the energy storage discharge power to maintain the meter power at the configured anti-reverse-power-flow threshold.

3.1.5. Prevent Excess Demand



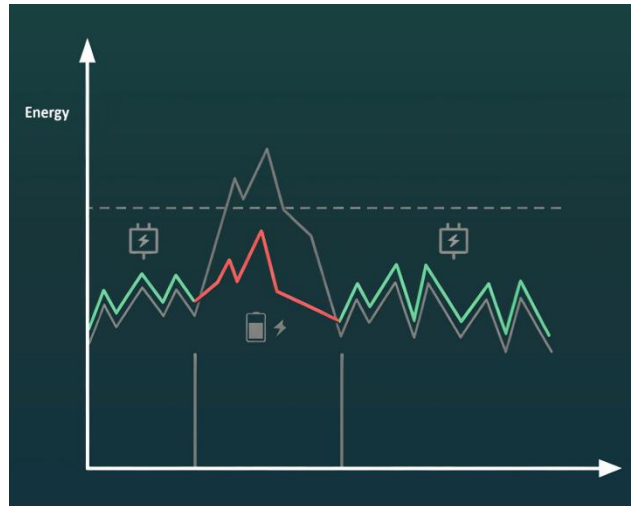
Use energy storage technology to balance electricity supply and demand, preventing power demand from exceeding supply capacity during peak periods. Excess electricity is stored when demand is low and released when demand is high, ensuring the stability and reliability of the power system.

During the energy storage charging cycle, the EMS monitors the power measured by the point-of-interconnection meter. When the meter power is greater than or equal to the configured over-demand protection threshold plus the upper deadband limit, the EMS reduces the energy storage charging power so that the meter power remains at the configured threshold. If the energy storage system is already idle or on standby and the meter power remains greater than or equal to the configured over-demand protection threshold plus the upper deadband limit, the EMS reduces the EV charger power to maintain the meter power at the configured threshold.

During the energy storage standby cycle, the EMS monitors the power measured by the point-of-interconnection meter. When the meter power is greater than or equal to the configured over-demand protection threshold plus the upper deadband limit, the EMS reduces

the EV charger power so that the meter power remains at the configured threshold.

3.1.6. Dynamic Scaling



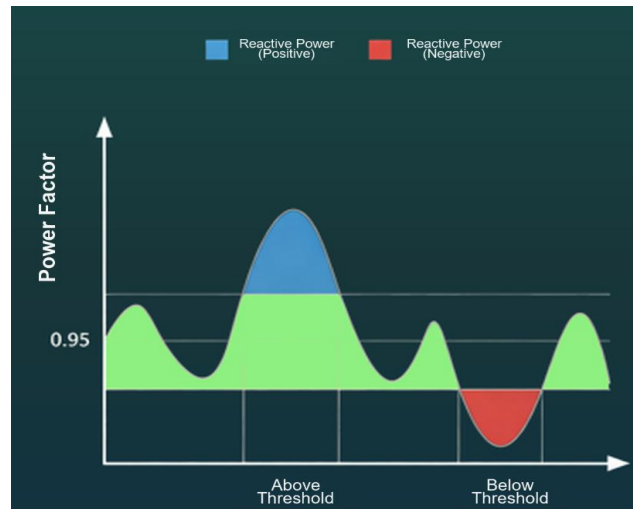
The EMS system collects real-time load data using a meter installed on the low-voltage side of the transformer. When the load factor approaches the safety threshold (typically 90% of the rated capacity), the capacity expansion mechanism is triggered.

When the load exceeds the threshold, the Energy Management System (EMS) automatically switches the operating mode:

- (1) Discharge supplementation: The Power Conversion System (PCS) discharges during peak demand periods to fill the power grid supply gap.
- (2) Reduce charging/standby mode: Pause energy storage charging or lower the charging power to reduce the load on the power grid.

When the load rate falls below the safety threshold, the EMS automatically terminates the expansion mode and resumes the energy storage charging and discharging schedule.

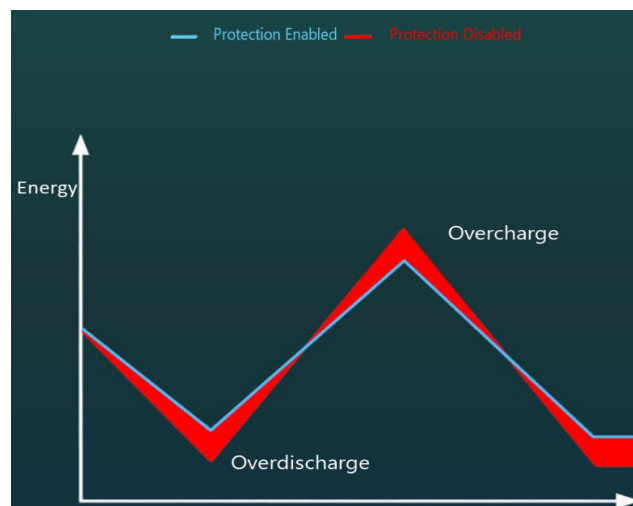
3.1.7. Reactive Power Compensation



By monitoring key grid parameters in real time and dynamically adjusting the reactive power output of the PCS (Power Conversion System), the system maintains stable control of the power factor and voltage.

1. If the power factor is below the configurable target value, the PCS is controlled to output negative reactive power.
2. If the power factor is above the configurable target value, the PCS is controlled to output positive reactive power.

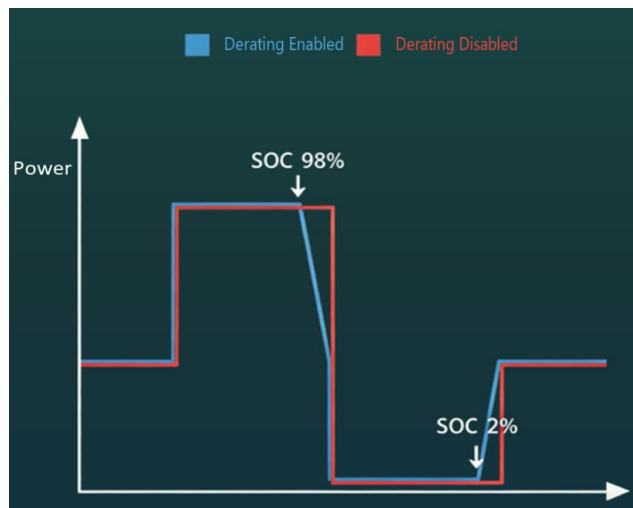
3.1.8. Dynamic SOC Balancing



SOC balancing mode uses the state of charge (SOC) of each battery cabinet as the primary criterion. In combination with battery health (SOH), battery capacity, and rated power, it calculates power weighting factors based on SOC differences and dynamically allocates charging and discharging power. This rapidly equalizes the SOC across the entire site,

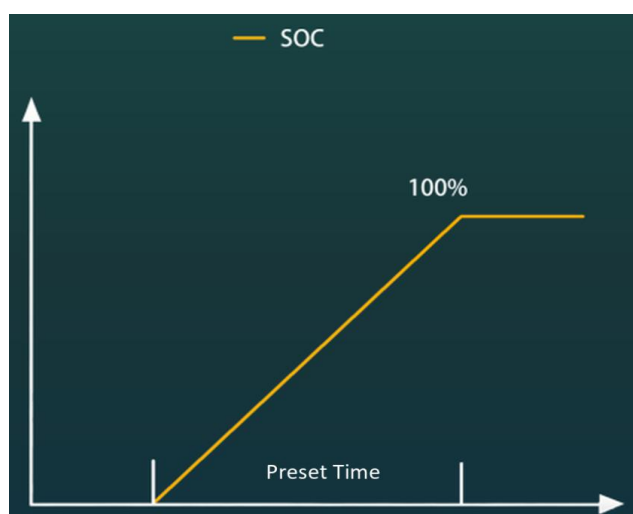
prevents overcharging and over-discharging, and improves overall system capacity utilization and operational stability.

3.1.9. Derating Protection



Derating protection is a power-smoothing control strategy based on battery SOC thresholds. The system determines the operating state according to preset SOC ranges. When the SOC approaches the safe charging or discharging limit, the system no longer operates at full power; instead, it linearly reduces the charging or discharging power as the SOC changes. This prevents sudden shutdowns or overcharging/over-discharging when the SOC reaches its upper or lower limit, enabling a smooth power transition and impact-free output while ensuring battery safety and stable system operation.

3.1.10. Scheduled Full Charging



The scheduled full-charge function automatically initiates battery charging at the configured intervals. When charging conditions are met, it continues charging until the

configured SOC target threshold is reached. The process ends automatically when the target threshold is reached, the maximum execution duration is exceeded, the charging conditions are no longer valid, a system protection or alarm event occurs, or the function is stopped manually.

3.2. Energy Storage Function

3.2.1. Function List

Primary Menu	Secondary Menu	Tertiary Menu / Function	Quaternary Menu	Function Description
Station Overview		Basic Station Information Display		Displays station rated power, installed capacity, PCS/BMS quantity, grid-connection information, SOC/SOH and other key parameters
		Equipment Information Monitoring		Displays real-time operating status and key data of PCS, BMS, auxiliary-control and other equipment
		Operation / Generation / Revenue Data Visualization		Uses charts to display trends in operating power, charge/discharge energy, revenue and other data
PCS		PCS Equipment Information Management		Selects a specific PCS device to view communication status, operating status and other basic information
		PCS Alarm Management		Includes real-time alarm display and historical alarm query functions
		AC/DC-side Parameter Monitoring		Monitors DC-side total voltage/current, AC-side phase voltage/current, active power and other electrical parameters
BMS		Cluster-level Real-time Information Monitoring		Monitors key indicators such as battery-cluster SOC, SOH and current; supports switching between different BMS devices
		Cluster Energy Statistics		Counts battery-cluster charge/discharge energy by week/month
		Cluster Extreme-value Monitoring		Displays extreme values such as maximum/minimum voltage and temperature of the battery cluster
		Cell-level Data Monitoring		Supports viewing detailed voltage, temperature, SOC, SOH and other data for all cells in each PACK
Cells		Cell Data Details		Views real-time voltage, temperature, SOC, SOH and other data for each cell
Auxiliary Control Monitoring		Liquid-cooling System Monitoring		Displays measurement points and event records of liquid-cooling equipment and monitors its operating status
Alarm Analysis		Event Level / Status Analysis		Performs statistical analysis of event levels and statuses; supports multi-condition alarm

Primary Menu	Secondary Menu	Tertiary Menu / Function	Quaternary Menu	Function Description
				record queries
Alarm Configuration		Alarm Rule Management		Supports adding and deleting alarm rules and setting rule name, alarm level, enabled status and other parameters
Electricity Cost Configuration		Electricity Price Settings		Configures time and price templates by season/month; supports setting effective year and issuing configurations
		Time / Price Template Management		Creates and maintains time and price templates to support electricity-price strategy configuration
Data Analysis	Report Analysis	Daily Total Energy Meter Query		Supports daily total energy-meter and other report queries; allows custom time ranges and displays revenue and other data
	Load Tracking	Power Curve Tracking		Queries historical curves for the grid-connection point, revenue meter and load power; supports data export
Operating Strategies	Strategy Management	Anti-backfeed Strategy		Monitors grid-inlet meter data and dynamically regulates the energy-storage system to prevent reverse power flow to the grid
		Demand-control Strategy		Balances power supply and demand through energy storage: charges during low demand and discharges during high demand to maintain grid stability
		Peak Shaving and Valley Filling Strategy		Sets peak/valley periods and corresponding charge/discharge power to reduce electricity costs through price differences
		Safety Configuration Strategy		Handles customized source-grid-load-storage control logic for scenarios not covered by other fixed strategies
		Reactive Power Compensation Strategy		Optimizes grid power factor and improves power quality and energy-use efficiency
		Dynamic Capacity Expansion Strategy		Dynamically adjusts station power-supply capability to address growing load demand
		Microgrid Strategy		Achieves energy autonomy and supply-demand balance within the microgrid and improves power-supply reliability
		Scheduled Full-charge Strategy		Periodically charges the battery to a specified threshold for SOC calibration and other scenarios
	Strategy History	Strategy Execution Record Query		Views strategy name, execution type, content, time and result; supports paging and filtering

Primary Menu	Secondary Menu	Tertiary Menu / Function	Quaternary Menu	Function Description
	Smart Temperature Control	Temperature-control Parameter Configuration		Configures cooling/heating start-stop temperatures during idle/working periods, full-condition cycle temperature difference, advance run time and other parameters
	Operating Mode	Local Mode		Runs local strategies autonomously and displays the strategy details executed in this mode
		Debug Mode	Group Control	Stops strategy execution and issues control commands to all cabinets in the station with one click
		Debug Mode	Individual Control	Stops strategy execution and issues a control command to a single cabinet in the station with one click
		Proxy Mode		Has no autonomous strategy-control capability; only receives upper-level dispatch commands and displays the dispatch content
		VPP Mode		Prioritizes upper-level dispatch commands; runs local strategies autonomously when no dispatch is received
		AGC/AVC Mode	AGC / Active Power Control	Responsive frequency regulation (secondary frequency regulation): receives target active power dispatched by upper-level commands and outputs active power
				Automatic frequency regulation (primary frequency regulation): monitors grid frequency at the grid-connection point and automatically outputs active power
			AVC / Reactive Power Control	Responsive voltage regulation (secondary voltage regulation/power factor): receives target reactive power dispatched by upper-level commands and outputs reactive power
				Automatic voltage regulation (primary voltage regulation/power factor): monitors three-phase voltage/power factor at the grid-connection point and automatically outputs reactive power
		Peak Shaving and		Sets start/end times,

Primary Menu	Secondary Menu	Tertiary Menu / Function	Quaternary Menu	Function Description
		Valley Filling Period Configuration		charge/discharge mode and power for peak shaving and valley filling
		Safety Parameter Configuration		Configures safety thresholds such as SOC upper/lower limits, maximum charge/discharge power and cell-voltage limits
	Host Configuration	Host Status Monitoring		Monitors host and slave operating status, power, SOC/SOH and other key indicators
		Host/Slave Management		Supports host switching, slave configuration and status monitoring
	EMU Monitoring	Energy Management Unit Monitoring		Monitors CPU/memory/disk utilization of the local unit and operating parameters of acquisition devices
Equipment Management	Equipment Analysis	Equipment Measurement-point Data Monitoring		Selects equipment type and measurement points to query real-time operating status, faults, voltage, current and other data; supports export
	Equipment Registry	Equipment Registry Management		Manages equipment codes, names, types, groups and other basic information; supports adding, editing, deleting, importing and exporting
	Equipment Models	Equipment Model Management		Manages model information for PCS, BMS, liquid-cooling and other equipment; supports model CRUD and import/export
	Equipment Groups	Equipment Group Management		Supports adding/deleting equipment groups and creating subgroups for classified equipment management
	Real-time Control	Remote Equipment Control		Performs real-time remote start/stop and mode switching for energy-storage meters and other equipment; supports viewing/control mode switching
	Control History	Control Record Query		Views historical equipment-control records, including equipment name, issue type, time, control status and details; supports paging and filtering
System Settings	User Management	User Information Management		Manages login name, name, mobile number, enabled status and other information; supports adding, editing, password reset and search
	Audit Log	Operation Log Query		Records and queries user system operations, including login name, user, IP, operation content

Primary Menu	Secondary Menu	Tertiary Menu / Function	Quaternary Menu	Function Description
				and time; supports multi-condition filtering
	Station Information	Basic Station Configuration		Configures project name, commissioning/grid-connection date, address, station type, rated power, PCS/BMS quantity and other key information; supports editing
		System Parameter Configuration		Configures basic settings such as system users, permissions and communication parameters

The power station overview displays information on the power station, including operational power, equipment details, power generation, and revenue. Equipment details include PCS, BMS, and auxiliary control information. Revenue statistics are displayed on a weekly, monthly, and yearly basis, allowing users to switch between these views. The central part of the page shows configuration information and corresponding equipment location details, as shown in Figure 3-1.

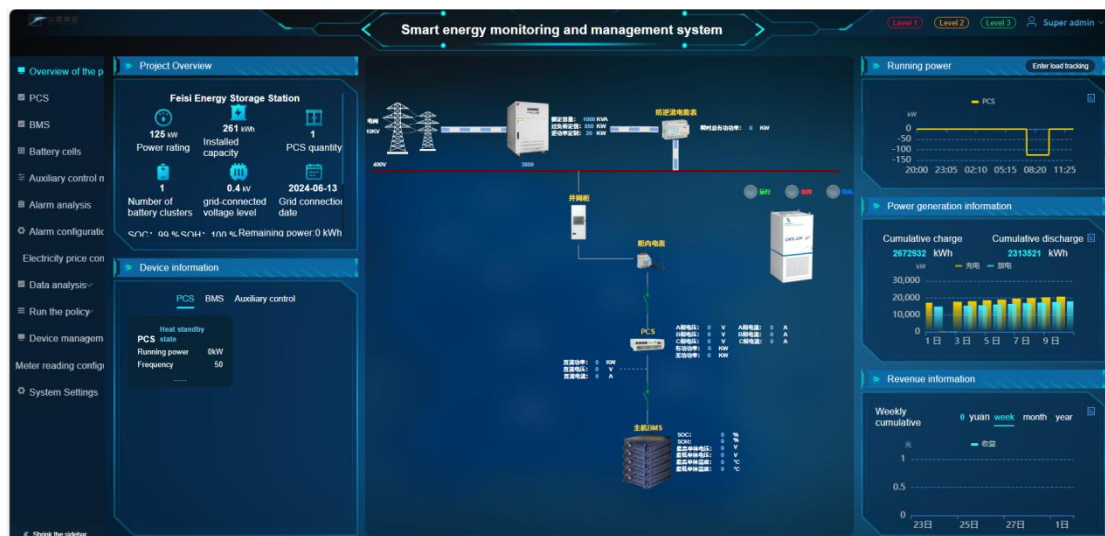


Figure 3- 1 Project Overview

3.2.2. PCS

The module displays basic information such as PCS information, equipment status, manufacturer, equipment model, battery cluster, number of batteries, battery specifications, and rated power. It shows active and reactive power. On the DC side, it displays total voltage and total current. For AC measurement, it shows voltage, current, active and reactive power,

apparent power, and frequency. The left side of the module displays real-time and historical alarm information for the PCS, as shown in Figure 3-2.

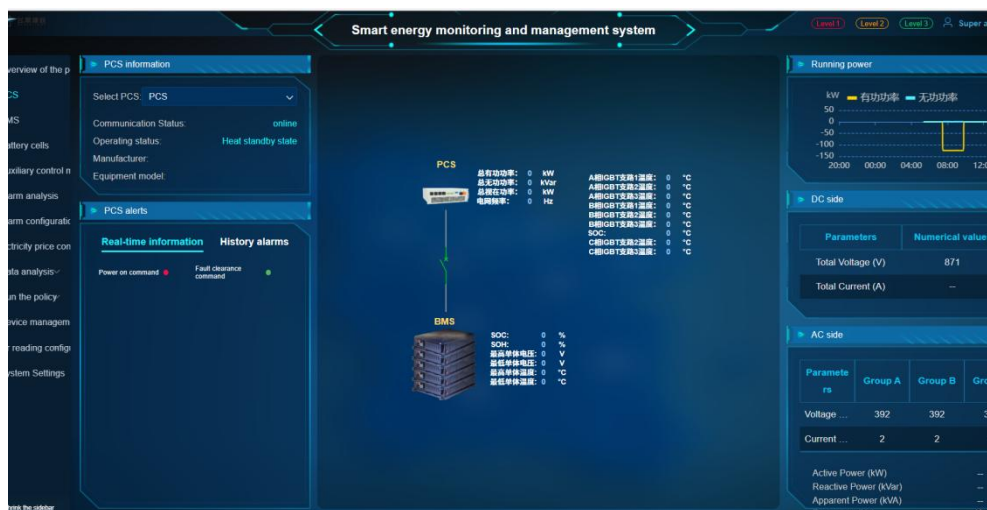


Figure 3-2 PCS

3.2.3. BMS

The BMS Battery Manager module displays the status of battery clusters, battery health, and remaining power. It also shows cluster extreme values, including the highest and lowest voltages, temperatures, SOC, and serial numbers. In the lower left corner, it displays cluster power information, including statistics on charge and discharge. Users can click to switch between daily, weekly, and monthly statistics. In the lower right corner, it displays historical alarm information, such as low battery voltage and excessive current discharge. The middle section shows the real-time status of the equipment in a configuration format, as illustrated in Figures 3-3.



Figure 3-3 BMS Main Interface

3.2.4. Battery

The battery page mainly displays the cell information. Users can view the real-time voltage, temperature, SOC and SOH measurement point information, as shown in Figure 3-4 and Figure 3-5.



Figure 3-4 Battery Data



Figure 3- 5 Historical data

3.2.5. Auxiliary Control Monitoring

The auxiliary control mainly displays and detects auxiliary control equipment, such as air conditioning, liquid cooling units, comprehensive protectors and other equipment. It also checks measurement points, alarm records and other information, as shown in Figure 3-6.



Figure 3- 6 Auxiliary Control Information

3.2.6. Alarm Analysis

The alarm analysis module displays all alarm records of the project, categorizing them by level: critical, major, severe, and urgent. It also provides detailed information on each alarm, including the device name, alarm level, event description, occurrence time, creation

and recovery times, and time status. The module allows users to manually confirm alarm records, filter records based on specific conditions, and view records in a paginated manner, as shown in Figure 3-7.



Figure 3- 7 Alarm History

3.2.7. Alarm Configuration

The alarm configuration adds rules to determine whether the point condition meets the trigger condition and generates an alarm record, as shown in Figure 3-8.

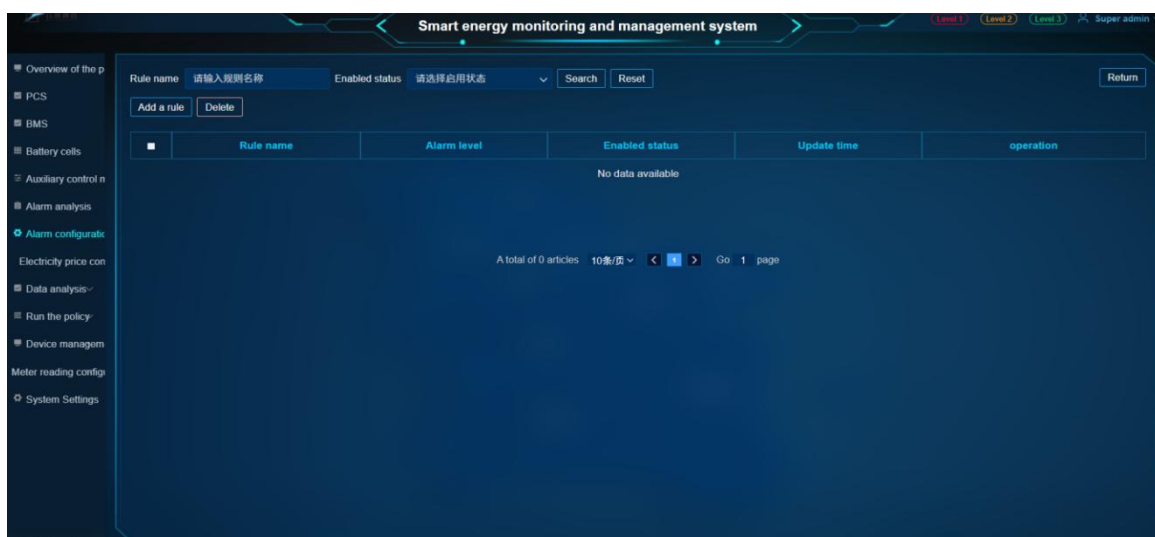


Figure 3- 8 Alarm Configuration

3.2.8. Electricity Tariff Configuration

3.2.8.1. Electricity Price Setting

The price setting is used to set and manage the price information of different months, including time template and price template. The price situation in different periods is displayed intuitively in a graphical way, as shown in Figure 3-9.

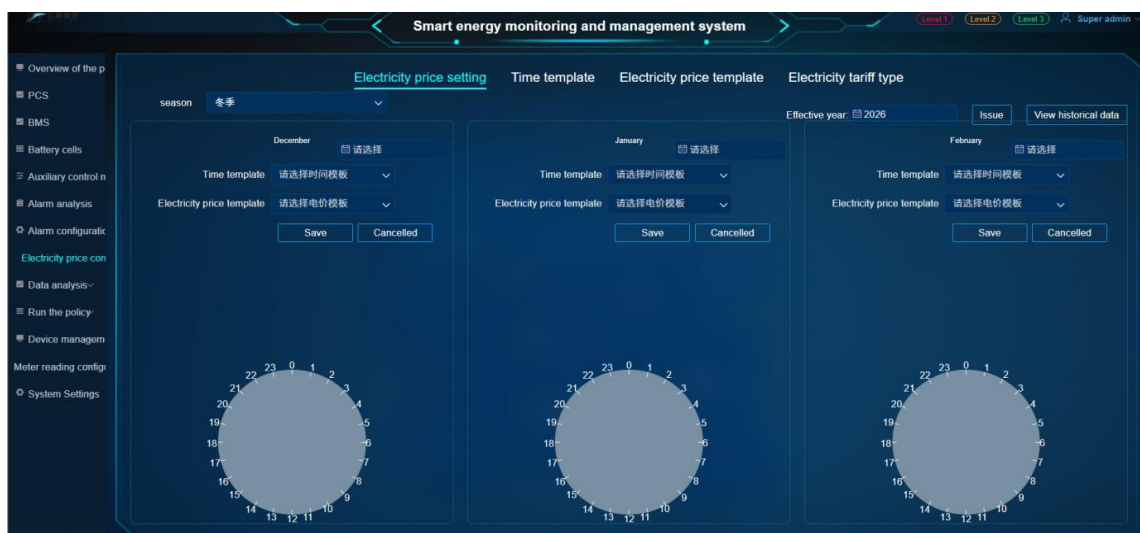


Figure 3- 9 Electricity Price Setting

3.2.8.2. Time Template

The time template facilitates the creation, editing and management of electricity price periods according to the type of electricity price. As shown in Figure 3-10.

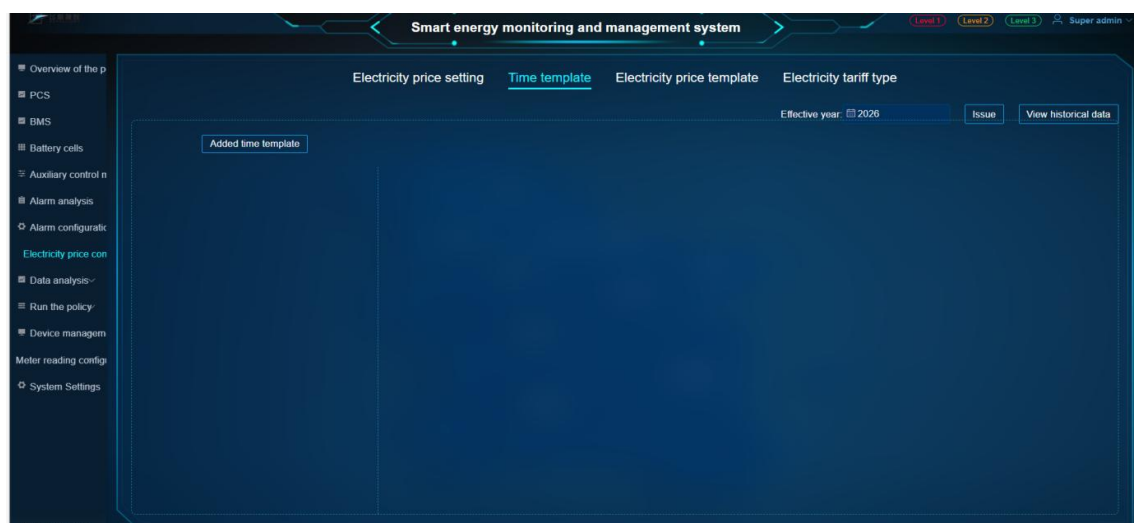


Figure 3- 10 Time template

3.2.8.3. Electricity Price Template

The electricity price template creates, edits and manages specific electricity price information according to the type of electricity price. As shown in Figure 3-11.

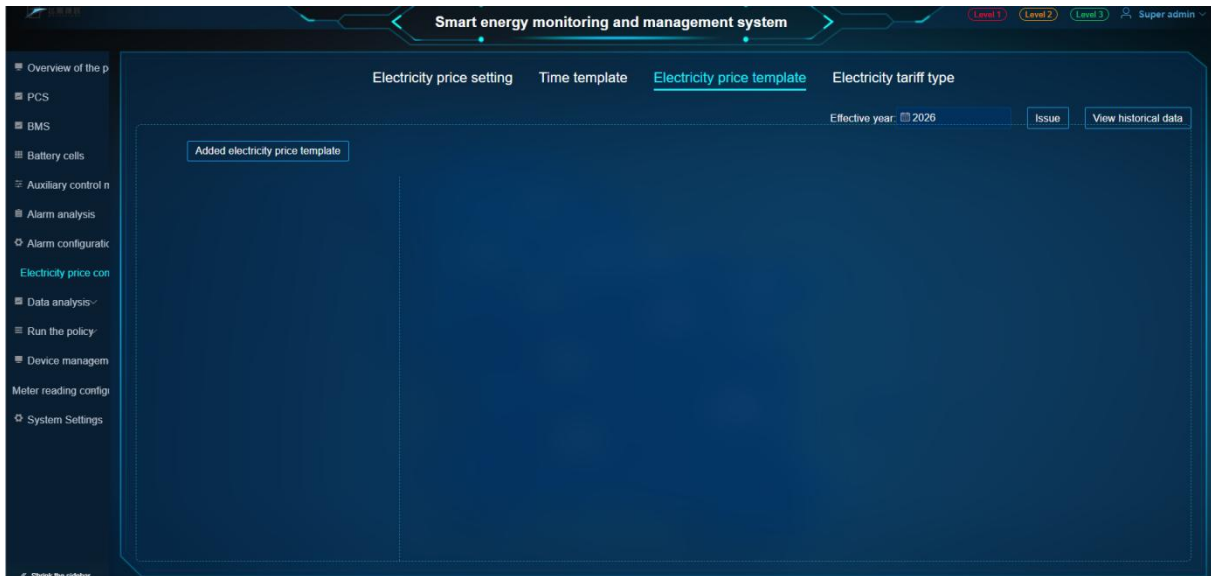


Figure 3- 11 Electricity Price Template

3.2.8.4. Type of Electricity Price

Customize and manage the name and color of the electricity price type, which is convenient to display in the electricity price setting, time template and electricity price template. As shown in Figure 3-12.

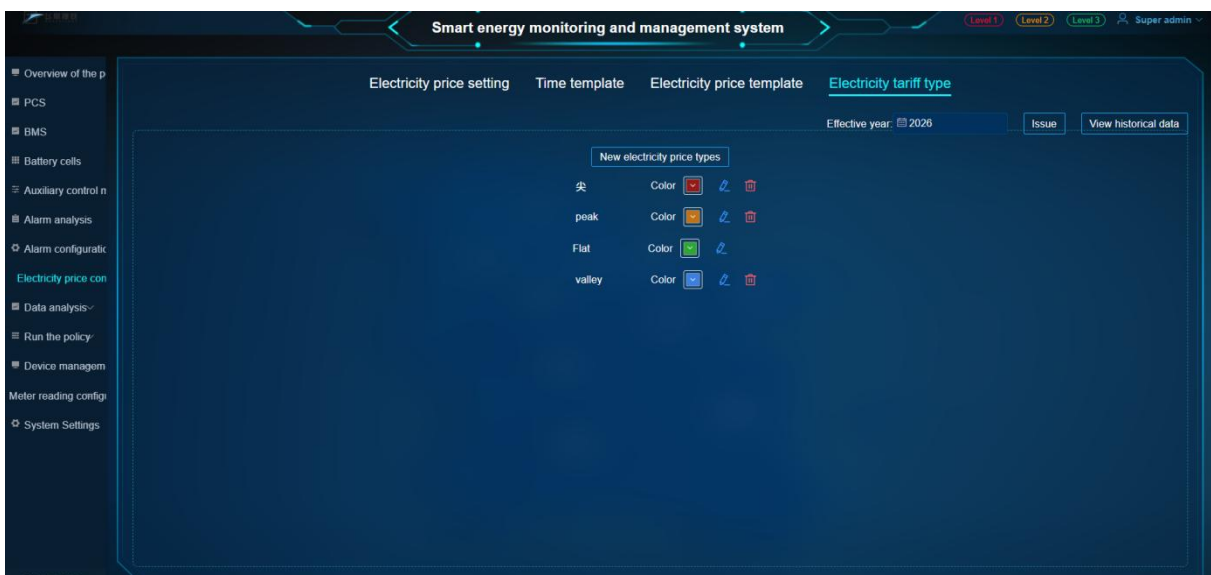


Figure 3- 12 Type of Electricity Price

3.2.9. Data Analysis

3.2.9.1. Statement Analysis

Users can view the charging current and discharge current information of day and month. Charging is divided into forward active total, peak, peak, flat and valley energy, and discharge is reverse active total, peak, peak, flat and valley energy, as shown in Figure 3-13.



Date	pointed		peak		Flat		valley		Revenue (yuan)
	Charging volume	Discharge volume	Charging volume	Discharge volume	Charging volume	Discharge volume	Charging volume	Discharge volume	
2026-02-10	9.00	285.00	131.00	10588.00	1149.00	7073.00	19451.00	0.00	0.00
2026-02-09	9.00	285.00	128.00	10335.00	1146.00	6990.00	19065.00	0.00	0.00
2026-02-04	9.00	285.00	115.00	9068.00	1134.00	6271.00	16796.00	0.00	0.00
2026-02-03	9.00	285.00	113.00	8815.00	1131.00	6268.00	16507.00	0.00	0.00
2026-02-08	9.00	285.00	125.00	10082.00	1144.00	6880.00	18651.00	0.00	0.00
2026-02-07	9.00	285.00	123.00	9829.00	1141.00	6841.00	18316.00	0.00	0.00
2026-02-06	9.00	285.00	120.00	9574.00	1138.00	6588.00	17737.00	0.00	0.00
2026-02-05	9.00	285.00	118.00	9320.00	1136.00	6512.00	17360.00	0.00	0.00
2026-02-02	-64.00	0.00	4.00	505.00	-153.00	-200.00	505.00	-52.00	0.00
2026-02-01	73.00	285.00	106.00	8060.00	1281.00	6465.00	15713.00	52.00	0.00

Figure 3- 13 Statement Analysis

Provide detailed monitoring and analysis of energy load in the form of charts to help users understand energy consumption patterns, optimize energy use strategies, and improve energy efficiency. See Figure 3-14.

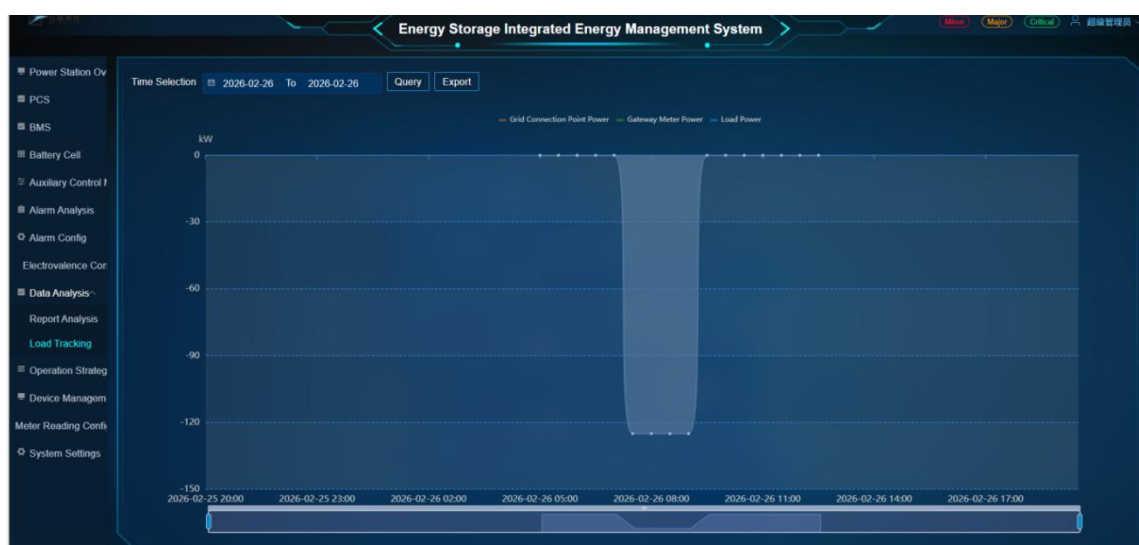


Figure 3- 14 Load following

3.2.10. Operational Strategy

3.2.10.1. Strategy Management

Strategy configuration shows the usage scenarios and functions of various strategy configurations in the system by combining graphics and text, as shown in Figure 3-15.

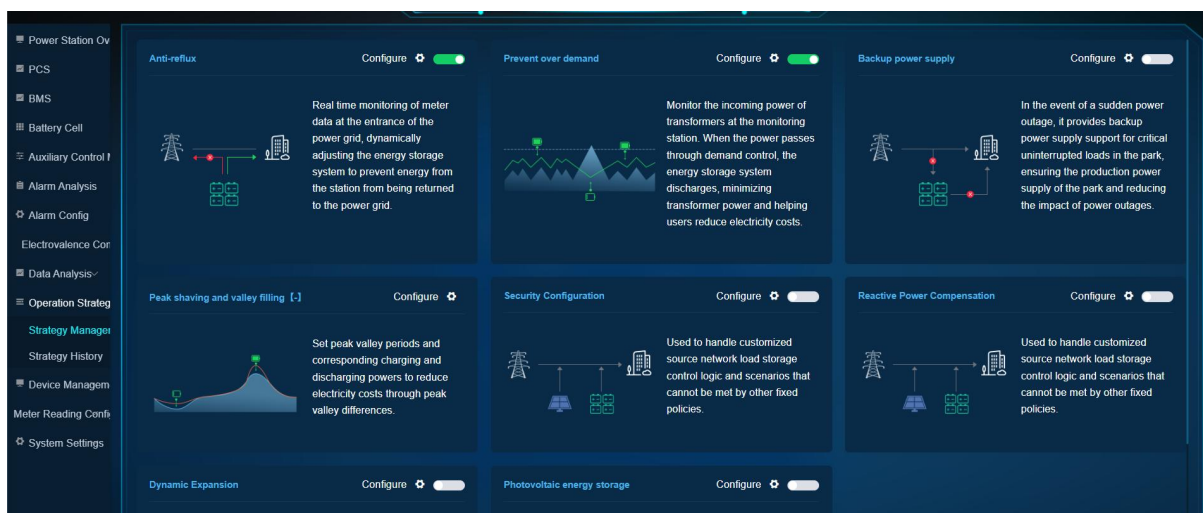
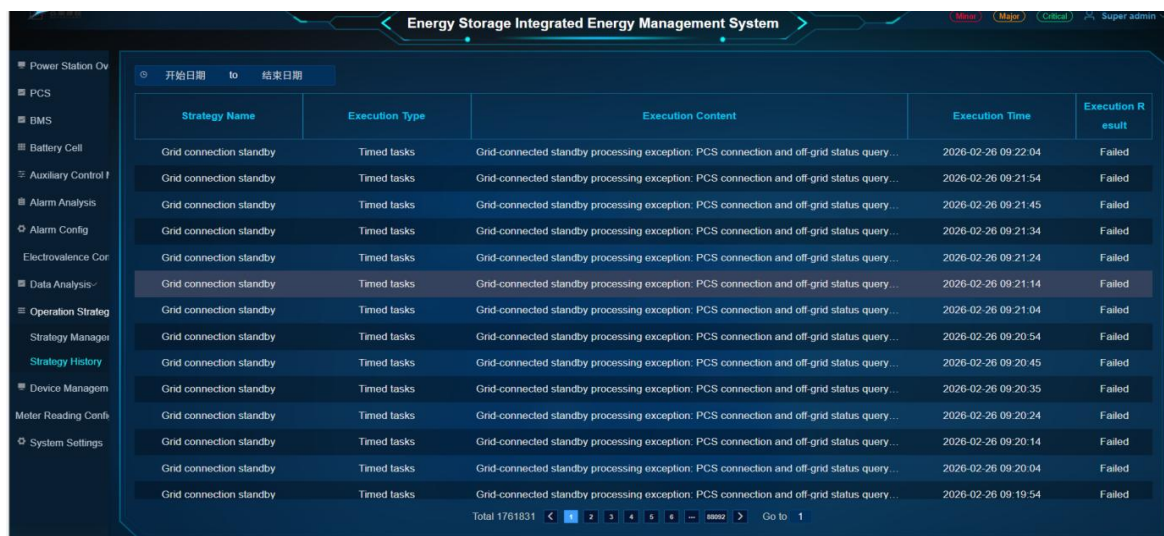


Figure 3- 15 Strategy Management

3.2.10.2. Strategy History

The history is issued to record and query the historical records of policy issuance, so that users can track the policy issuance and know whether the policy has been successfully issued to the specified device. As shown in Figure 3-16.



Strategy Name	Execution Type	Execution Content	Execution Time	Execution Result
Grid connection standby	Timed tasks	Grid-connected standby processing exception: PCS connection and off-grid status query ...	2026-02-26 09:22:04	Failed
Grid connection standby	Timed tasks	Grid-connected standby processing exception: PCS connection and off-grid status query ...	2026-02-26 09:21:54	Failed
Grid connection standby	Timed tasks	Grid-connected standby processing exception: PCS connection and off-grid status query ...	2026-02-26 09:21:45	Failed
Grid connection standby	Timed tasks	Grid-connected standby processing exception: PCS connection and off-grid status query ...	2026-02-26 09:21:34	Failed
Grid connection standby	Timed tasks	Grid-connected standby processing exception: PCS connection and off-grid status query ...	2026-02-26 09:21:24	Failed
Grid connection standby	Timed tasks	Grid-connected standby processing exception: PCS connection and off-grid status query ...	2026-02-26 09:21:14	Failed
Grid connection standby	Timed tasks	Grid-connected standby processing exception: PCS connection and off-grid status query ...	2026-02-26 09:21:04	Failed
Grid connection standby	Timed tasks	Grid-connected standby processing exception: PCS connection and off-grid status query ...	2026-02-26 09:20:54	Failed
Grid connection standby	Timed tasks	Grid-connected standby processing exception: PCS connection and off-grid status query ...	2026-02-26 09:20:45	Failed
Grid connection standby	Timed tasks	Grid-connected standby processing exception: PCS connection and off-grid status query ...	2026-02-26 09:20:35	Failed
Grid connection standby	Timed tasks	Grid-connected standby processing exception: PCS connection and off-grid status query ...	2026-02-26 09:20:24	Failed
Grid connection standby	Timed tasks	Grid-connected standby processing exception: PCS connection and off-grid status query ...	2026-02-26 09:20:14	Failed
Grid connection standby	Timed tasks	Grid-connected standby processing exception: PCS connection and off-grid status query ...	2026-02-26 09:20:04	Failed
Grid connection standby	Timed tasks	Grid-connected standby processing exception: PCS connection and off-grid status query ...	2026-02-26 09:19:54	Failed

Figure 3- 16 Strategy History

3.2.10.3. Smart Temperature Control

The Intelligent Temperature Control Configuration Interface allows users to set the start/stop temperature thresholds for the cooling and heating equipment of the energy storage system during both idle and operational periods; it also enables the configuration of parameters such as the full operating cycle temperature difference and the advance runtime duration for the temperature control equipment. Users can activate the control strategy by turning on the status switch and manage the configuration using the Save and Reset buttons. Its primary function is to precisely regulate battery temperature, ensuring the safe and efficient operation of the system. See Figure 3-17 for details.



Figure 3-17 Smart Temperature Control

3.2.10.4. Running Mode

1. Local Mode

The Local Mode Configuration Interface, available in operational mode, is used to configure key parameters for the energy storage system when it is operating locally. Users can set power thresholds and deadband parameters to prevent backflow or excessive demand, define the charging and discharging periods and power levels for peak shaving and valley filling, and manage safety parameters such as SOC upper and lower limits as well as maximum charging and discharging power. Through these configurations, the system can achieve precise scheduling and robust safety protection for the local operation strategy of the

energy storage station. See Figure 3-28.



Figure 3-18 Local Mode

2. Debugging Mode

The Operation Mode Debugging Configuration Interface is designed for debugging and controlling the core equipment of the energy storage system. Under either Group Control or Single Control mode, users can issue commands to the PCS – such as fault clearing, power-on/off operations, grid connection/disconnection, and power target setting – and can monitor the PCS's operating status and power data in real time; simultaneously, users can issue commands to the BMS – including fault clearing and circuit breaker opening/closing operations – and monitor key parameters such as SOC and operating status in real time. Through these operations, precise debugging and state monitoring of the energy storage system can be achieved. As shown in Figure 3-19.



Figure 3-19 Debugging Mode

3. Proxy Pattern

The Proxy Mode Scheduling History Interface, displayed in operating mode, shows the scheduling history of the energy storage system under proxy mode. Users can view information such as scheduling source, scheduling time, scheduling content, scheduling result, and scheduling details; this interface supports paginated browsing. Through this page, system scheduling activities can be traced, aiding operations and maintenance personnel in analyzing scheduling execution status and system operating conditions. As shown in Figure 3-20.



Figure 3-20 Proxy Pattern

4. VPP pattern

The VPP Mode Configuration Interface, used for configuring operational strategies under the Virtual Power Plant (VPP) mode, allows users to set power thresholds and deadband parameters for backflow prevention and over-demand protection; configure charging/discharging periods, power limits, and upper SOC limits for peak shaving and valley filling; and manage safety parameters such as upper and lower SOC limits as well as maximum charging/discharging power. Through these configurations, the system can participate in grid dispatching, enabling the optimized operation and secure protection of the energy storage station. As shown in Figure 3-21.



Figure 3-21 VPP Mode

1. AGVC pattern

The AGVC mode configuration interface in operating mode is divided into two sub-modules: AGC active power control and AVC reactive power control.

In the AGC Active Power Control Module, users can perform signal operations such as activating or deactivating the AGC substation, as well as switching between remote and local modes; they can also configure parameters including the active power target value, active power output upper and lower limits, adjustment rate, and maximum variation range, and can monitor real-time data such as active power output boundaries and total active power; see Figure 3-22 for details.

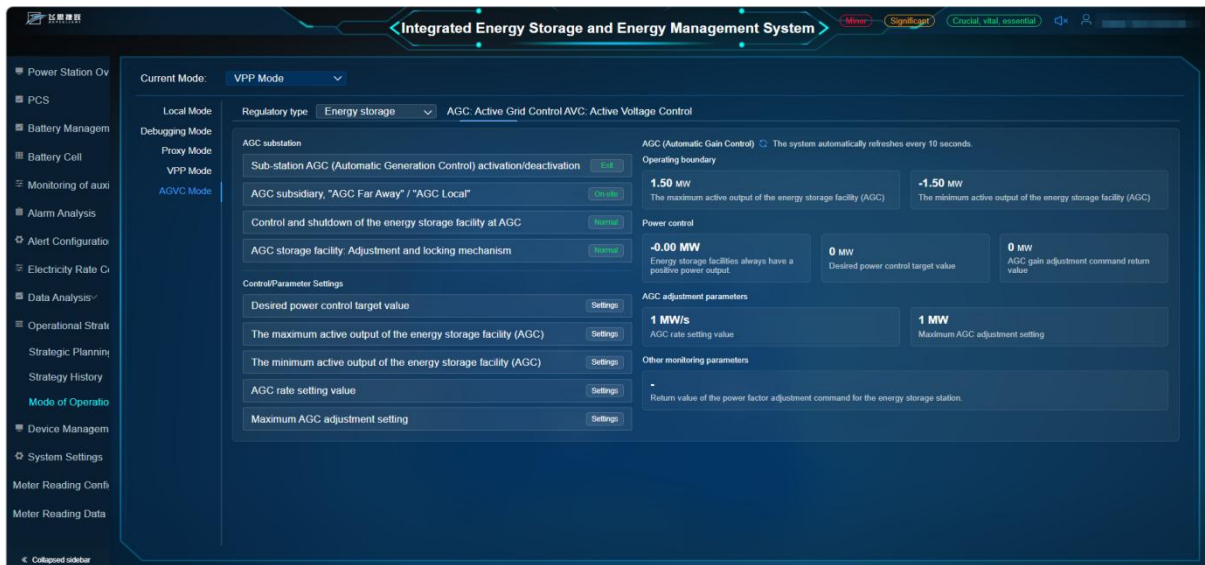


Figure 3-22 AGC Active Power Control

In the AVC Reactive Power Control Module, users can perform signal operations such as activating or deactivating the AVC substation, as well as switching between remote and local control modes; they can also configure parameters including the reactive power target value, bus voltage target value, the adjustable upper and lower limits for reactive power across the entire substation, and the power factor; additionally, users can monitor in real time data such as the reactive power regulation potential, bus voltage, and power factor. This is illustrated in Figure 3-23.

Through these configurations, the system enables precise regulation of both active and reactive power in energy storage stations, thereby meeting the requirements of grid dispatching.

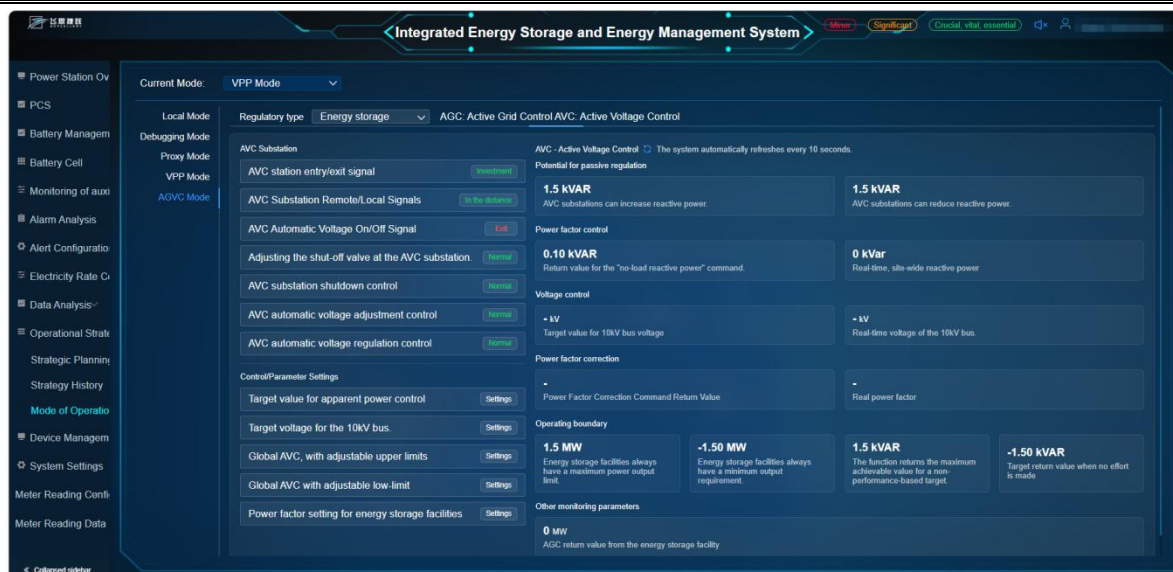


Figure 3-23 AVC Reactive Power Control

3.2.10.5. Main Unit Configuration

The Host Configuration Interface is used to display and manage the status of the system's main and slave units. Users can view core metrics such as the host's IP address, operating status, runtime mode, total active/reactive power, total SOC, and total SOH, as well as statistical data including daily charge/discharge amounts and total charge/discharge amounts. Additionally, users can monitor the real-time operating data of each slave unit—such as SOC, SOH, active/reactive power—and can filter the slave units as needed. This interface enables state monitoring and management of the energy storage system cluster; see Figure 3-24 for details.



Figure 3-24 Main Host Configuration

3.2.10.6. EMU Monitor

The EMU Monitoring Interface enables comprehensive status monitoring of the core equipment and operating environment of the energy storage system. Users can view the PCS's operating status, power, voltage, current and other electrical parameters, the EMU's system resource utilization rate, as well as key battery data such as the BMS's high-voltage status, SOC, and SOH. Additionally, the interface allows for monitoring auxiliary system information—including energy consumption statistics, liquid-cooled units, dehumidifiers, and ambient temperature and humidity—and provides trend charts for the active power consumption of the grid power supply, load, photovoltaic system, and energy storage system. Through this page, users can gain a holistic view of the energy storage system's overall operating status and perform visual management of its performance. As shown in Figure 3-25.



Figure 3-25 EMU Monitoring

3.2.11. Device Management

3.2.11.1. Device Analysis

By filtering device, , the device information status can be detected in real time, as shown in Figure 3-26.

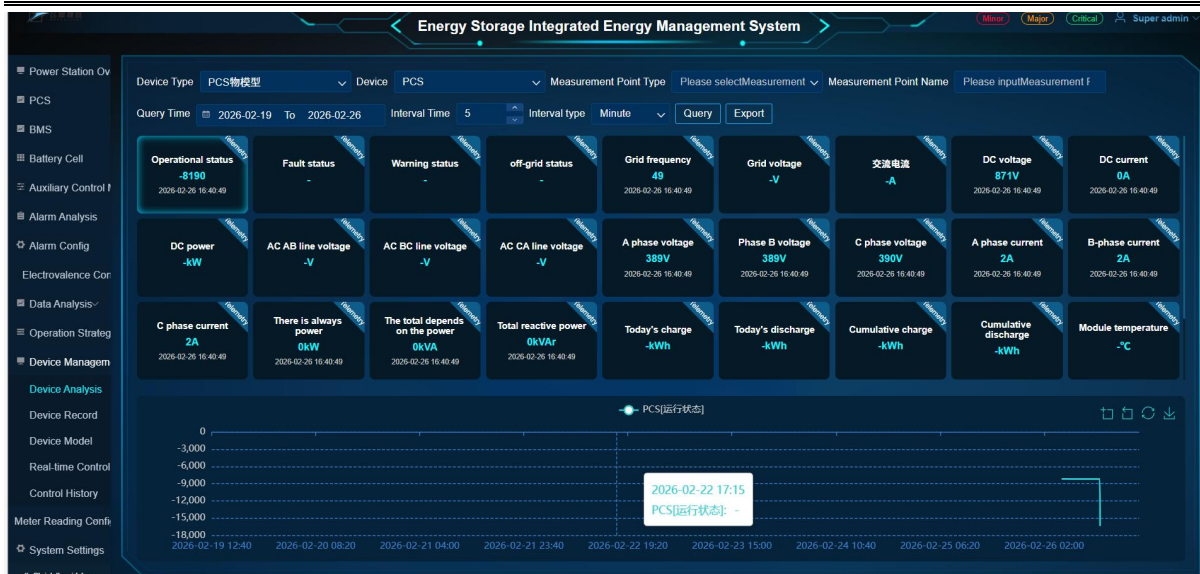


Figure 3-26 Device Analysis

3.2.11.2. Device Ledger

The device ledger is used to display the basic information of the device, and users can view, edit, and manage the point operations, as shown in Figure 3-27.



The Device Ledger interface displays a table of device information. The table has the following columns: Device Code, Device Name, Device Type, Device Group, Device Model, Manufacturer, and Operation. The data is as follows:

Device Code	Device Name	Device Type	Device Group	Device Model	Manufacturer	Operation
1	PCS	PCS object model	-	-	-	Managed Points Edit Delete
2	BMS	BMS object model	-	-	-	Managed Points Edit Delete
3	Air conditioning	制冷	-	-	-	Managed Points Edit Delete
4	Fire protection	Fire protection	-	-	-	Managed Points Edit Delete
5	Anti-countercurrent meter 1	Anti-countercurrent meter	-	-	-	Managed Points Edit Delete
6	Anti-countercurrent meter 2	Anti-countercurrent meter	-	-	-	Managed Points Edit Delete
7	Energy meter	Energy storage meter	-	-	-	Managed Points Edit Delete
99	Energy storage system equipm	Energy storage system m...	-	-	-	Managed Points Edit Delete

Figure 3-27 Device Ledger

3.2.11.3. Device Model

Manage the unique identity of the device model, the unique identity of the point, and the electricity price configuration, as shown in Figure 3-28.



Model Code	Model Name	Unique Identifier	Operation
1	PCS object model	pcs	Managed Points Edit Delete
2	BMS object model	bms	Managed Points Edit Delete
3	Anti-countercurrent meter	ac_meter	Managed Points Edit Delete
4	液冷 (Liquid Cooling)	air_conditioner	Managed Points Edit Delete
5	Fire protection	fire_fighting	Managed Points Edit Delete
6	Energy storage meter	em_meter	Managed Points Edit Delete
7	Dehumidifier	dehumidifier	Managed Points Edit Delete
8	Load meter	load_meter	Managed Points Edit Delete
99	Energy storage system model	energy_system	Managed Points Edit Delete

Total 9 < 1 > Go to 1

Figure 3-28 Device Model

3.2.11.4. Real-time Control

It supports remote control and remote adjustment of the control device, and issues instructions to make the device effective, as shown in Figure 3-29.

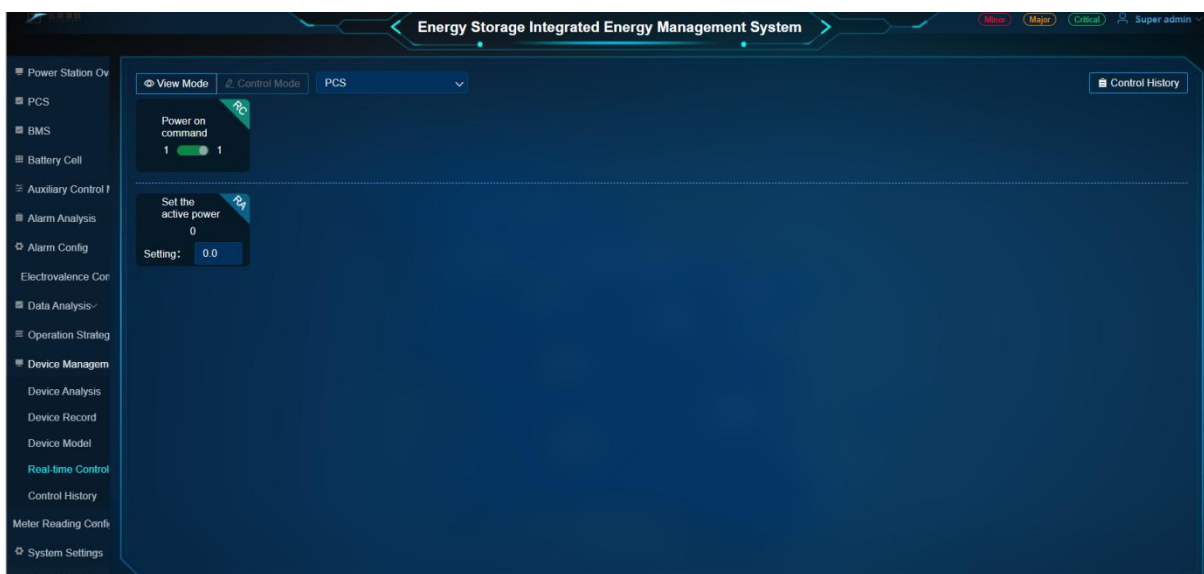


Figure 3- 29 Real-time Control

3.2.11.5. Control History

The control history records the operation of issuing point information in real-time control, which is convenient for user to observe whether the delivery operation takes effect, as shown in Figure 3-30.

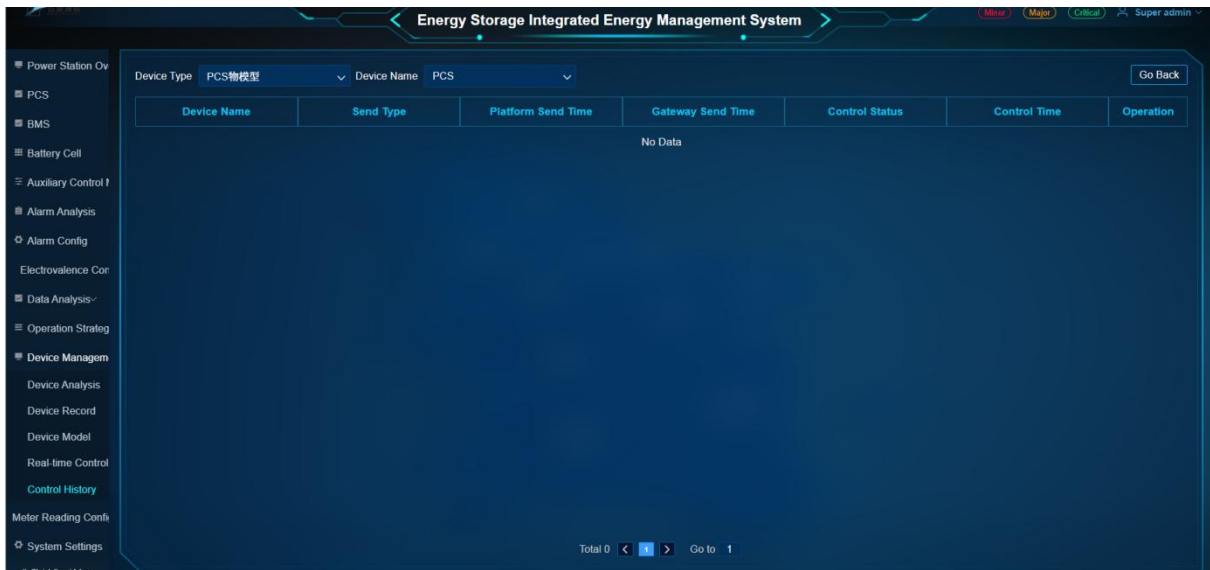


Figure 3-30 Control History

3.2.12. System Settings

3.2.12.1. User Management

Manage user basic information, login name, mobile phone number, role assignment, and password reset, as shown in Figure 3-31.



Figure 3-31 User Management

3.2.12.2. Audit Logs

The audit log records important information such as the IP address and time when users log in to the platform, tracks and audits user operation behaviors, and ensures platform security and compliance. As shown in Figure 3-32.

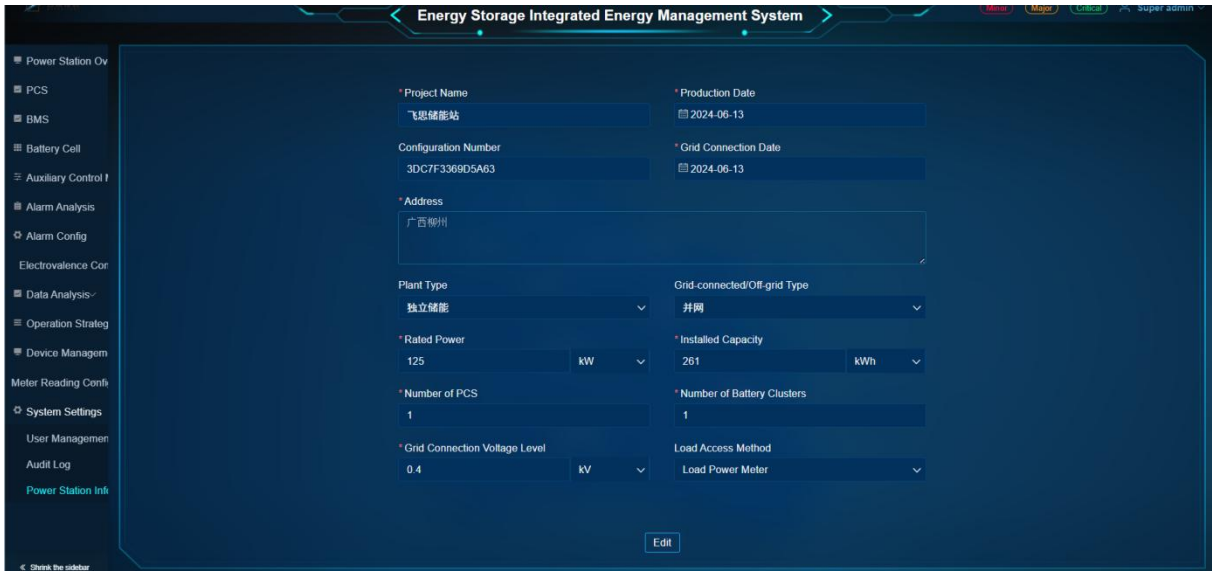


Login Name	User	IP	Content	Time
root	Super admin	113.13.119.98	Log in to the energy storage platform	2026-01-14 13:41:25
root	Super admin	183.237.184.244	Log in to the energy storage platform	2026-01-05 10:13:55
root	Super admin	183.237.184.244	Log in to the energy storage platform	2025-12-30 14:32:59
root	Super admin	183.237.184.244	Log in to the energy storage platform	2025-12-30 14:22:32
root	Super admin	127.0.0.1	Log in to the energy storage platform	2025-12-10 03:43:07
root	Super admin	127.0.0.1	Log in to the energy storage platform	2025-12-10 03:29:23
root	Super admin	127.0.0.1	Log in to the energy storage platform	2025-11-08 08:12:50
root	Super admin	116.253.122.25	Log in to the energy storage platform	2025-10-29 20:52:13
root	Super admin	124.226.46.205	Log in to the energy storage platform	2025-10-21 10:01:36
root	Super admin	124.226.46.205	Log in to the energy storage platform	2025-10-21 09:59:29
root	Super admin	124.226.46.205	Log in to the energy storage platform	2025-10-21 09:57:25
root	Super admin	127.0.0.1	Log in to the energy storage platform	2025-10-20 11:48:55
root	Super admin	180.141.151.75	Log in to the energy storage platform	2025-10-17 09:42:03
root	Super admin	180.141.151.75	Log in to the energy storage platform	2025-10-17 09:39:05
root	Super admin	180.141.151.75	Log in to the energy storage platform	2025-10-16 15:22:54
root	Super admin	127.0.0.1	Log in to the energy storage platform	2025-10-16 15:18:15

Figure 3-32 Audit Logs

3.2.12.3. Power Station Information

This module mainly displays the basic information of the project, and users can edit the project information, as shown in Figure 3-33.



Energy Storage Integrated Energy Management System

Project Name: 飞思储能站 | Production Date: 2024-06-13

Configuration Number: 3DC7F3369D5A63 | Grid Connection Date: 2024-06-13

Address: 广西柳州

Plant Type: 独立储能 | Grid-connected/Off-grid Type: 并网

Rated Power: 125 kW | Installed Capacity: 261 kWh

Number of PCS: 1 | Number of Battery Clusters: 1

Grid Connection Voltage Level: 0.4 KV | Load Access Method: Load Power Meter

[Edit]

Figure 3-33 Power Station Information

3.2.13. Meter Reading

Manage and view meter and meter reading information, and perform meter reading configuration and meter reading operations, as shown in Figure 3-34.



Energy Storage Integrated Energy Management System

Energy Storage Meter Name: Please enter energy storage | Status: Please select status | Query

Meter Name	Meter Reading Type	Last Execution Time	Last Execution Result	Next Execution Time	Start Date	End Date	Freezing Capability	Enable Status	Operation
Energy meter	Daily Freeze...	2026-02-11 1...	Failed	2026-02-26 0...	2025-07-15	2999-12-31	With Freezing ...	●	Meter Reading Configuration Execute Once Operation Details Delete
Anti-countercur...	--	--	--	--	--	--	--	--	Meter Reading Configuration
Anti-countercur...	--	--	--	--	--	--	--	--	Meter Reading Configuration

Total 3 20/page < 1 > Go to 1

Figure 3-34 Meter Reading

3.2.14. Meter Data

Check the meter reading information frozen for 15 minutes and daily freezing of the device, support re-metering and new meter reading data as shown in Figure 3-35.

Power Station Ov

PCS

BMS

Battery Cell

Auxiliary Control I

Alarm Analysis

Alarm Config

Electrovalence Cor

Data Analysis

Operation Strategy

Device Managem

Meter Reading Conf

Electricity Meter F

Meter Data

System Settings

Smart Distribution

Please enter energy storage

15-Minute Freeze

Daily Freeze

Reset

Re-read Meter

Add

Query

Energy meter

Normal

Meter Read ing Time	Forward Active					Reverse Active					Operation
	Total Ener gy	pointed	peak	Flat	valley	Total Ener gy	pointed	peak	Flat	valley	
2026-02-11 18:45:00	21099	9	137	1306	19525	18114	285	10335	7285	53	Edit Delete
2026-02-11 18:30:00	21099	9	137	1306	19525	18114	285	10335	7285	53	Edit Delete
2026-02-11 18:15:00	21099	9	137	1306	19525	18114	285	10335	7285	53	Edit Delete
2026-02-11 18:00:00	21099	9	137	1306	19525	18114	285	10335	7285	53	Edit Delete
2026-02-11 17:45:00	21099	9	137	1306	19525	18114	285	10335	7285	53	Edit Delete
2026-02-11 17:30:00	21099	9	136	1306	19525	18114	285	10335	7285	53	Edit Delete
2026-02-11 17:15:00	21098	9	136	1306	19525	18114	285	10335	7285	53	Edit Delete
2026-02-11 17:00:00	21098	9	136	1306	19525	18114	285	10335	7285	53	Edit Delete
2026-02-11 16:45:00	21098	9	136	1306	19525	18114	285	10335	7285	53	Edit Delete

Super admin

Figure 3-35 Meter Reading Dat

The EMU (Energy Management Unit) is an innovative energy management and control unit with significant advantages, specifically designed for energy storage and microgrid applications. It integrates Ethernet, CAN, RS-485, RS-232, DI, and DO interfaces, fully supporting data acquisition and digital input/output control for BMSs, PCS units, diesel generators, and PV inverters. At the software level, it incorporates standard data-acquisition protocols and provides compatibility with interfaces from major equipment manufacturers. The EMU can be widely deployed in commercial and industrial energy storage, residential energy storage, and microgrid control applications.

3.3. Data Acquisition Function

3.3.1. Home Page

On the home page, the network architecture diagram is generated according to the configured collection configuration, and it can also be switched to the display of the list. At the same time, the list form can search for the corresponding device information in the search bar according to your needs. As shown in Figure 4-1 and Figure 4-2.

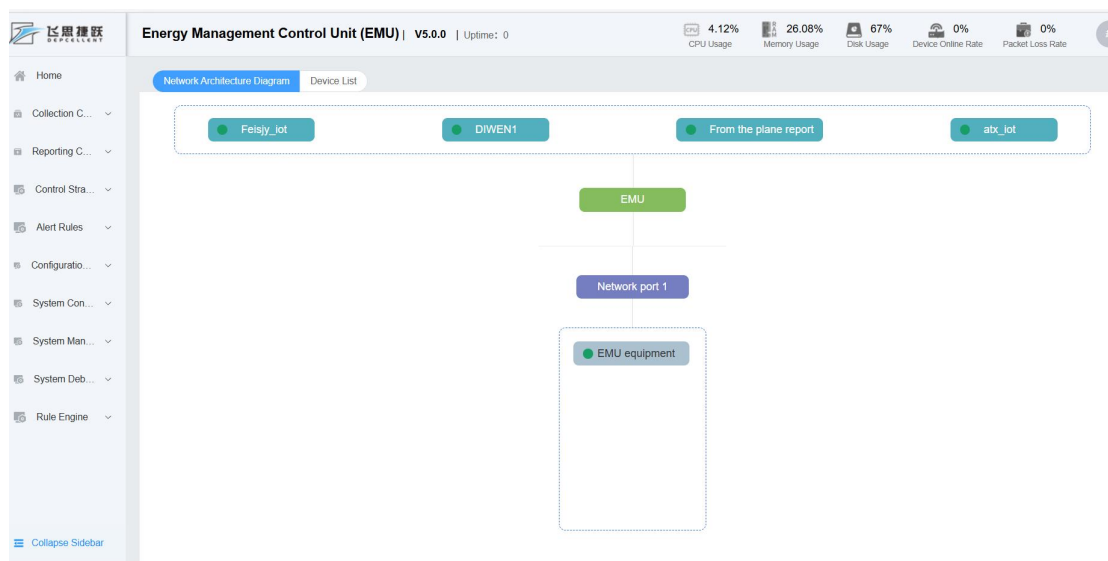
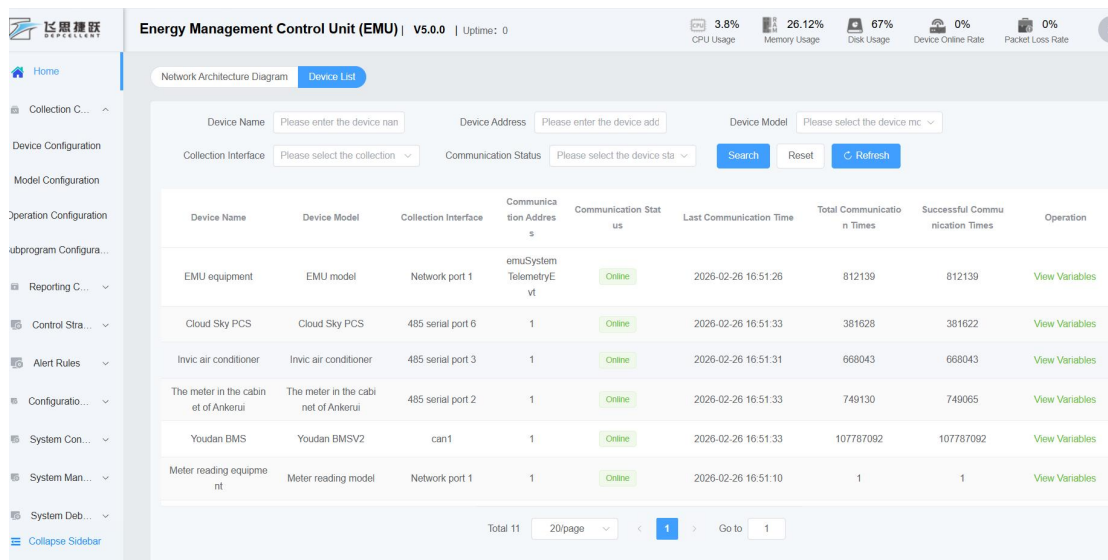


Figure 4- 1 Network Architecture Diagram



Device Name	Device Model	Collection Interface	Communication Address	Communication Status	Last Communication Time	Total Communication Times	Successful Communication Times	Operation
EMU equipment	EMU model	Network port 1	emuSystem TelemetryE vt	Online	2026-02-26 16:51:26	812139	812139	View Variables
Cloud Sky PCS	Cloud Sky PCS	485 serial port 6	1	Online	2026-02-26 16:51:33	381628	381622	View Variables
Invic air conditioner	Invic air conditioner	485 serial port 3	1	Online	2026-02-26 16:51:31	668043	668043	View Variables
The meter in the cabinet of Ankerui	The meter in the cabinet of Ankerui	485 serial port 2	1	Online	2026-02-26 16:51:33	749130	749065	View Variables
Youdan BMS	Youdan BMSV2	can1	1	Online	2026-02-26 16:51:33	107787092	107787092	View Variables
Meter reading equipment	Meter reading model	Network port 1	1	Online	2026-02-26 16:51:10	1	1	View Variables

Figure 4- 2 Device List

3.3.2. Southbound Configuration

A functional module for data communication between the gateway and the actual device.

3.3.2.1. Device Configuration

The module is divided into three interfaces, namely the interface of all devices, the interface of serial port devices and the interface of network port devices. Click the middle device button to switch, as shown in the figure below. ttyS0~ttyS4 are serial port devices, and network port one and network port two are network port devices.

3.3.2.2. All Device

This interface displays all the configured device interfaces and divides all devices into devices connected to serial ports, as shown in Figure 4-3:

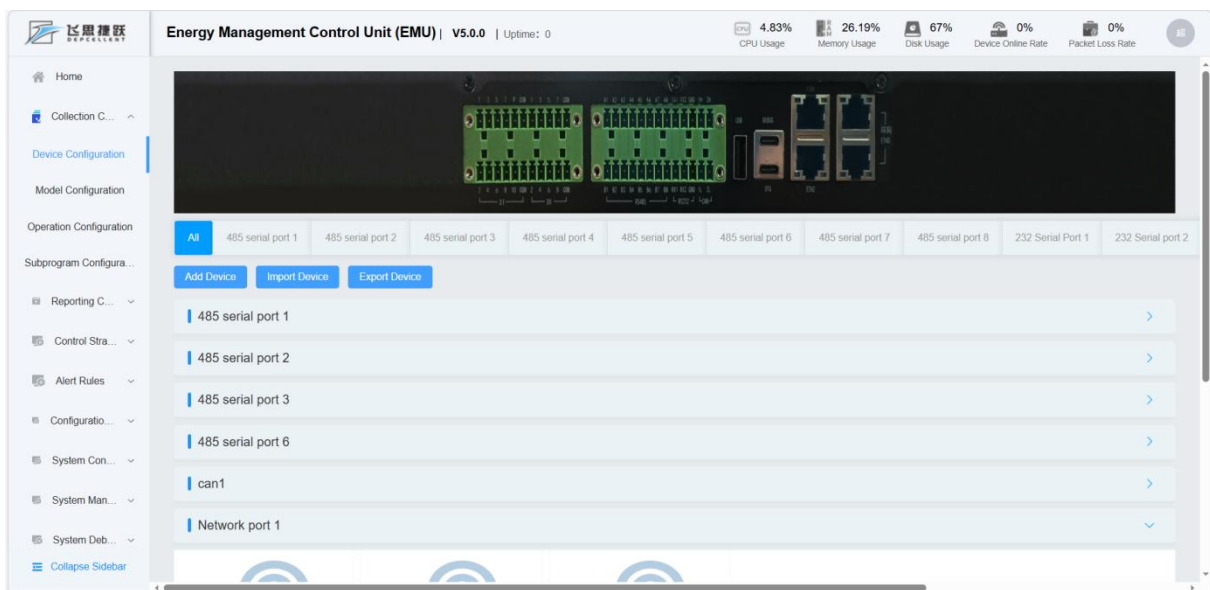


Figure 4- 3 All Device

3.3.2.2.1. Serial Port Device

Click on the serial port in ttyS0~ttyS4 to display the information of the device connected to the serial port, as shown in Figure 4-4.

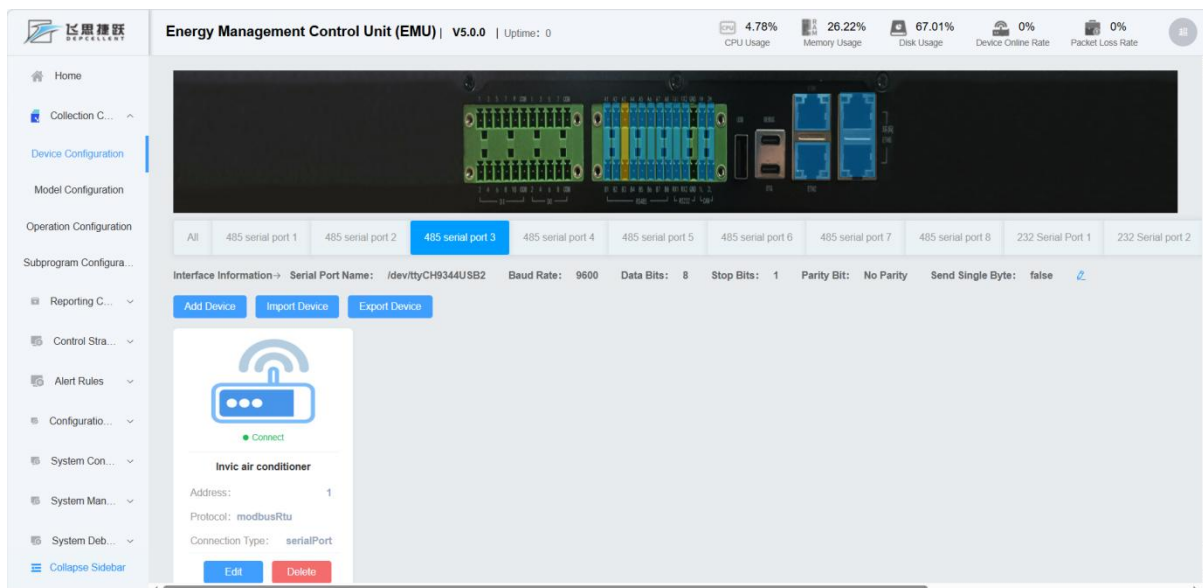


Figure 4- 4 Serial Port Device

3.3.2.2.2. Network Port Device

Click port 1 and port 2 to display the information of the corresponding devices connected to port 1 and port 2. As shown in Figure 4-5:

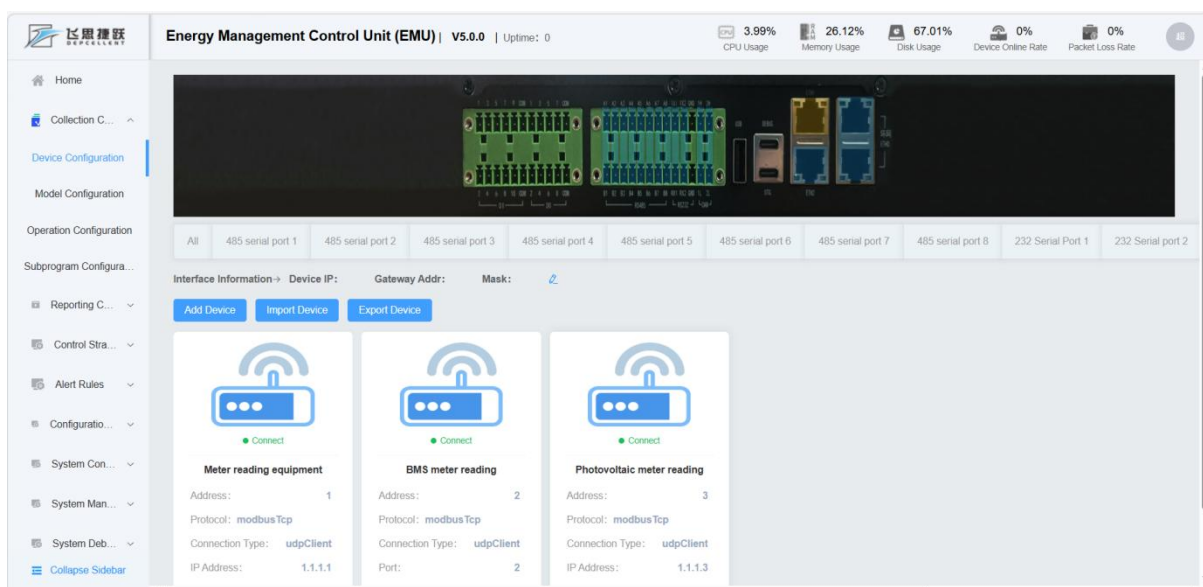
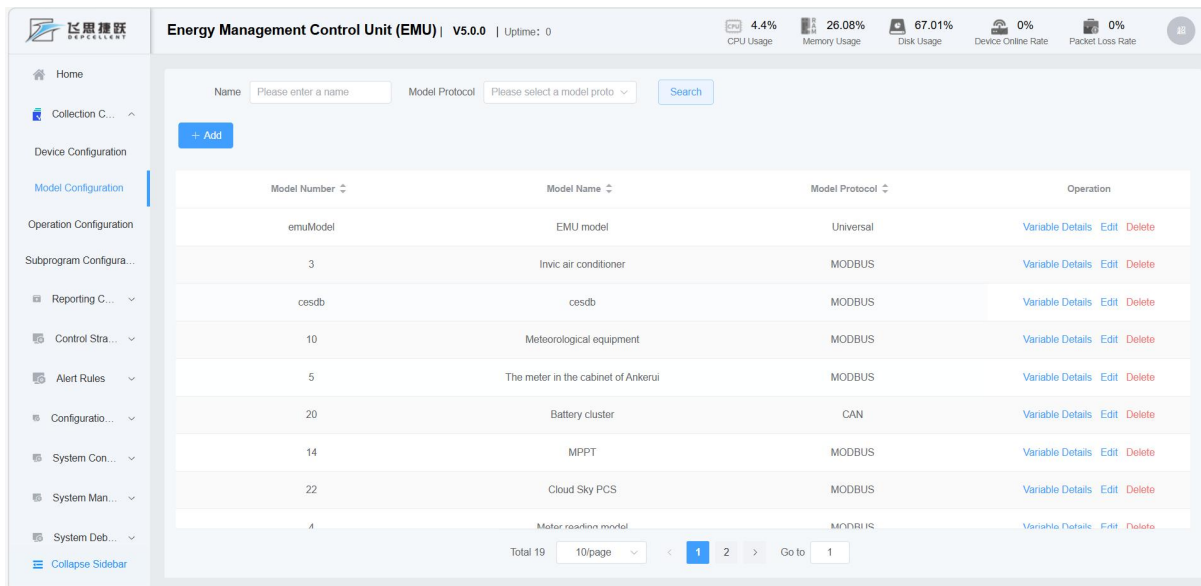


Figure 4- 5 Network Port Device

3.3.3. Model Configuration

The model configuration is a module used to configure the device point information, including general, PLC, DL/T645-2007, and Modbus models, and the user can add variable parameters to realize the data point configuration through the configuration command information, as shown in Figure 4-6:

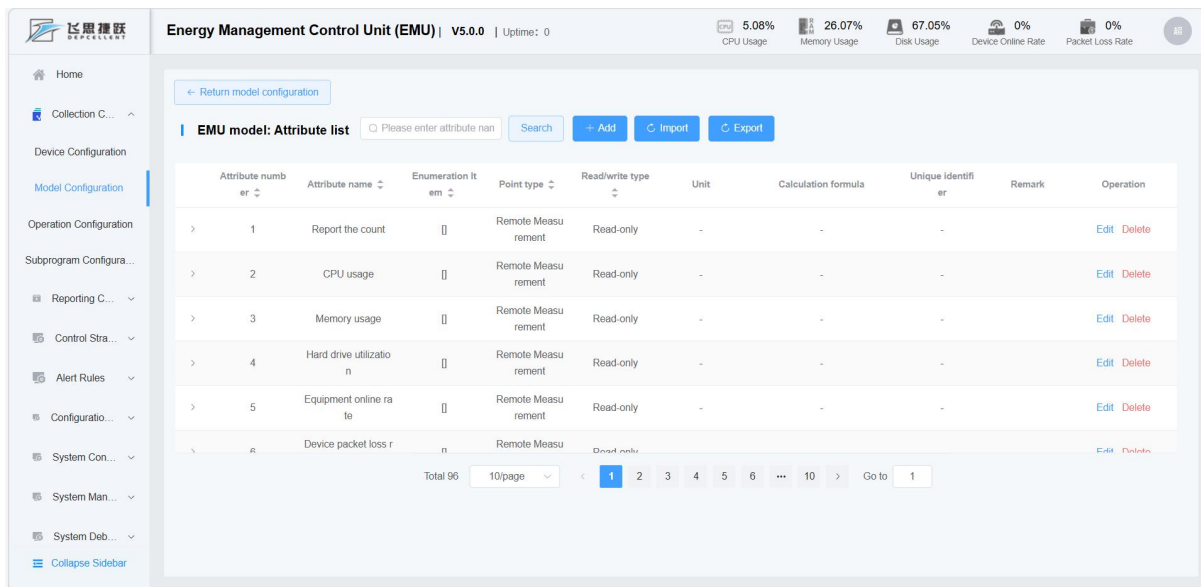


Model Number	Model Name	Model Protocol	Operation
emuModel	EMU model	Universal	Variable Details Edit Delete
3	Invic air conditioner	MODBUS	Variable Details Edit Delete
cesdb	cesdb	MODBUS	Variable Details Edit Delete
10	Meteorological equipment	MODBUS	Variable Details Edit Delete
5	The meter in the cabinet of Ankerui	MODBUS	Variable Details Edit Delete
20	Battery cluster	CAN	Variable Details Edit Delete
14	MPPT	MODBUS	Variable Details Edit Delete
22	Cloud Sky PCS	MODBUS	Variable Details Edit Delete
4	Motor reaction model	MODBUS	Variable Details Edit Delete

Figure 4- 6 Model Configuration

3.3.3.1. Variable Details

In the model configuration interface, click the variable details button of the model list to enter the corresponding model variable details interface, which is used to configure the corresponding model point data. As shown in Figure 4-7.



Attribute number	Attribute name	Enumeration	Point type	Read/write type	Unit	Calculation formula	Unique identifier	Remark	Operation
1	Report the count		Remote Measurement	Read-only	-	-	-		Edit Delete
2	CPU usage		Remote Measurement	Read-only	-	-	-		Edit Delete
3	Memory usage		Remote Measurement	Read-only	-	-	-		Edit Delete
4	Hard drive utilization		Remote Measurement	Read-only	-	-	-		Edit Delete
5	Equipment online rate		Remote Measurement	Read-only	-	-	-		Edit Delete
6	Device packet loss rate		Remote Measurement	Read-only	-	-	-		Edit Delete

Figure 4- 7 Variable Details

3.3.4. Operation Configuration

Run the configuration, formulate device collection rules, such as the collection cycle and the number of offline judgments, and then bind the devices defined by the device

configuration module, and one running configuration can be bound to multiple devices. As shown in Figure 4-8:

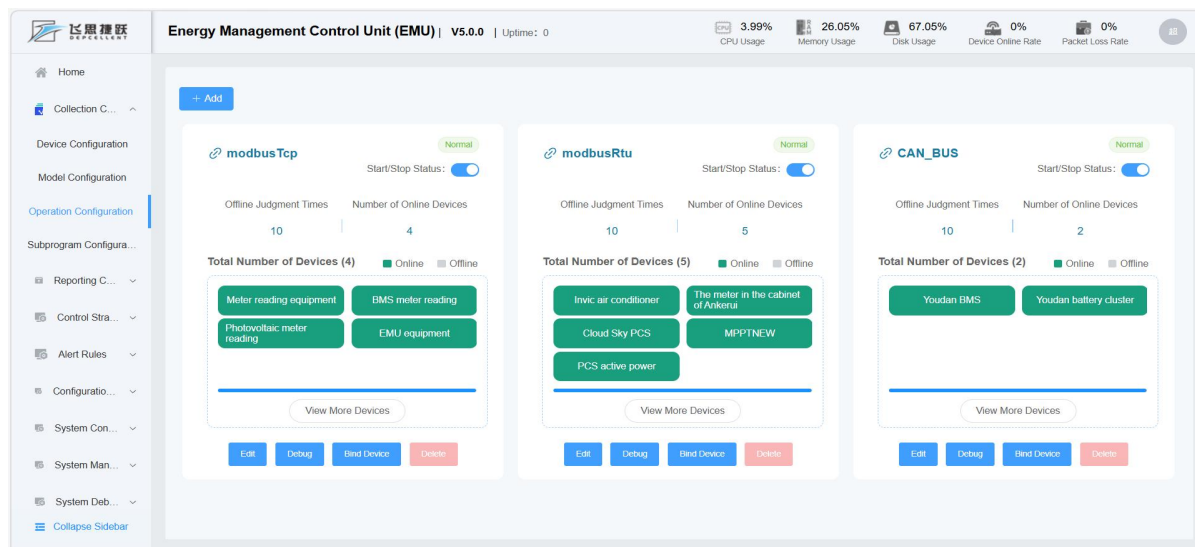


Figure 4- 8 Operation Configuration

3.3.4.1. Debug

The interface can debug the devices bound to the current running configuration, such as command issuance, manual collection, stop collection and message debugging, as shown in Figure 4-9:

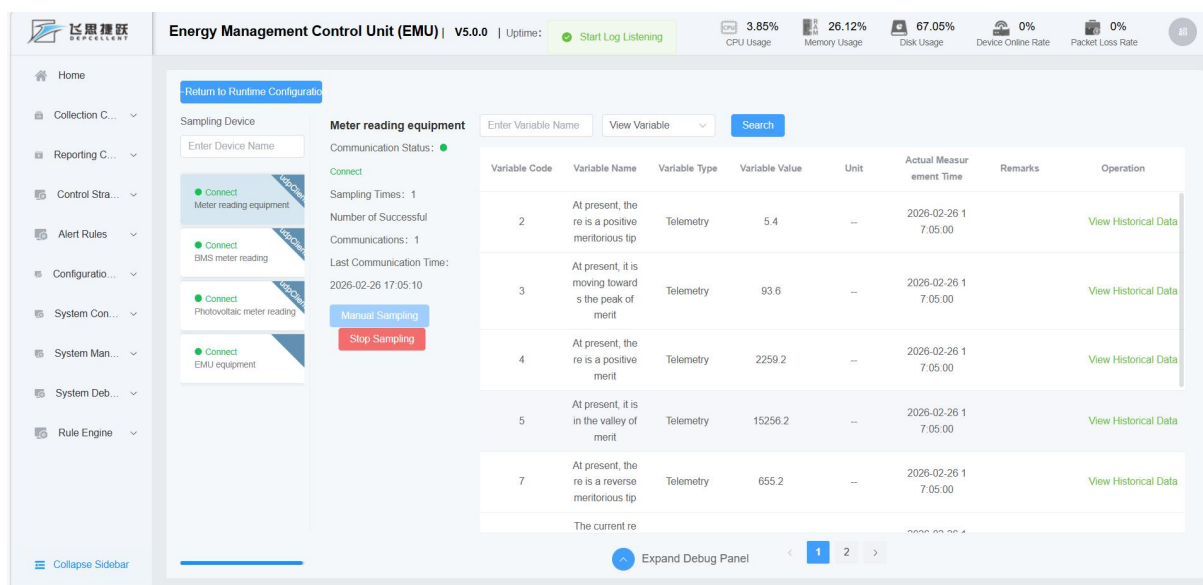


Figure 4- 9 Debug

Function:

- 1) The command is issued: the pop-up window shows the writable points, and the command can be issued.

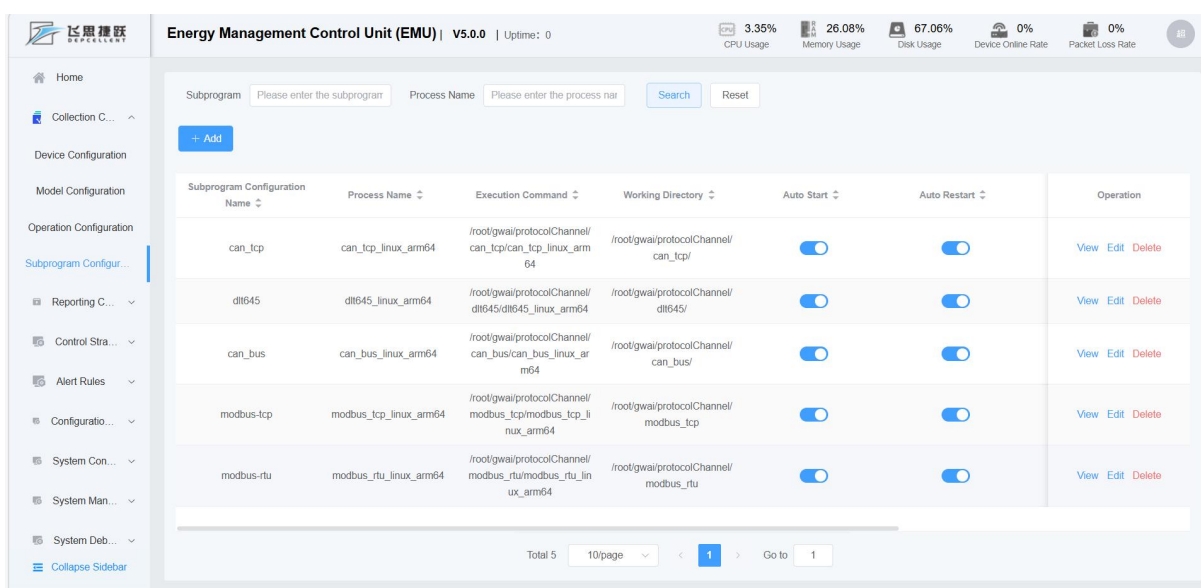
- 2) Manual collection: manual collection once.
- 3) Stop collection: Click stop collection to temporarily stop the collection according to the cycle configured by the operation configuration. Exit the page or click again to resume the cycle collection.



- 4) Click on the right , the system log information of the current device will appear.

3.3.5. Subroutine Configuration

The management and configuration of each subroutine running in the system allows users to view, add, edit and delete subroutines, as well as configure the operating parameters of the subroutines. As shown in Figure 4 -10:



Subprogram Configuration Name	Process Name	Execution Command	Working Directory	Auto Start	Auto Restart	Operation
can_tcp	can_tcp_linux_arm64	/root/gwai/protocolChannel/can_tcp/can_tcp_linux_arm64	/root/gwai/protocolChannel/can_tcp/	☒	☒	View Edit Delete
dt645	dt645_linux_arm64	/root/gwai/protocolChannel/dt645/dt645_linux_arm64	/root/gwai/protocolChannel/dt645/	☒	☒	View Edit Delete
can_bus	can_bus_linux_arm64	/root/gwai/protocolChannel/can_bus/can_bus_linux_arm64	/root/gwai/protocolChannel/can_bus/	☒	☒	View Edit Delete
modbus-tcp	modbus_tcp_linux_arm64	/root/gwai/protocolChannel/modbus_tcp/modbus_tcp_linux_arm64	/root/gwai/protocolChannel/modbus_tcp	☒	☒	View Edit Delete
modbus-rtu	modbus_rtu_linux_arm64	/root/gwai/protocolChannel/modbus_rtu/modbus_rtu_linux_arm64	/root/gwai/protocolChannel/modbus_rtu	☒	☒	View Edit Delete

Figure 4- 10 Subroutine Configuration

3.3.6. Northbound Configuration

3.3.6.1. Reporting Channel

Through the configuration of the reporting channel, the collected data is reported to the specified platform. As shown in Figure 4-11:

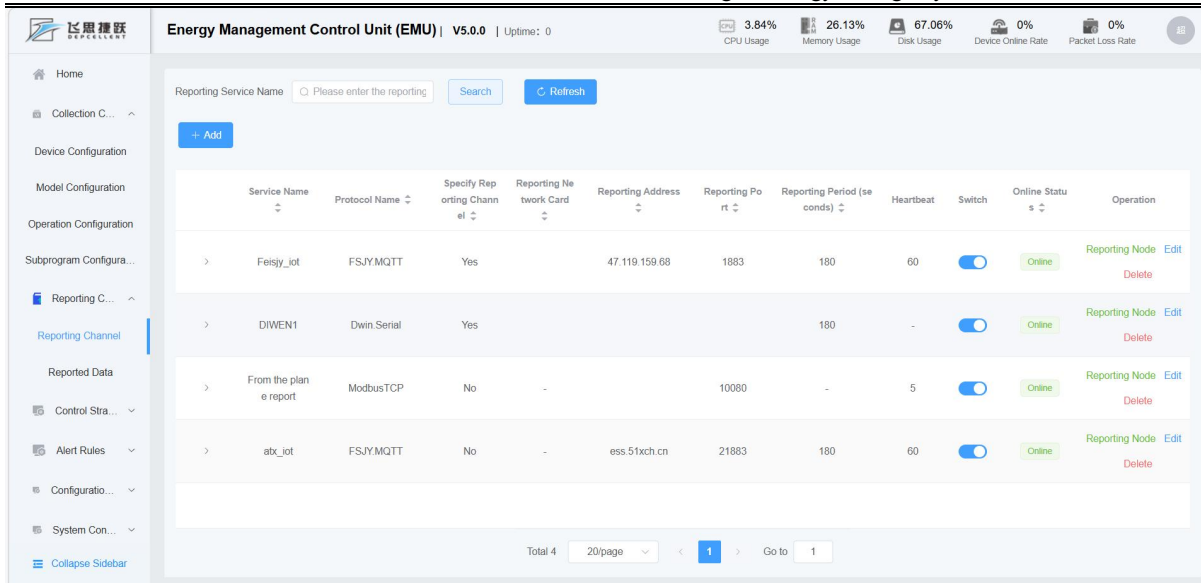


Figure 4- 11 Reporting Channel

3.3.6.2. Report Nodes

Report the device information corresponding to the channel, as shown in Figure 4-12:

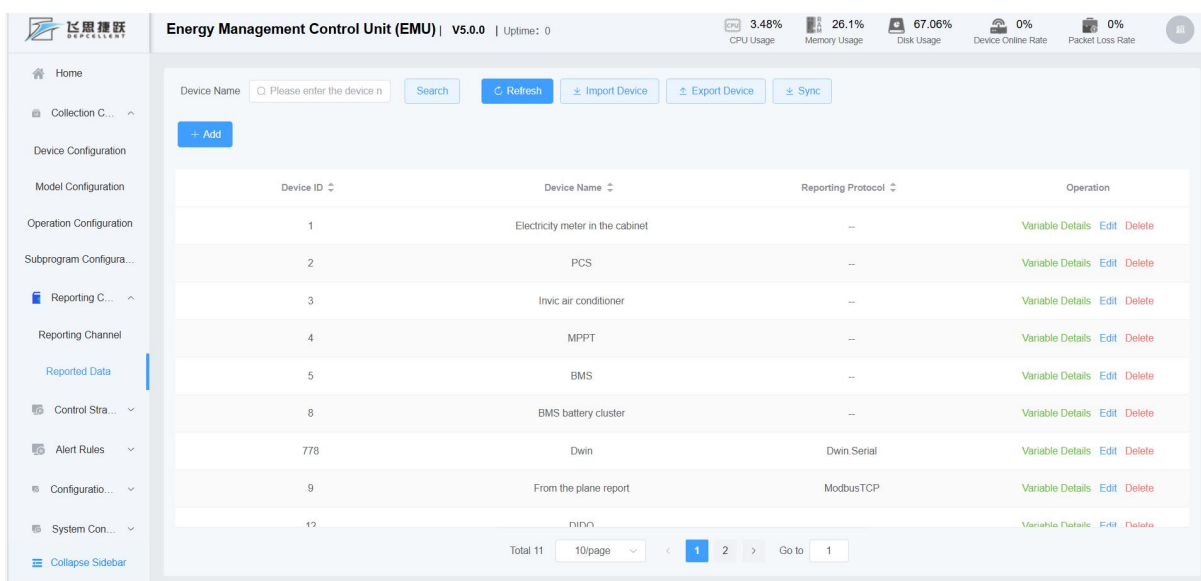


Figure 4- 12 Report Nodes

3.3.7. Alarm Rules

3.3.7.1. Alarm Configuration

By adding the rule to configure the point rule of the device, it can judge whether the point data collected conforms to the rule and generate an alarm record. As shown in Figure 4-13:

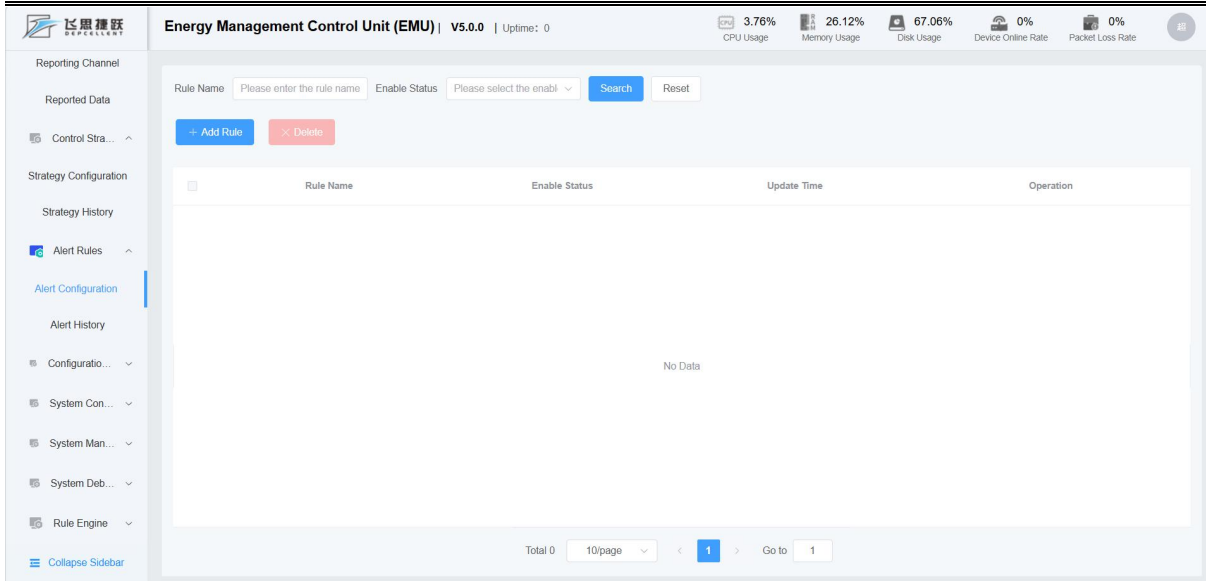


Figure 4-13 Alarm Configuration

3.3.7.2. Alarm History

After the rules are configured, the generation time and other information of the rules will be recorded every time the rules are started. After the rules are triggered, alarm events can be manually processed. As shown in Figure 4-14:

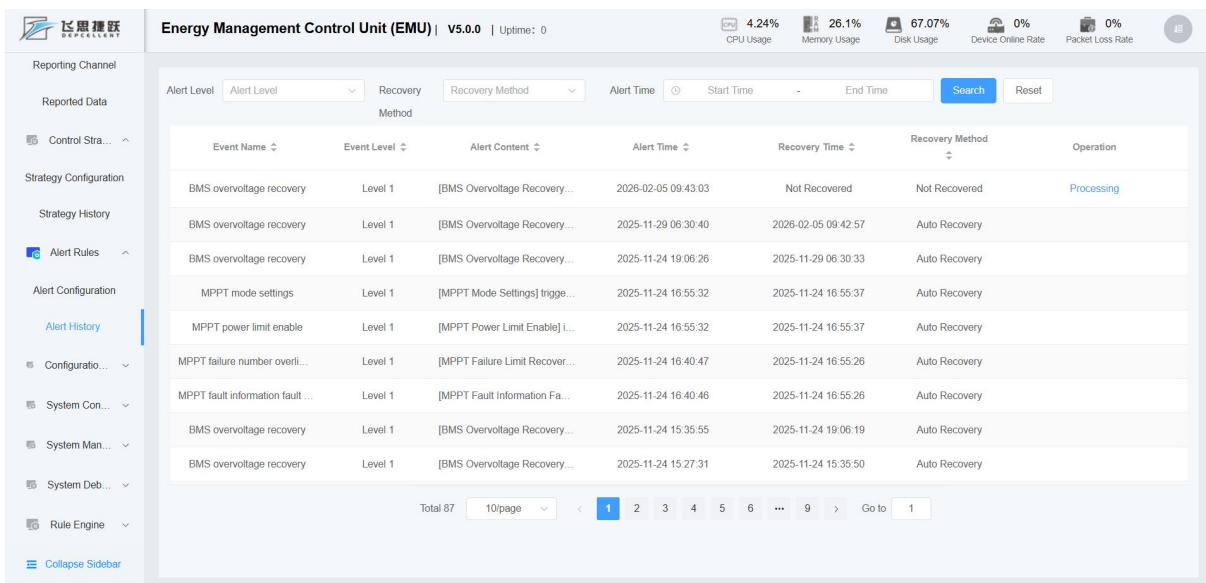


Figure 4- 14 Alarm History

3.3.8. Configuration Management

3.3.8.1. Configuration List

The configuration list is used to display the overview of the power station, PCS, BMS and other pages. Users can configure the required related pages through the configuration, and

can intuitively observe the running status of the current equipment through the configuration. As shown in Figure 4-15:

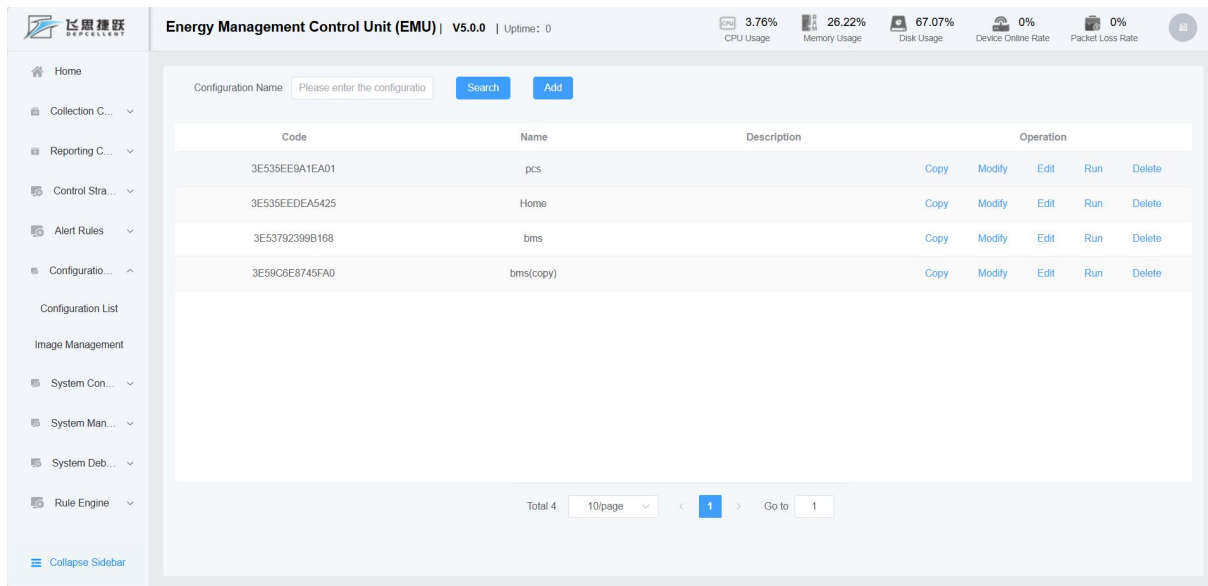


Figure 4- 15 Configuration Management

3.3.8.2. Image Management

Image management is the place for configuration picture management. It contains many configuration pictures, classifies and organizes them, and provides an interface for uploading pictures. As shown in Figure 4-16:

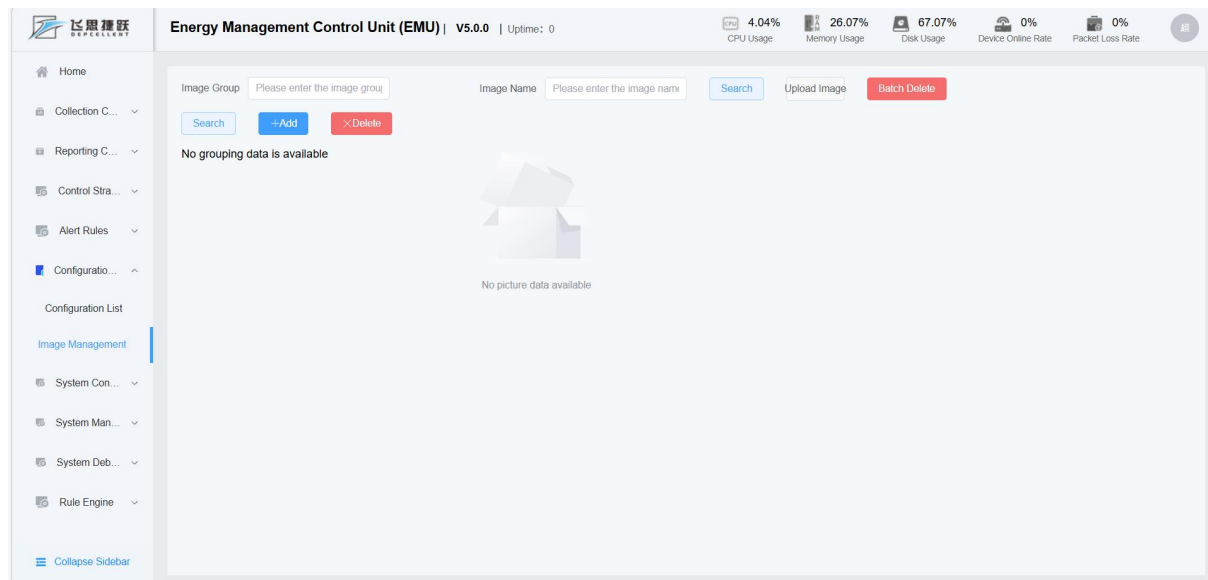


Figure 4-16 Image Management

3.3.9. System Configuration

3.3.9.1. Storage Settings

Configure the parameters related to data storage in the system, including reported data storage and historical storage. As shown in Figure 4-17:

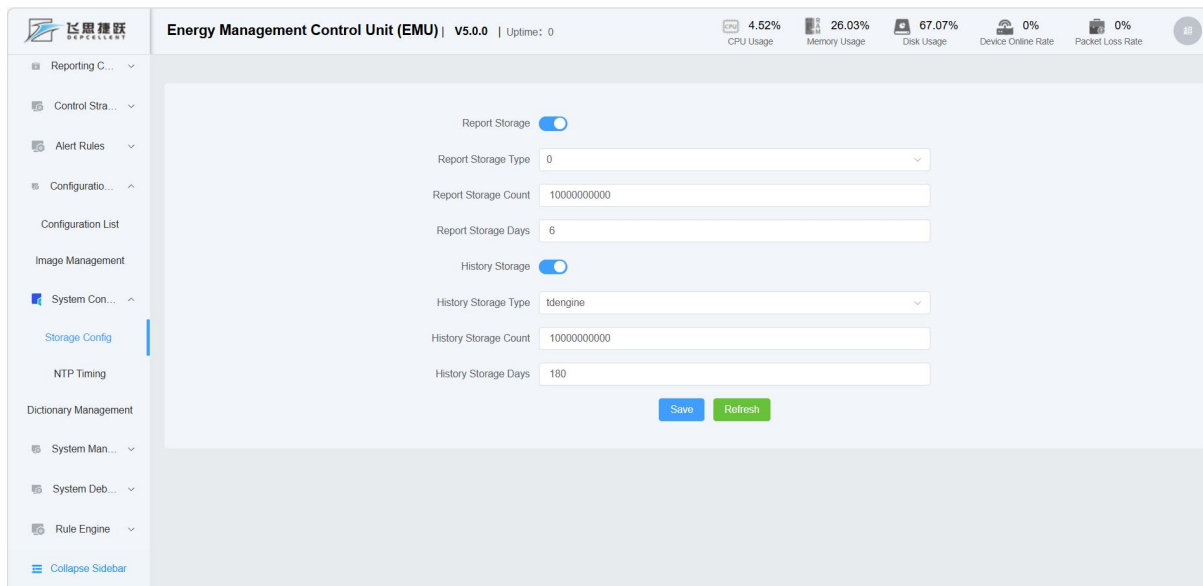


Figure 4- 17 Storage Settings

3.3.9.2. NTP Calibration

The configuration and management system synchronizes the time function automatically calibrates the system time through the Network Time Protocol (NTP) server. As shown in Figure 4-18:

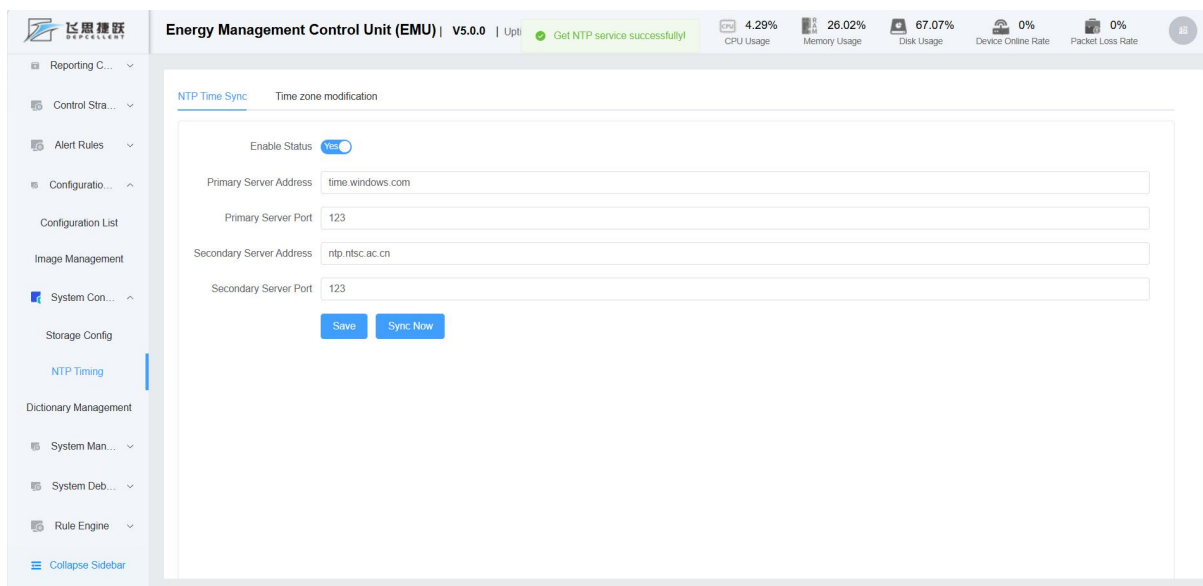


Figure 4- 18 NTP Calibration

3.3.9.3. Dictionary Management

Maintain various data dictionaries used in the system, and users can view, add, modify and delete dictionary entries to ensure the standardization and consistency of system data. As shown in Figure 4-19:

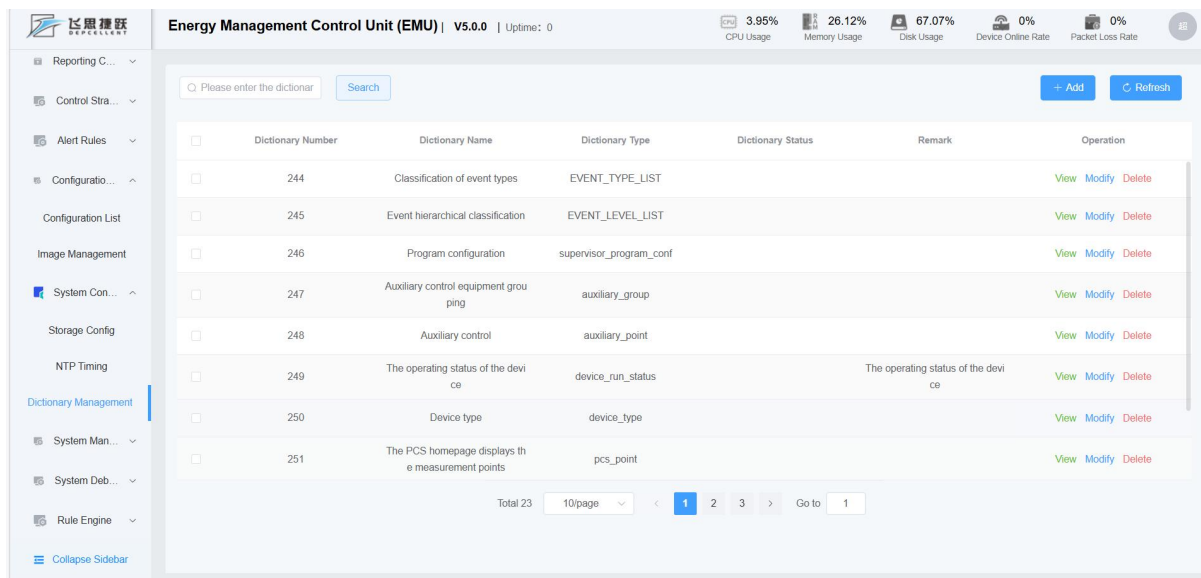


Figure 4-19 Dictionary Management

3.3.10. System Management

3.3.10.1. User Management

It includes adding, querying, editing and deleting users, as well as resetting user passwords for users in the management system. As shown in Figure 4-20:

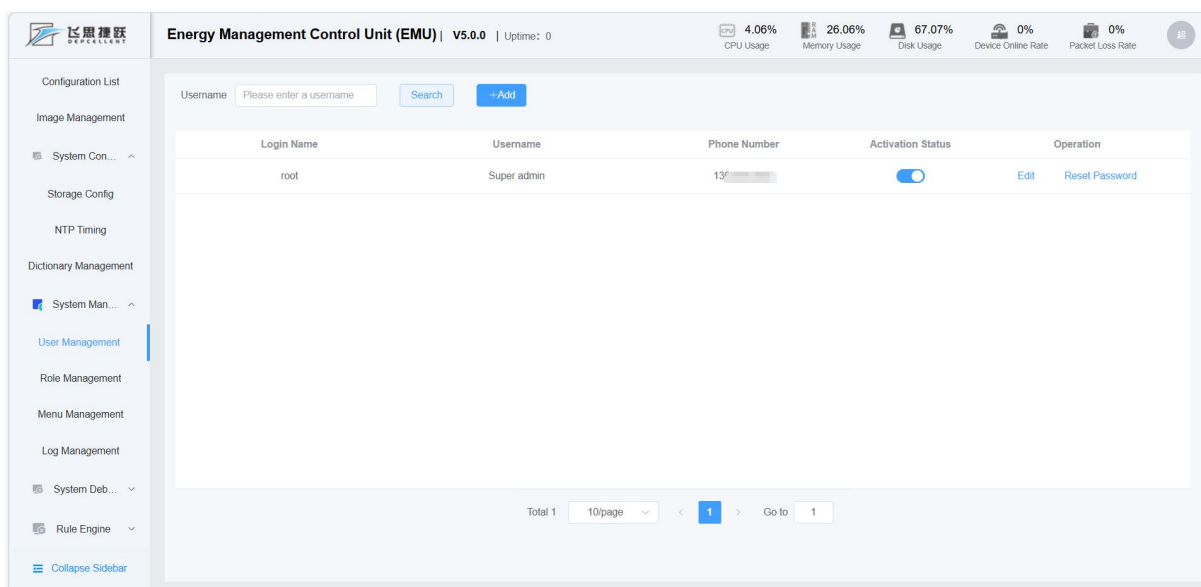


Figure 4- 20 User Management

3.3.10.2. Character Management

The roles in the management system include adding, querying, editing and deleting roles, as well as updating user status and configuring menus. As shown in Figure 4-21:

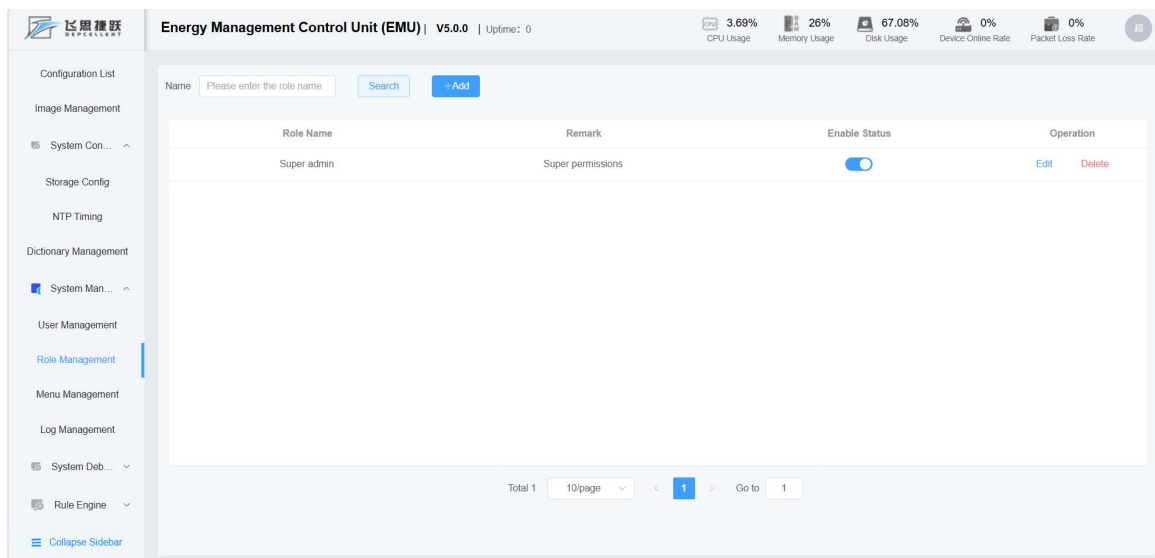


Figure 4- 21 Character Management

3.3.10.3. Menu Management

The menu used in the management system includes adding, querying, editing and deleting menus, as well as sorting menus and other operations. As shown in Figure 4-22:

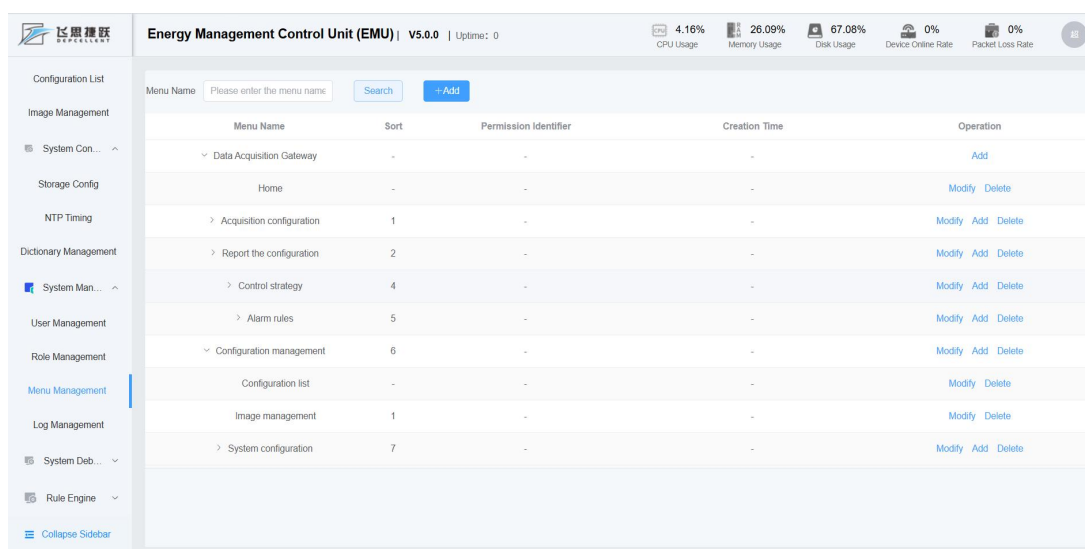
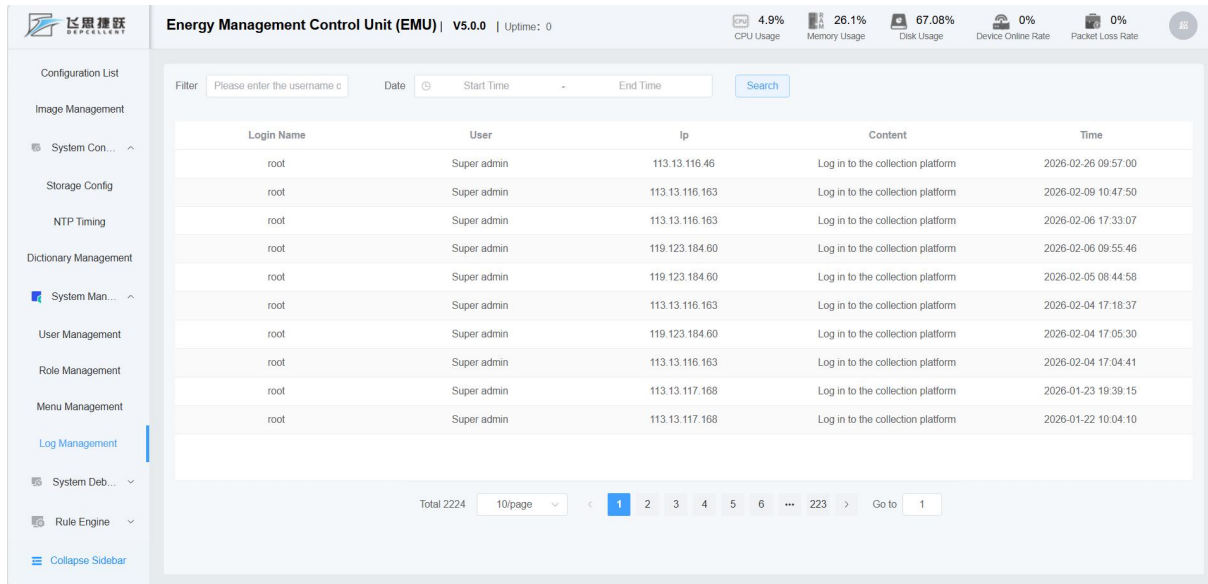


Figure 4- 22 Menu Management

3.3.10.4. Log Management

Log management records important information such as the IP address and time of user login to the platform, tracks and audits user operation behaviors, and ensures the security and compliance of the platform. As shown in Figure 4-23:



Login Name	User	Ip	Content	Time
root	Super admin	113.13.116.46	Log in to the collection platform	2026-02-26 09:57:00
root	Super admin	113.13.116.163	Log in to the collection platform	2026-02-09 10:47:50
root	Super admin	113.13.116.163	Log in to the collection platform	2026-02-06 17:33:07
root	Super admin	119.123.184.60	Log in to the collection platform	2026-02-06 09:55:46
root	Super admin	119.123.184.60	Log in to the collection platform	2026-02-05 08:44:58
root	Super admin	113.13.116.163	Log in to the collection platform	2026-02-04 17:18:37
root	Super admin	119.123.184.60	Log in to the collection platform	2026-02-04 17:05:30
root	Super admin	113.13.116.163	Log in to the collection platform	2026-02-04 17:04:41
root	Super admin	113.13.117.168	Log in to the collection platform	2026-01-23 19:39:15
root	Super admin	113.13.117.168	Log in to the collection platform	2026-01-22 10:04:10

Figure 4- 23 Log Management

3.3.11. System Debugging

3.3.11.1. Channel Debugging

By opening serial port, CAN port, TCP client and other methods, the debugging channel is ensured to be smooth, and the accuracy of the data sent by the message is verified. As shown in Figure 4-24:

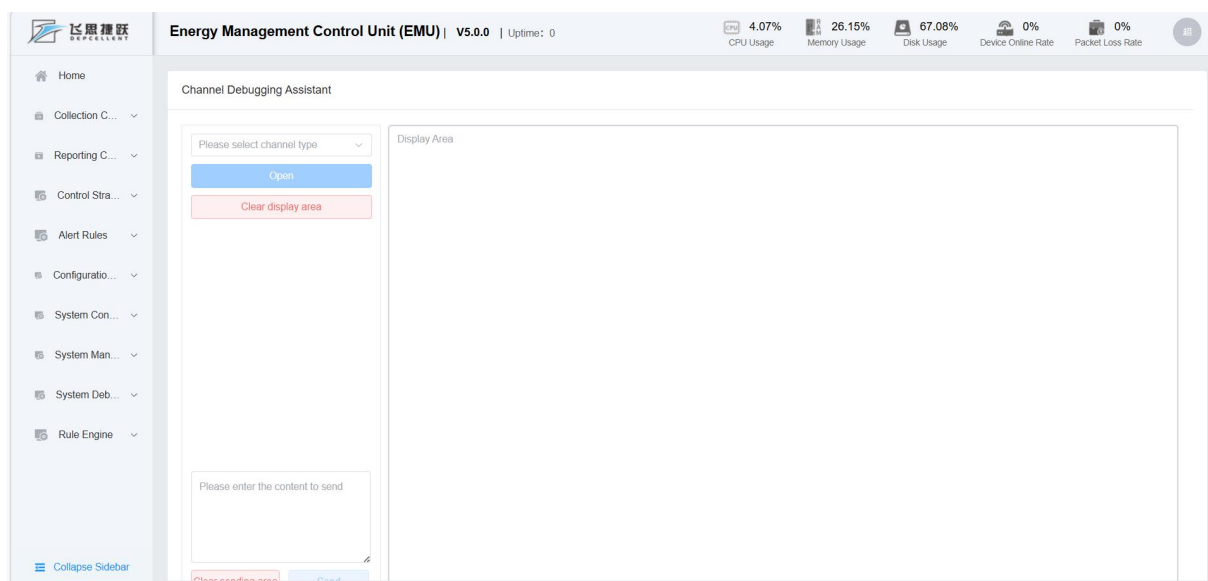


Figure 4- 24 Channel Debugging

3.3.11.2. System Logs

View and analyze the log information generated during the operation of the system to understand the running status of the system and troubleshoot errors. As shown in Figure 4-25:

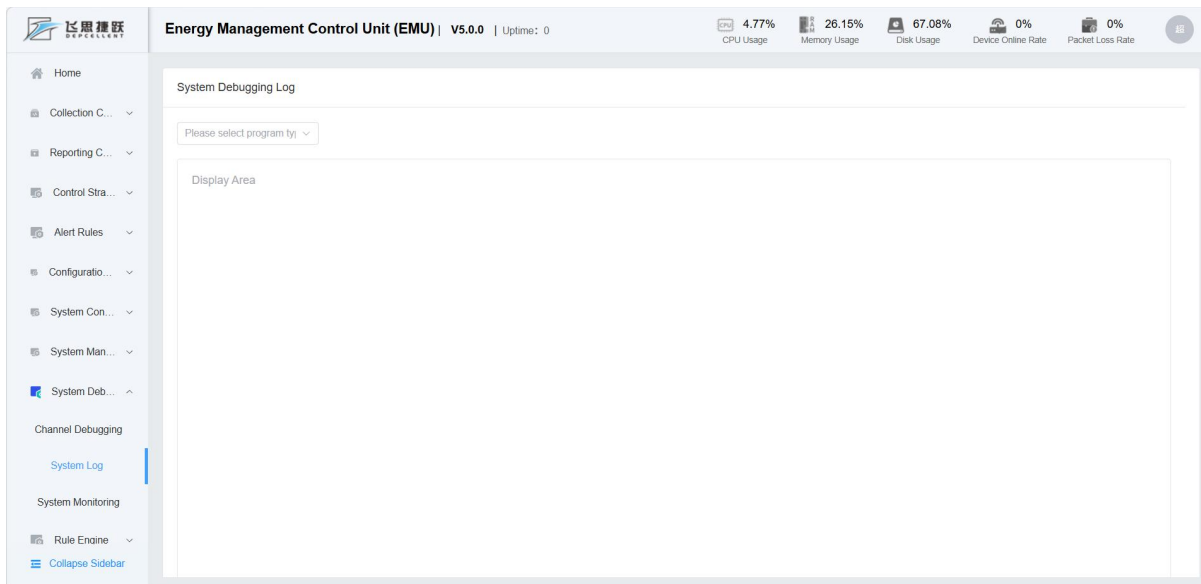


Figure 4- 25 System Logs

3.3.11.3. System Monitoring

System monitoring is used to monitor the performance indicators of the system in real time to ensure the stability and reliability of the system. As shown in Figure 4-26:

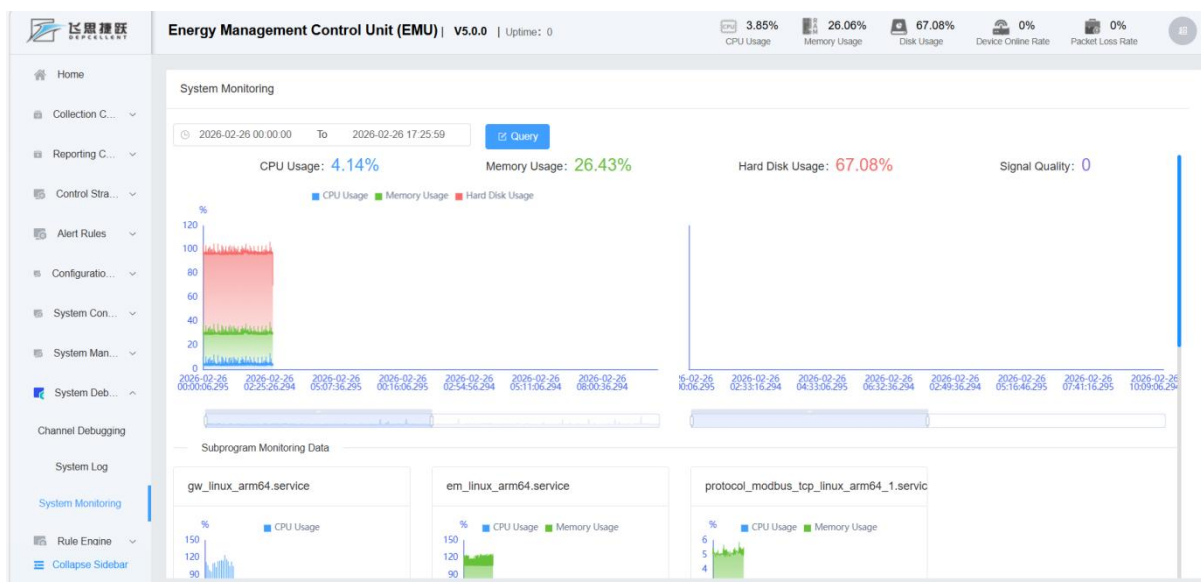
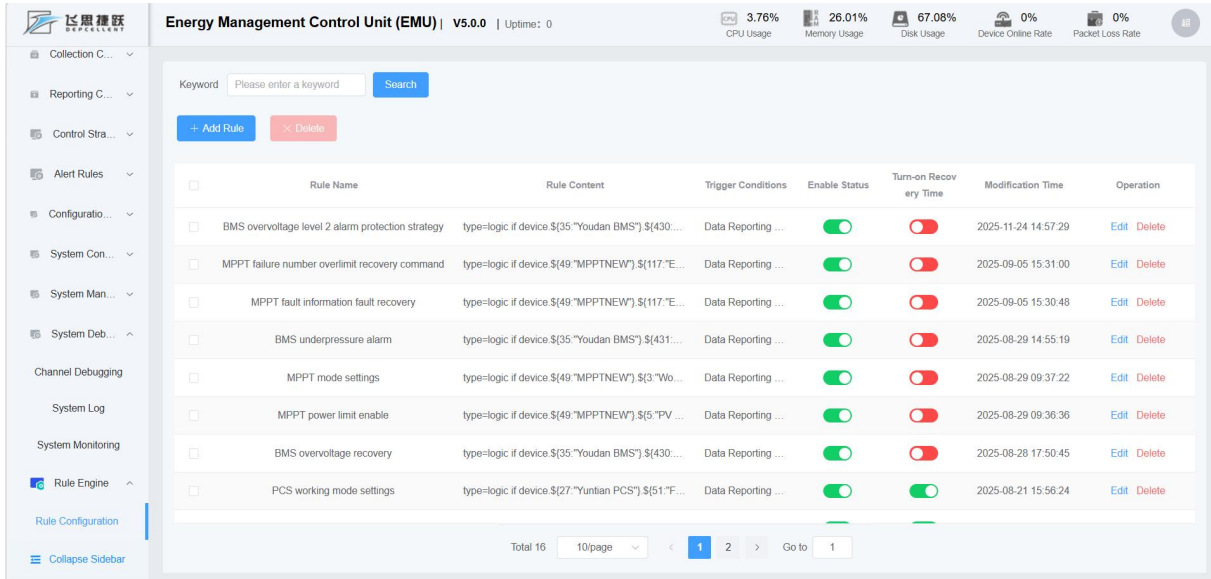


Figure 4- 26 System Monitoring

3.3.12. Rule Engine

3.3.12.1. Rule Configuration

Rules are configured to manage and configure rules. Users can create new rules, set the trigger conditions and actions of the rules, and view, edit, and delete configured rules. As shown in Figure 4-27:



Rule Name	Rule Content	Trigger Conditions	Enable Status	Turn-on Recovery Time	Modification Time	Operation
BMS overvoltage level 2 alarm protection strategy	type=logic if device \${35:"Youdan BMS"} \${430:...	Data Reporting ...	☒	☐	2025-11-24 14:57:29	Edit Delete
MPPT failure number overlimit recovery command	type=logic if device \${49:"MPPTNEW"} \${117:"E...	Data Reporting ...	☒	☐	2025-09-05 15:31:00	Edit Delete
MPPT fault information fault recovery	type=logic if device \${49:"MPPTNEW"} \${117:"E...	Data Reporting ...	☒	☐	2025-09-05 15:30:48	Edit Delete
BMS underpressure alarm	type=logic if device \${35:"Youdan BMS"} \${431:...	Data Reporting ...	☒	☐	2025-08-29 14:55:19	Edit Delete
MPPT mode settings	type=logic if device \${49:"MPPTNEW"} \${3:"Wo...	Data Reporting ...	☒	☐	2025-08-29 09:37:22	Edit Delete
MPPT power limit enable	type=logic if device \${49:"MPPTNEW"} \${5:"PV ...	Data Reporting ...	☒	☐	2025-08-29 09:36:36	Edit Delete
BMS overvoltage recovery	type=logic if device \${35:"Youdan BMS"} \${430:...	Data Reporting ...	☒	☐	2025-08-28 17:50:45	Edit Delete
PCS working mode settings	type=logic if device \${27:"Yuntian PCS"} \${51:"F...	Data Reporting ...	☒	☒	2025-08-21 15:56:24	Edit Delete

Figure 4- 27 Rule Configuration

3.3.13. Fault Waveform Recording

3.3.13.1. Waveform Recording Configuration

Add a fault waveform recording configuration to define the recording strategy. You can specify the basic strategy information, configure multi-condition combined trigger rules, define the pre-trigger/post-trigger durations and sampling rate, select the recording points, and enable high-speed acquisition and debounce functions. The strategy takes effect after it is saved, as shown in Figure 4-28: Add Fault Waveform Recording Strategy.

Add Strategy
 ×

Basic Information

* Strategy Name

Strategy Description

Enabled
 ☒

Execution strategy
 Trigger when conditions are met

Trigger condition

Conditions
 Conditions
All
Condition triggered

Type
 Device Point
Select device
Select measurement point
==
×

0

New condition

Waveform parameters

Waveform parameters
 Pre-recording

Post-recording

Sampling rate (Hz)

Recording points

Recording points
 Select device
Select or enter measurement point
×

New location
 Bulk import
 Clear/Empty
 1 / 50

High-speed acquisition

High-speed acquisition
 ☐

The acquisition speed only applies to active acquisition; passive acquisition is determined by the frequency of data pushed from the other end. High-speed acquisition does not interfere with existing acquisition. Due to differences in device protocols and characteristics, a device may not be able to perform both existing and high-speed acquisition simultaneously. In such cases, both will acquire data sequentially according to the queue order.

Anti-vibration

Anti-vibration
 ☐
 Prevent accidental events and frequent data fluctuations from occurring.

Save

Return

Figure 4-28 Add Fault Waveform Recording Strategy

The Edit Strategy page is used to modify an existing waveform recording strategy. Users can adjust the basic strategy information, trigger conditions, recording parameters, and recording points, as well as configure high-speed acquisition and debounce functions. After the changes are saved, the strategy is updated accordingly, as shown in Figure 4-29: Edit Waveform Recording Strategy.

Edit Strategy
×

Basic Information

Strategy Name

Strategy Description

Enabled ☒

Execution strategy Trigger when conditions are met

Trigger Condition

Conditions
Conditions
All
Condition triggered

Type
Device status

whhztBMS

Online

×

New condition

Waveform Parameters

Waveform parameters
Pre-recording (s)

10

Post-recording (s)

5

Sampling rate (Hz)

1

Recording Points

Recording points

Active Power (kW), Positive = Discharge

×

New location

Bulk import

Clear/Empty / 50 items

High-speed Acquisition

High-speed acquisition

D

Acquisition speed applies only to active acquisition; passive acquisition is determined by the frequency of data pushed from the other end.
High-speed acquisition does not affect existing acquisition. Due to differences in device protocols and characteristics, a device may not support both existing and high-speed acquisition simultaneously. In such cases, both acquire data sequentially according to the queue order.

Acquisition speed (ms)

1000

Acquisition duration (s)

10

whhzt Fire Protection

3

×

Sync recording points

New location

Clear/Empty / 50 items

Anti-vibration

Anti-vibration

D

Prevent accidental event triggers and frequent data fluctuation triggers.

Save

Return

Figure 4-29 Edit Waveform Recording Strategy

3.3.13.2. Record History

The Waveform Recording Historypage is used to view trigger and execution records for waveform recording strategies. Records can be filtered by rule, mode, status, and time. Users can view the details and file list for each record, and delete records individually or in batches,

as shown in Figure 4-30: Waveform Recording History.

Trigger rule	Select rule	Mode	Select	Status	Select	Time	Start time	To	End time	Search	Reset	Refresh	Batch
☐	All ID	Trigger rule	Mode	Status	Check	Trigger time	Actions						
		Device offline environment test	Trigger alarm	Success	Normal								
		Device offline environment test	Trigger alarm	Success	Normal								
		Device offline environment test	Trigger alarm	Success	Normal								
		Device offline environment test	Trigger alarm	Success	Normal								
		Device offline environment test	Trigger alarm	Success	Normal								
		Device offline environment test	Trigger alarm	Success	Normal								
		Device offline environment test	Trigger alarm	Success	Normal								
		Device offline environment test	Trigger alarm	Success	Normal								
		Device offline environment test	Trigger alarm	Success	Normal								
2765 items 10 / page < 1 2 3 4 5 6 ... 277 Go to 1 page													

Figure 4-30 Waveform Recording History

3.3.13.3. Storage Configuration

The Waveform Recording Storage Configuration page is used to globally configure the storage path, file format, disk thresholds, retention policy, and file-splitting policy for waveform recording files. Users can configure the storage root directory, file format, maximum disk usage, and minimum remaining disk space; set the waveform recording retention period; and define the maximum size and duration of each file segment. When a threshold is reached, the file is split automatically. The configuration takes effect after clicking Save, as shown in Figure 4-31: Storage Configuration.

Waveform Storage Configuration

(Configure waveform file storage directory, threshold and retention strategy (global config).)

Basic Configuration

Storage settings, file format and disk usage threshold

* Storage directory

/root/ems/data/waveform

* Waveform file format

csv

* Disk usage upper limit (%)

90

* Minimum free space (MB)

1024

Retention Strategy

Controls how long historical data is retained

Mode

By time

Retention days

30

File Splitting Strategy

Automatically split waveform files by time

Max size per segment (MB)

10

Max duration per segment (ms)

60000

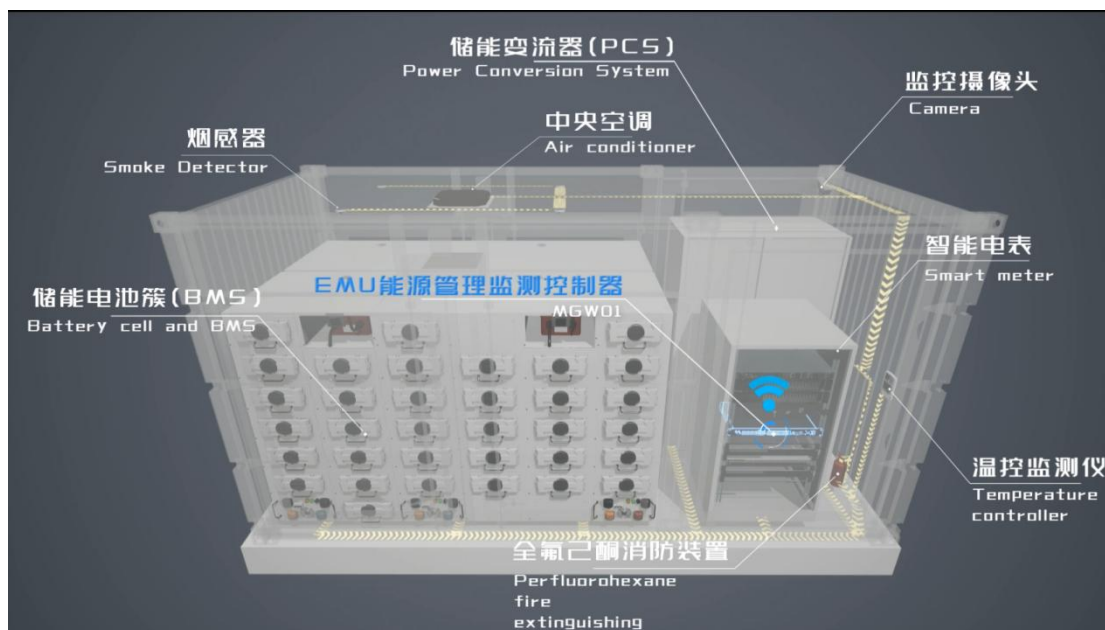
Note: 0 means unlimited; splitting starts when either configured limit is reached.

Refresh Save

Figure 4-31: Storage Configuration

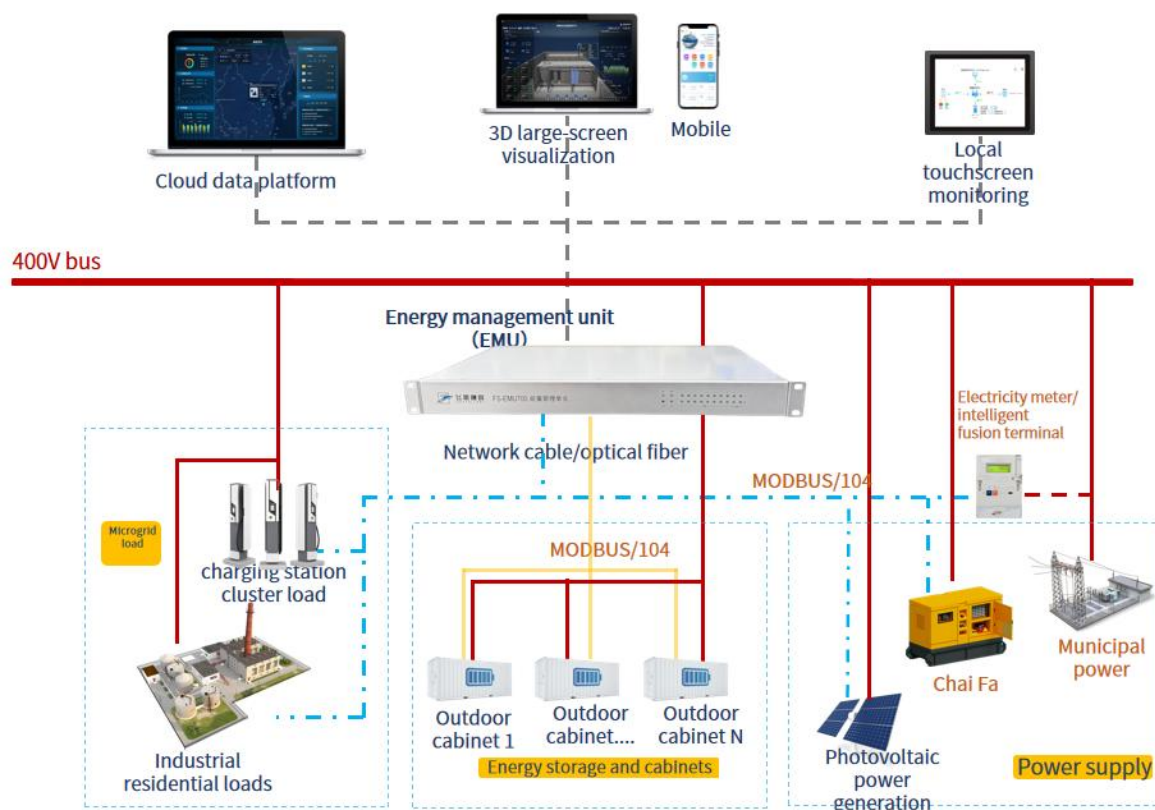
4. EMU Hardware Requirements

The EMU Energy Management, Monitoring, and Control Unit is an innovative solution with significant advantages, specifically designed for energy storage and microgrid applications. Compared with multiple separate devices such as traditional 4G routers, 5G routers, and PLC controllers, the EMU provides integrated management, simplifies the system architecture, and reduces the number of devices and maintenance costs. It also provides efficient energy management through real-time monitoring and intelligent control, optimizing energy storage and utilization. The controller enables precise control of energy storage equipment and provides flexible energy dispatch strategies to improve energy efficiency and enhance system stability and reliability. Whether used by industrial, commercial, or residential customers, the EMU Energy Management, Monitoring, and Control Unit provides a convenient and cost-effective solution for their energy needs, making it an ideal solution for energy storage system operation. The EMU uses a high-end quad-core ARM Cortex-A53 processor with an integrated GPU and NPU. It offers high efficiency, high performance, and low cost, and supports 4 GB of RAM and 32 GB of onboard storage. The gateway integrates Ethernet, 4G, 5G, Wi-Fi, RS-485, RS-232, HDMI, and DI/DO interfaces.



4.1. Product Features

The EMU provides comprehensive monitoring of equipment used in energy storage energy management applications. It collects the real-time operating status of PCS, BMS, and auxiliary control equipment in a timely manner, and supports I/O control outputs.



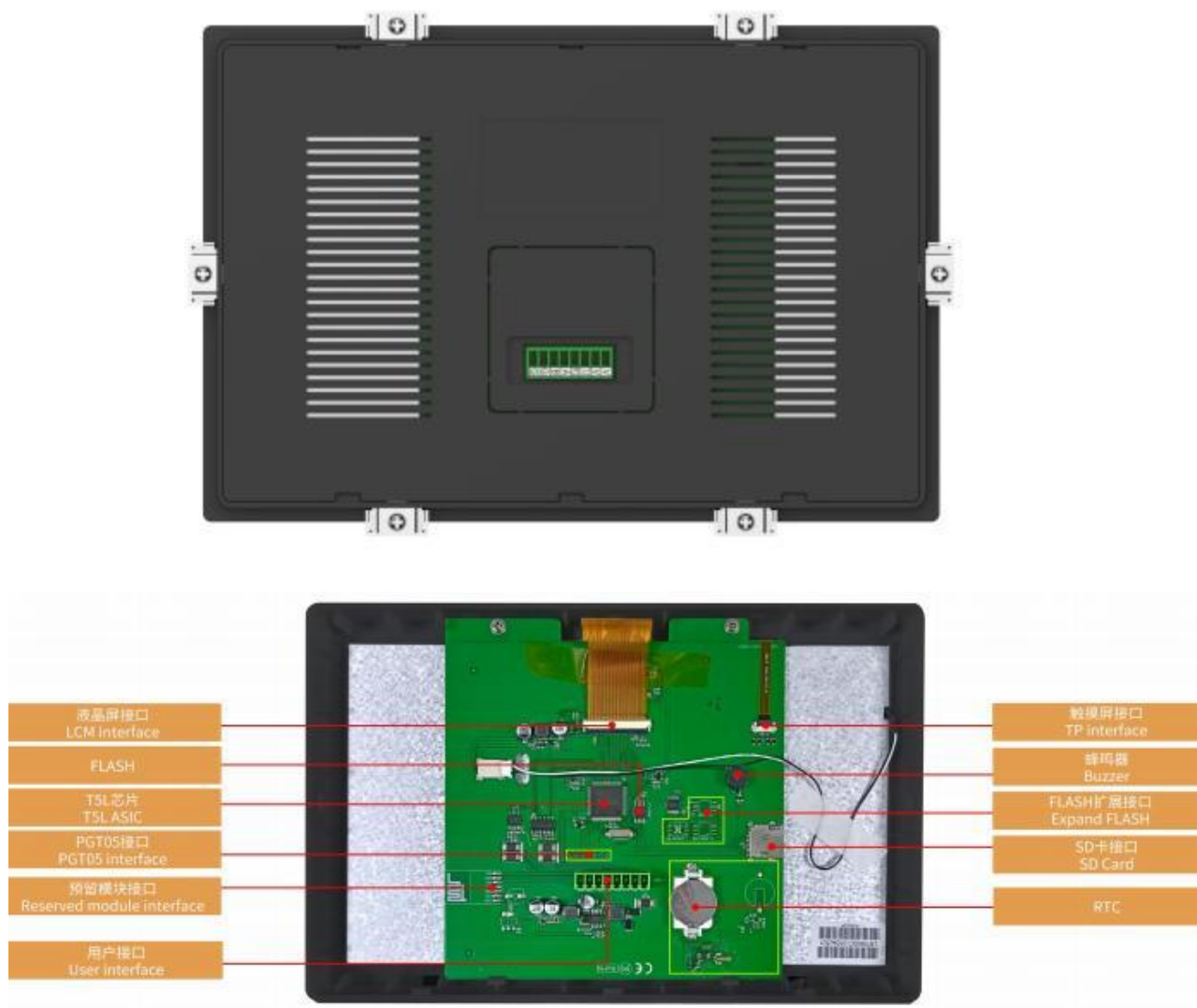
For commercial and industrial energy storage, as well as microgrid scenarios integrating photovoltaic power, energy storage, diesel generation, and EV charging.

4.2. Screen Optional

Product features:

- Based on T5L2 chip, running DGUS II system, commercial grade.
- 10.1 inches, 1024*600 resolution, 16.7M color, IPS screen, wide viewing angle.
- Resistive touch screen.
- With a case.

Screen interface diagram:



Hardware and interface description:

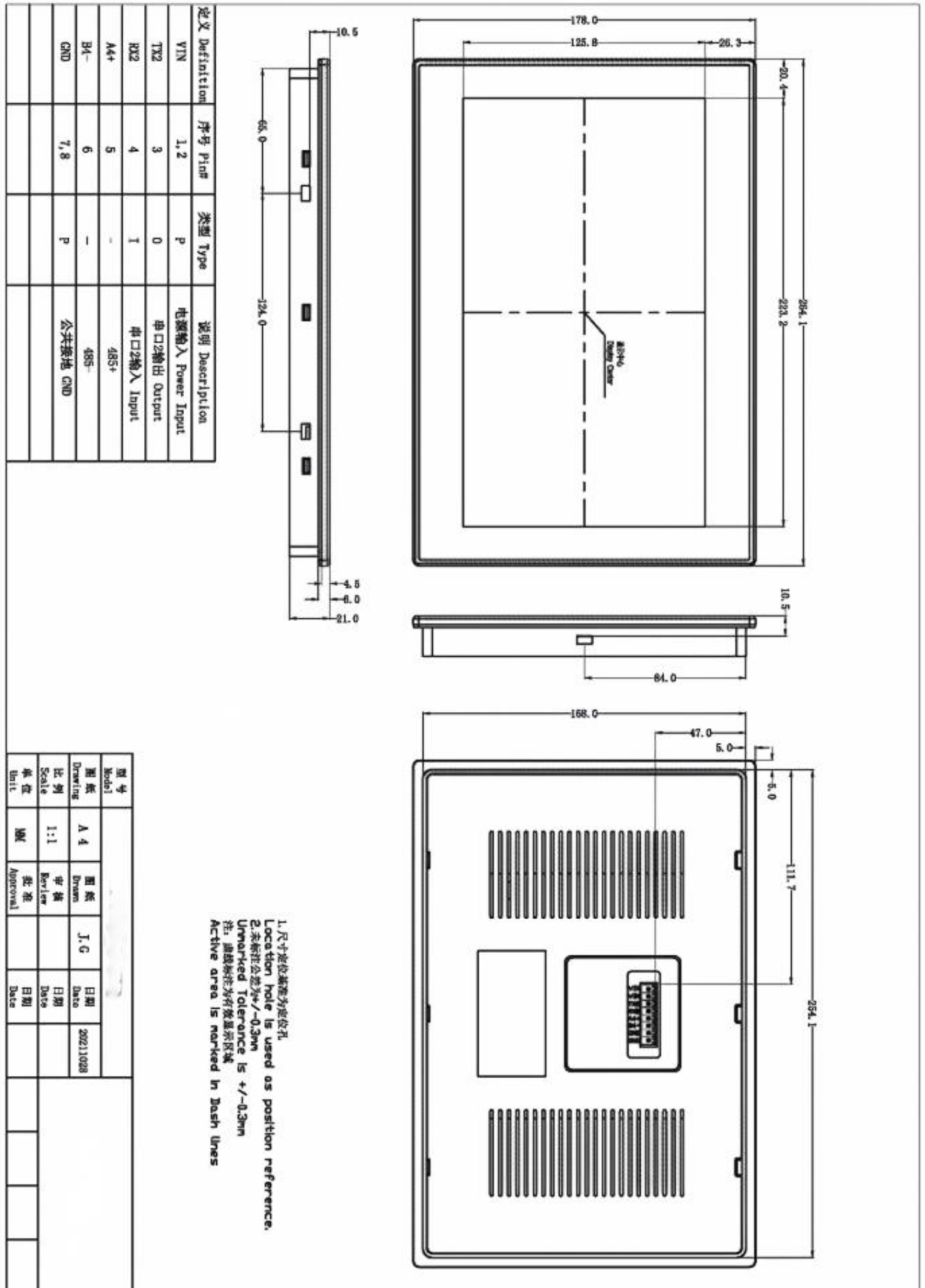
No.	Name	Description
1	T5L2 chip T5L2 ASIC	Mass product in 2019, 1MBytes on-chip Nor Flash , of which 512KBytes are used to store user databases,Erase times>100,000 times
2	LCM interface	FPC50_0.5mm, RGB interface

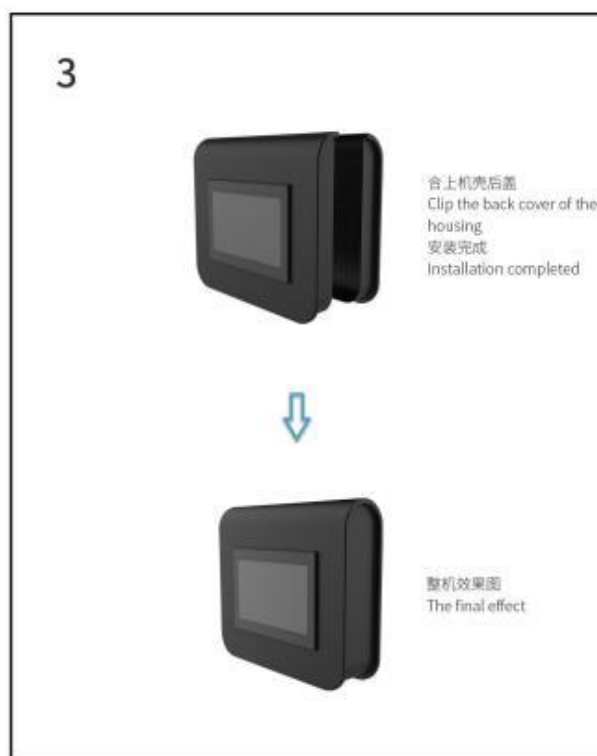
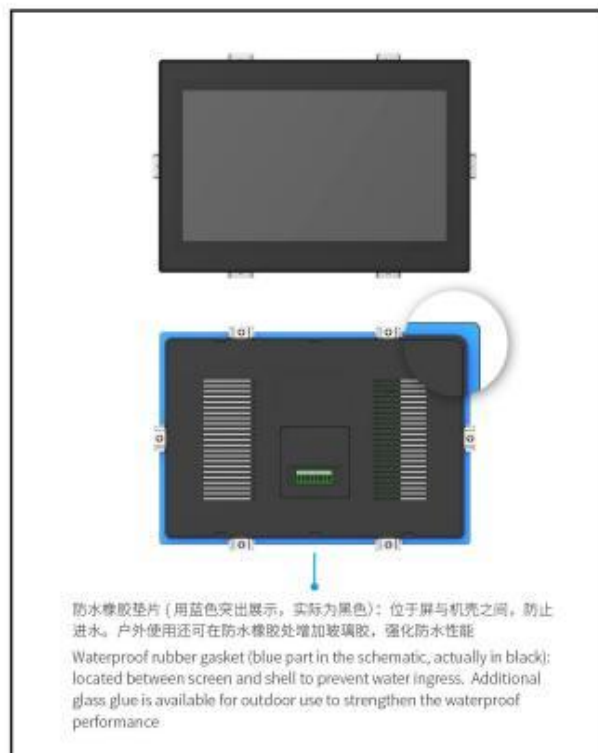
3	RTP interface	4Pin_1.0mm interface
4	User interface	12KByte/s 8Pin_3.81mm socket for power supply and serial communication. Download rate(typical value): 12KByte/s
5	Flash	16MBytes NOR Flash, for fonts, pictures and audio files. Rewrite cycle: over 100,000 times
6	Expand Flash interface	Expandable to 64Mbytes NOR Flash or 48Mbytes NOR Flash+512Mbytes NAND Flash
7	Buzzer	3V passive buzzer. Power: <1W
8	RTC	Button cell for power supply. Accuracy: $\pm 20\text{ppm}@25^{\circ}\text{C}$
9	SD interface	FAT32. Download files by SD interface can be displayed in statistics
10	Reserved module interface	Wi-Fi module: connect to the cloud platform to update remotely USB module: download files by USB flash disk
11	PGT05 interface	When product crashes by accident, you can use PGT05 to update DGUS kernel and make the product return to normal

Packaging and physical dimensions:

Form Factor	264.1mm (W)×178.0mm (H) ×21.0mm (T)			
Net Weight	660g			
Packaging Standards				
packaging box model	Dimensions	Layer	Quantity/Layer	Quantity(Pcs)

Carton1:	220mm(L)×160mm(W)×47mm (H)	-	-	-
Carton2:	250mm(L)×200mm(W)×80mm (H)	-	-	-
Carton3:	320mm(L)×270mm(W)×80mm (H)	-	-	-
Carton4:	435mm(L)×335mm(W)×290mm(H)	-	-	-
Carton5:	600mm(L)×430mm(W)×290mm(H)	1	10	10





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Shenzhen Feisi Jieyue Technology Co., Ltd.

<https://www.feisjy.com>

Email: support@feisjy.com