C&I Energy storage EMU100

Detailed Introduction

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CATALOG

C&I Energy storage EMU100

Detailed Introduction

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 Principles of Energy Storage System Operation

The control objectives are to maximize the peak shaving and valley filling benefits, not

to feed back to the grid, and not to overload the transformer during charging.

During off-peak hours at night and daytime low-load periods, the Energy Management System (EMS) controls the Power Conversion System (PCS) to charge energy storage based on battery State of Charge (SOC), while discharging during peak electricity hours.

(1) When the load power is less than or equal to the maximum discharge power of the energy storage system, the EMS controls the discharge power of the energy storage PCS to be ≤ the load power.

(2) When the load power exceeds the maximum discharge capacity of the energy storage system, the EMS controls the PCS to discharge at its maximum capacity.

(3) During load mutation, the EMS system monitors the load power in real time and controls the charging/discharging power of the energy storage PCS, ensuring that the discharged energy from the storage does not feed back into the grid.

Specific application scenarios include the following:

1) Peak shaving and valley filling strategy: control the battery discharge during the peak load phase (electricity price peak) to control the load at a reasonable level. When the load is low, choose the appropriate time period (electricity price valley section) to charge in the appropriate way.

2) Demand control strategy: systematic monitoring of grid-connected points to absorb grid electricity; When the grid-connected point absorbs the power consumption of the grid, it increases; exceeding a certain threshold; The energy storage system automatically increases the output; Ensure that the total power of the grid-connected point is less than the set threshold.

3) Anti-countercurrent control strategy: system monitoring of grid-connected points absorbing electricity consumption from the grid; When the grid-connected point absorbs less electricity from the grid; The energy storage system automatically reduces the output; Ensure that the energy storage system does not send power backwards to the grid; When the system has a reverse power transmission phenomenon; The system should immediately control the corresponding relay at the grid-connected point to trip.

1.3. Data acquisition, display and storage

(1) The system provides real-time monitoring of operational status and fault alerts across all devices, including: PCS (Power Control System) data (power, voltage, current, etc.) and status; BMS (Battery Management System) data (cell voltage, temperature, SOC, etc.) and status; energy meter data (forward/reverse active power, reactive power, power factor, voltage, current, etc.); and status information for system access control, water intrusion detection, switches, air conditioning, and fire safety systems (transmitted via BMS or directly connected through dry contacts).

(2) The query displays the operation records of each device, showing the operation data curves and working status curves of the devices in the database.

(3) The statistics of charging and discharging quantity can be queried by year, month and day.

(4) Store for ⩾90 days, including fault status information, with data collection completed within 3 seconds per cycle.

1.4. System Architecture Design

Scenario architecture diagram:

Electricity/New Energy: This technology can be applied to power equipment monitoring, solar power generation systems, wind power generation systems, photovoltaic energy storage charging stations, and microgrid scenarios, enabling remote monitoring and control of energy equipment to enhance energy utilization efficiency.

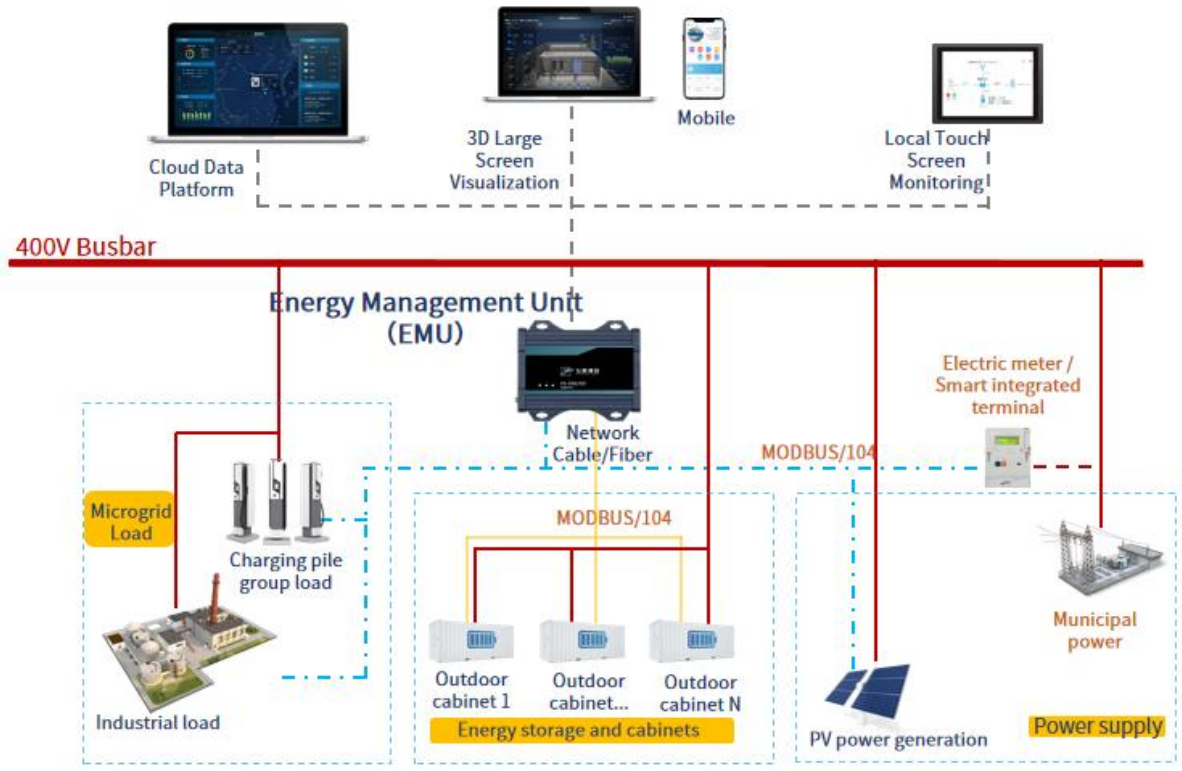


Figure 1-1 Architecture Diagram

System diagram:

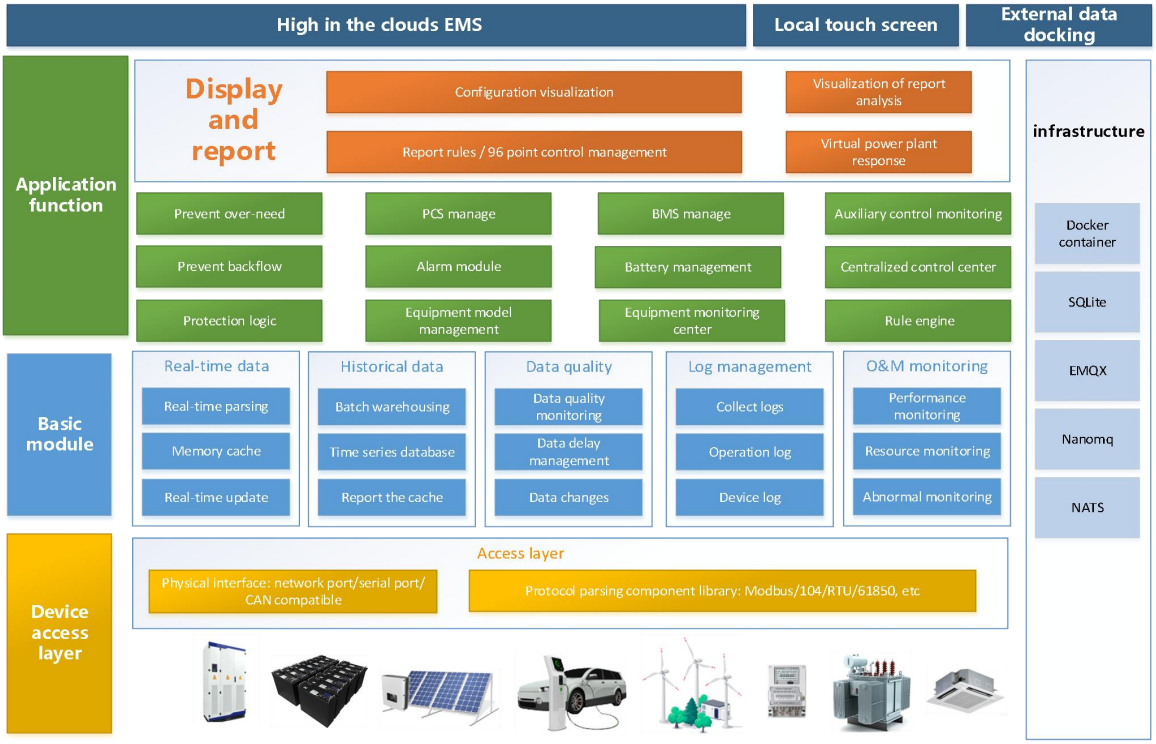
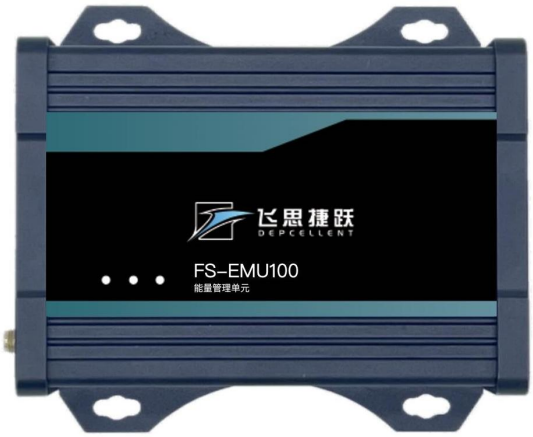


Figure 1-2 Functional Composition Diagram

2. Runtime Environment

2.1. Hardware Equipment

The device features an EMU configuration with 128/256MB DDR3 RAM and 8GB eMMC storage, powered by the RV1106 chipset.



2.2. Environmental Requirements

- Altitude: <4000m.
- Maximum ambient temperature (indoor or outdoor): 55°C;

- Minimum temperature: -25℃; Maximum daily temperature difference: 25℃;
- Maximum relative humidity: daily average: 95%; monthly average: 90%;
- Operating temperature: -30℃ to +70℃;
- Seismic resistance: Seismic fortification intensity: 9 (0.2g)

2.3. Installation methods

Wall-mounted installation in pre-assembled containers or outdoor cabinets.

2.4. Support software

Database: SQLite

Development languages: Vue-Javascript, GO

Middleware: EMQX, Nanomq

The Energy Management Unit (EMU) is an innovative technology with significant advantages, designed specifically for energy storage and microgrid scenarios. It is professionally designed to meet the energy management needs of these systems, integrating network ports, CAN, 485,232, and DI/DO interfaces. This setup fully supports data acquisition and control for BMS, PCS, diesel generators, and photovoltaic inverters. Additionally, the software integrates standard acquisition protocols and supports interfaces from major equipment manufacturers, making it widely applicable in industrial and commercial energy storage, household storage, and microgrid control scenarios.

2.5. Data Acquisition Function

2.5.1. Home Page

On the home page, a network architecture diagram is generated based on the configured collection settings, which can also be switched to a list view. In the list view, corresponding device information can be searched in the search bar as required. As shown in Figure 2.5.1-1 Network Architecture Diagram and Figure 2.5.1-2 Device List:

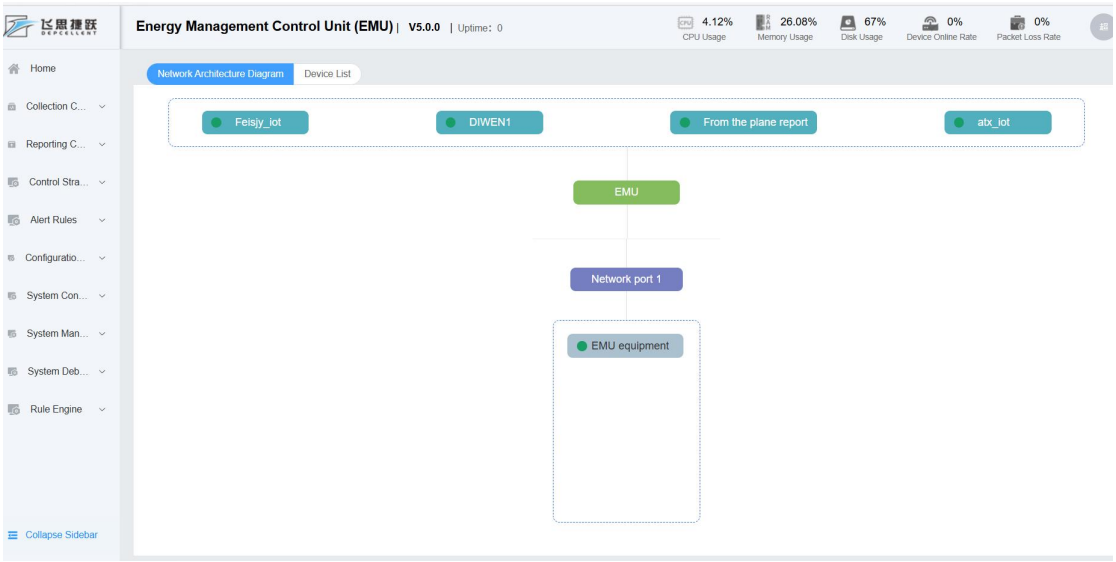


Figure 2.5.1-1 Network Architecture Diagram

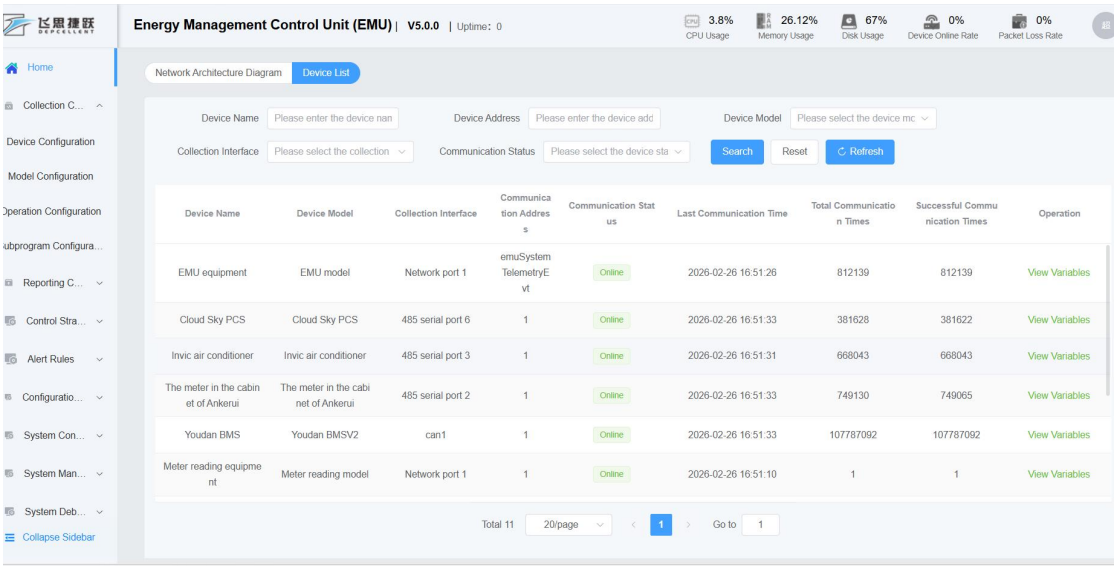


Figure 2.5.1-2 Device List

2.5.2. Southbound Configuration

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

2.5.2.1. 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.

2.5.2.2. All Device

This interface displays all configured devices, which are grouped by the serial ports they

are connected to, as shown in Figure 2.5.2-1 All Devices:

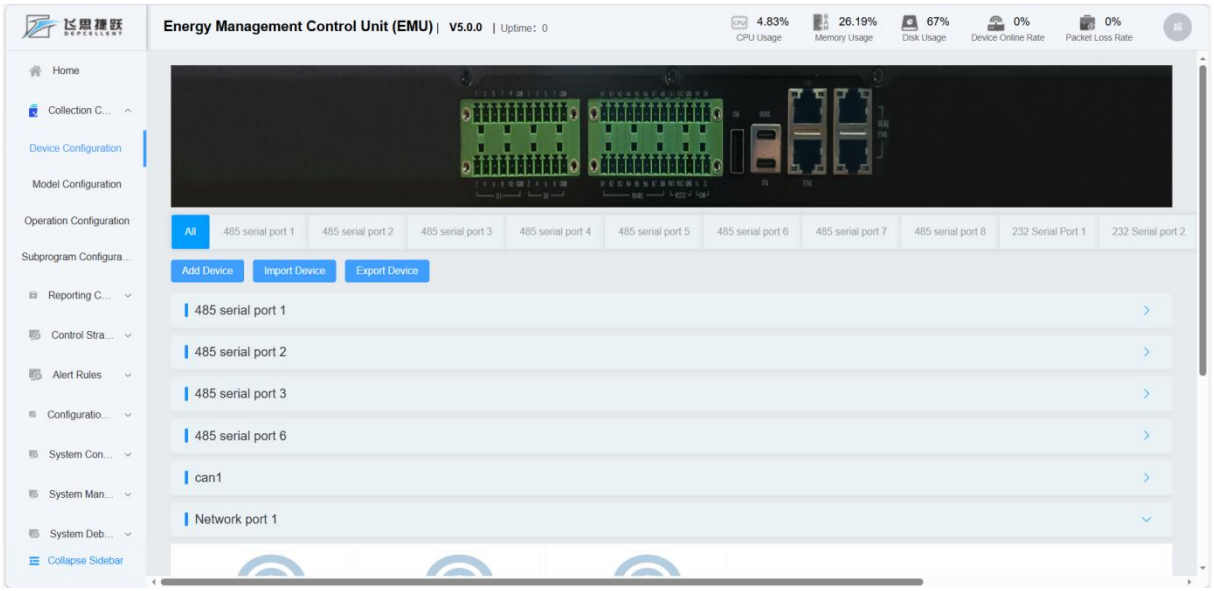


Figure 2.5.2-1 All Devices

2.5.2.2.1. Serial port device

Clicking on any serial port from ttyS0 to ttyS4 displays the connected device information. As shown in Figure 2.5.2-2 Serial Port Devices.

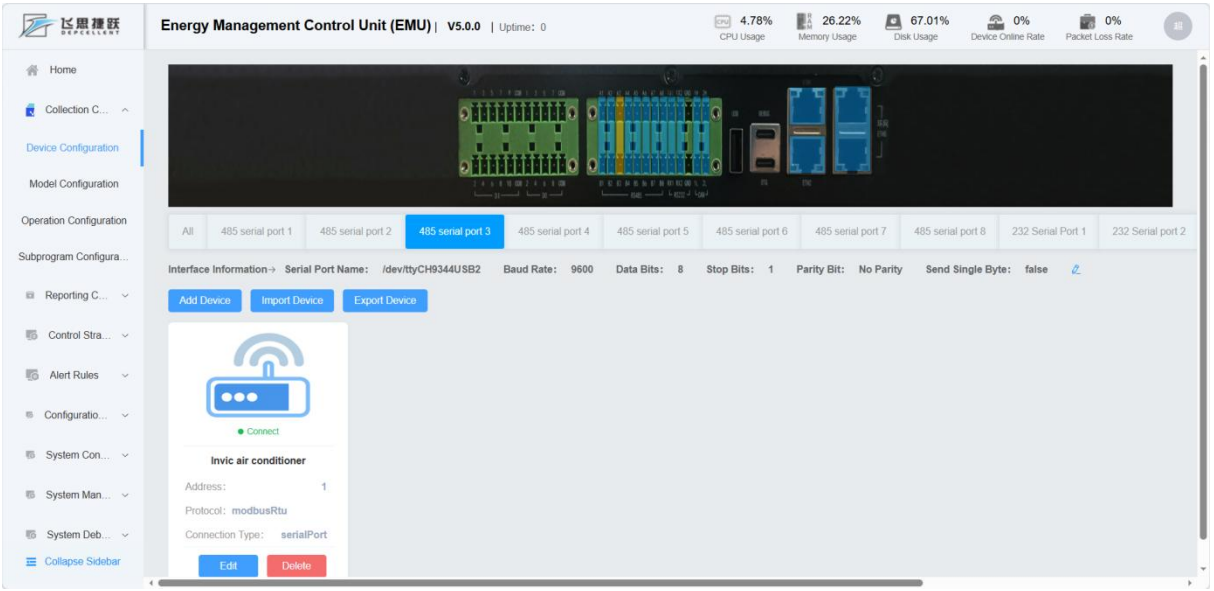


Figure 2.5.2-2 Serial Port Devices

2.5.2.2.2. Network port device

Clicking Network Port 1 and Network Port 2 will display the information of the devices connected to the corresponding network ports, as shown in Figure 2.5.2-3 Network Port Devices:

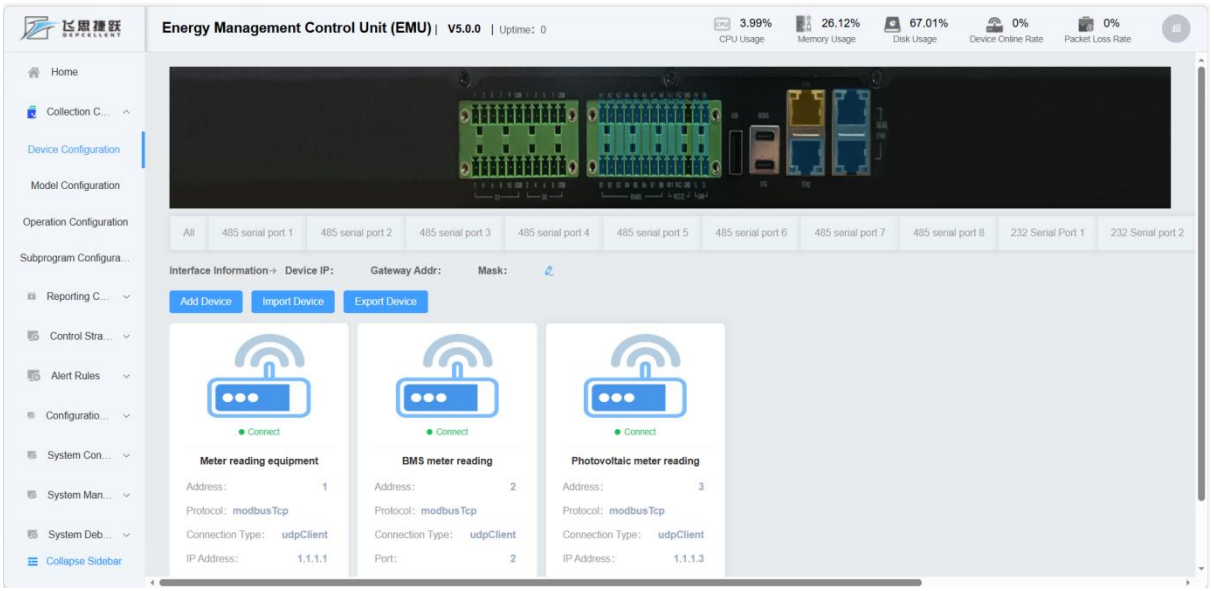


Figure 2.5.2-3 Network Port Device

2.5.3. Model Configuration

The model configuration module is designed to set up device point information, supporting standard, PLC, DL/T645-2007, and Modbus models. Users can configure data points by adding variable parameters through command information, as illustrated in Figure 2.5.3-1.

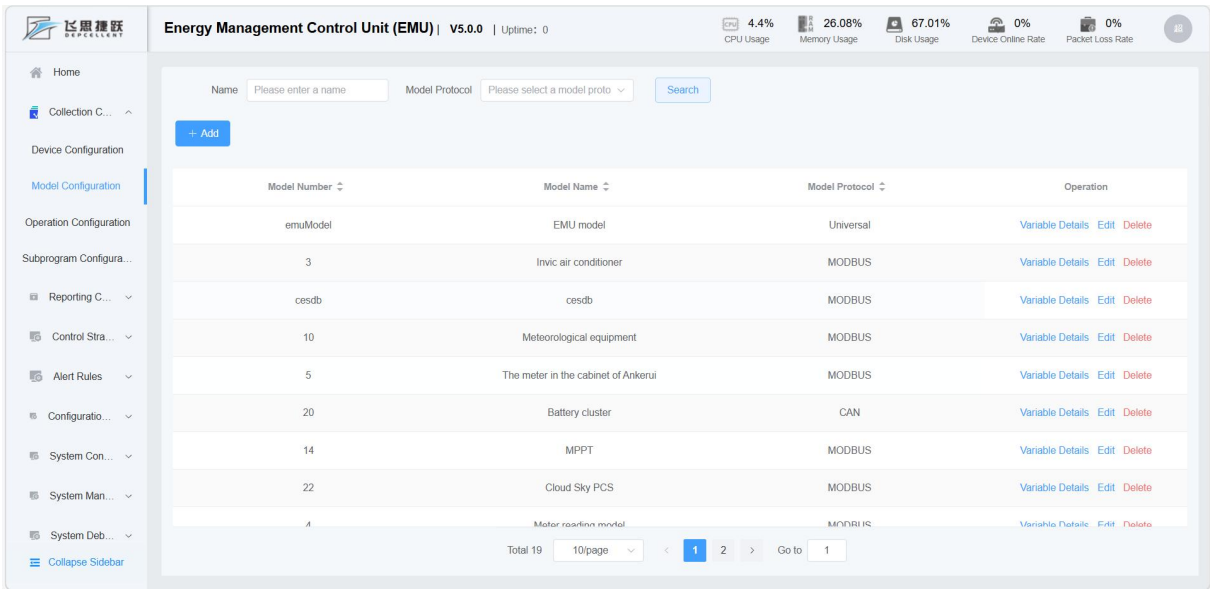


Figure 2.5.3-1 Model Configuration

2.5.3.1. Variable Details

In the model configuration interface, click the variable details button in the model list to access the corresponding model variable details interface, where you can configure the model

point data. See Figure 2.5.3-2 for variable details.

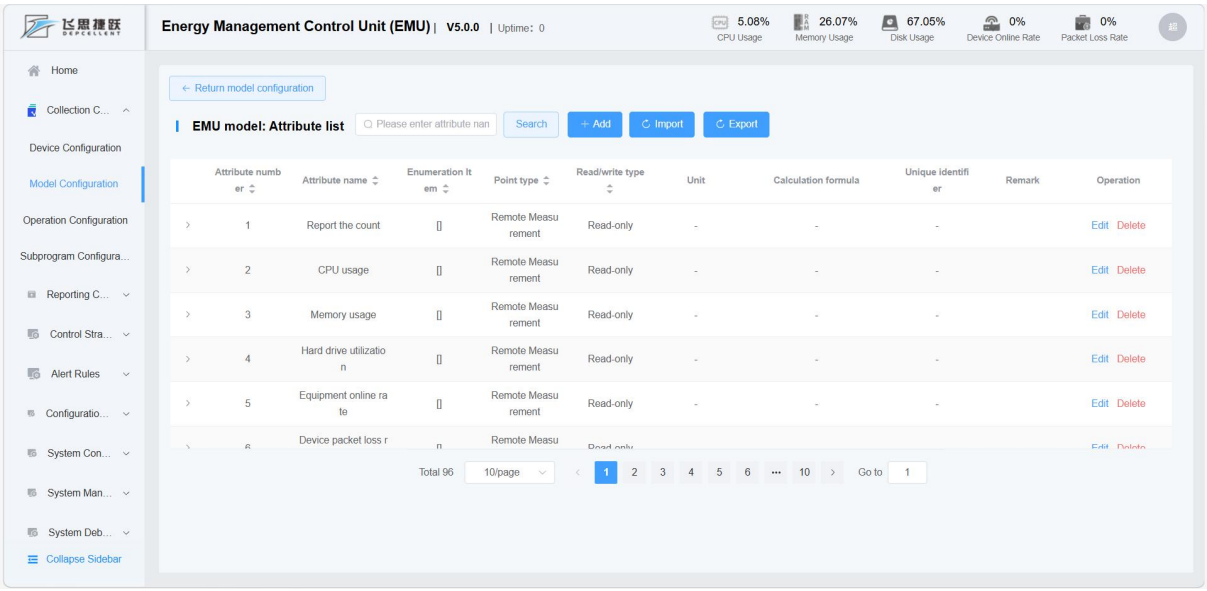


Figure 2.5.3-2Variable Details

2.5.4. Operation Configuration

Run configurations to set device collection rules, such as collection cycles and offline detection counts, then bind devices defined in the device configuration module. A single run configuration can bind multiple devices. As shown in Figure 2.5.4-1:

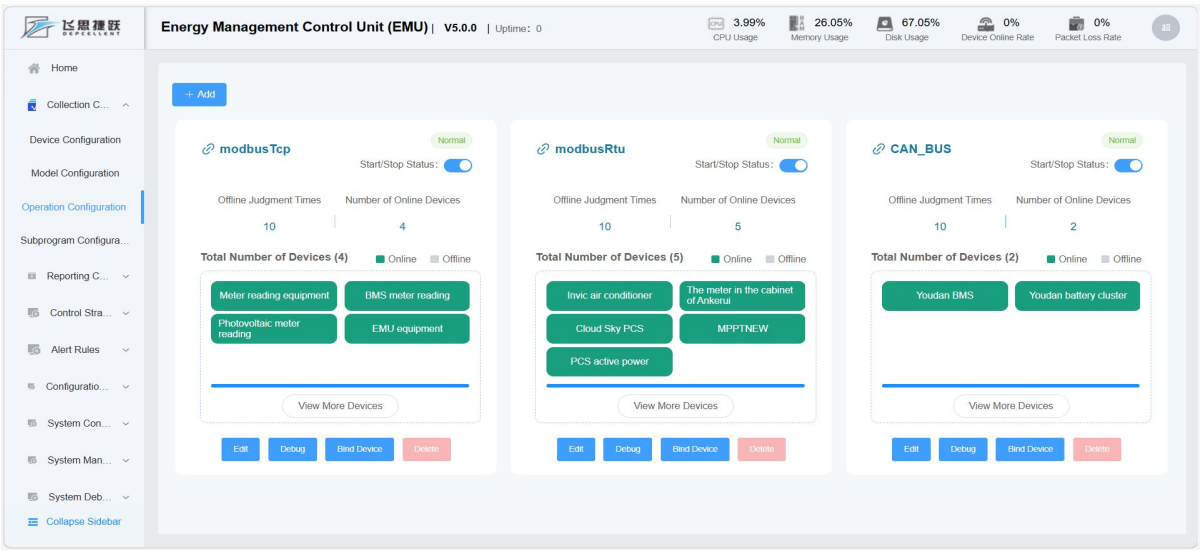


Figure 2.5.4-1 Operation Configuration

2.5.4.1. Debug

This interface enables debugging of devices bound to the current running configuration, including command issuance, manual data collection, stopping collection, and message debugging, as shown in Figure 2.5.4-2 Debugging.

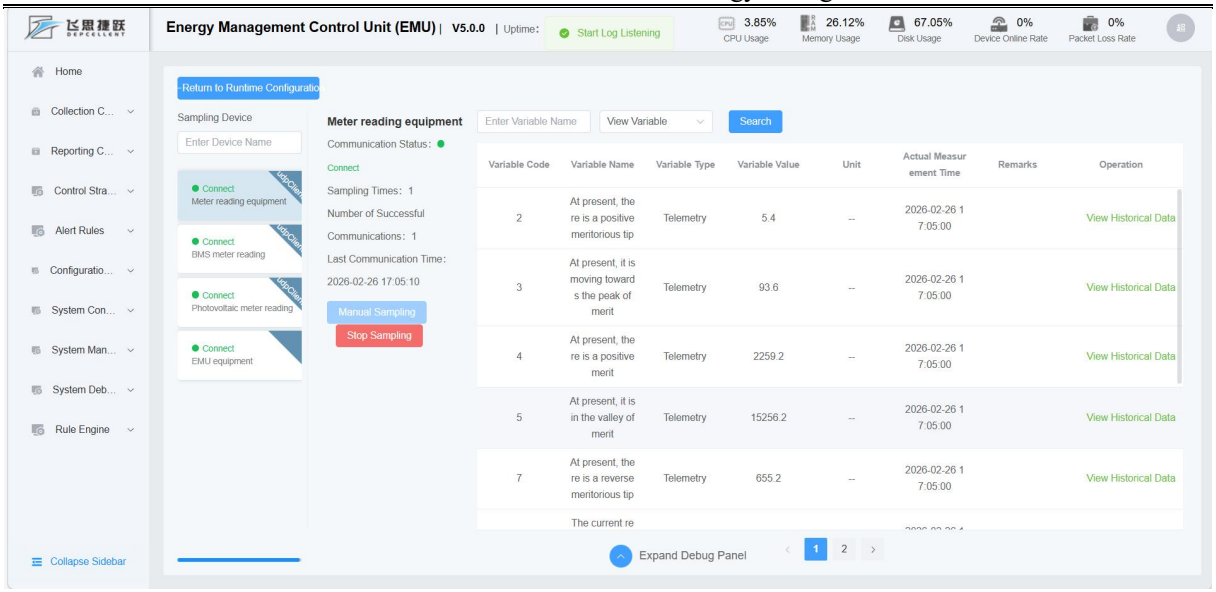


Figure 2.5.4-2 Debugging

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.

2.5.5. Subroutine Configuration

Manage and configure the subroutines running in the system. Users can view, add, edit, and delete subroutines, as well as configure their runtime parameters. See Figure 2.5.5-1 Subroutine Configuration for details.

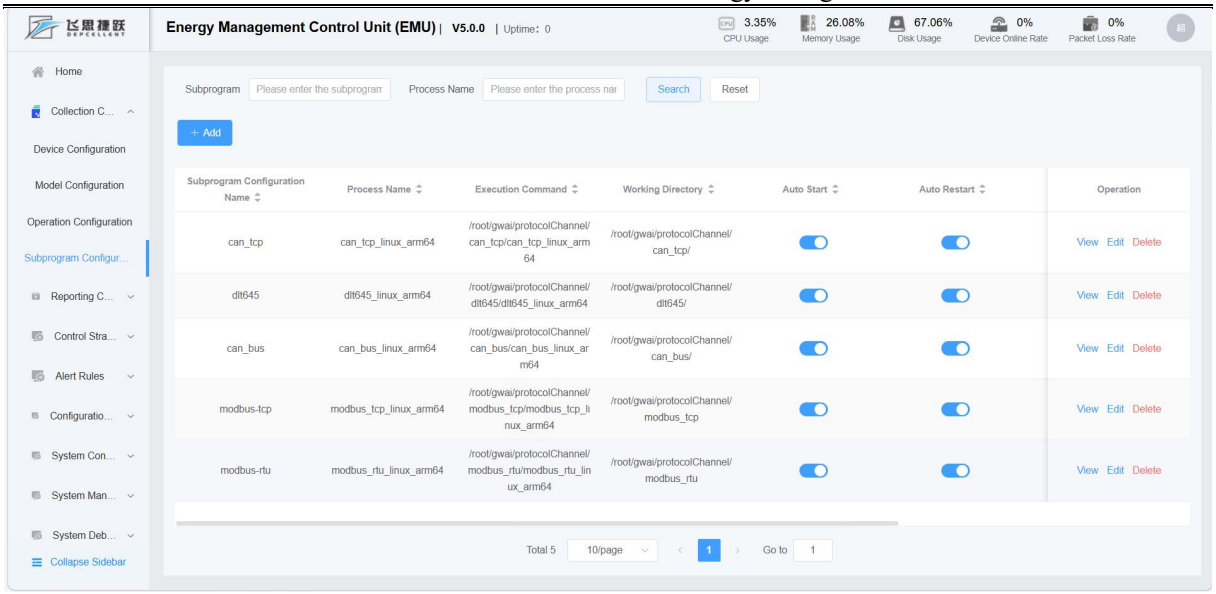


Figure 2.5.5-1 Subroutine Configuration

2.5.6. Northbound configuration

2.5.6.1. Reporting channel

Configure the reporting channel to submit collected data to the designated platform. As shown in Figure 2.5.6-1 :

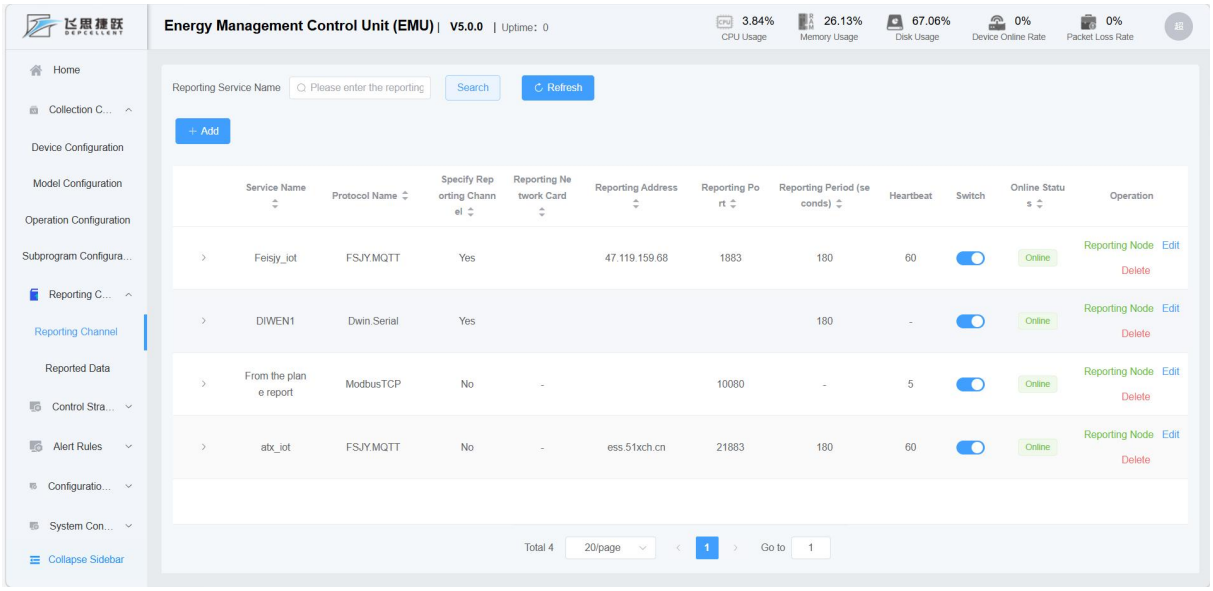


Figure 2.5.6-1 Reporting Channel

2.5.6.2. Report nodes

Report the device information corresponding to the channel, as shown in Figure 2.5.6-2 :

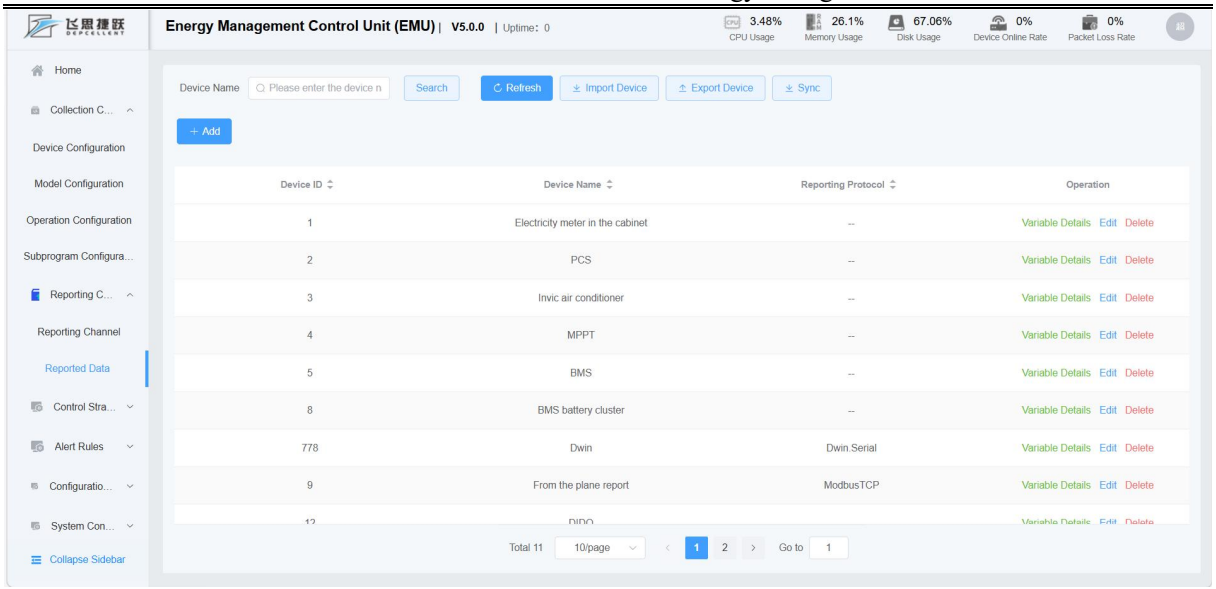


Figure 2.5.6-2 Reporting Node

2.5.7. Alarm rules

2.5.7.1. Alarm Configuration

By adding rule configurations to the device's point rules, the system checks whether collected point data meets the rules to generate an alarm record. As shown in Figure 2.5.7-1 Alarm Configuration:

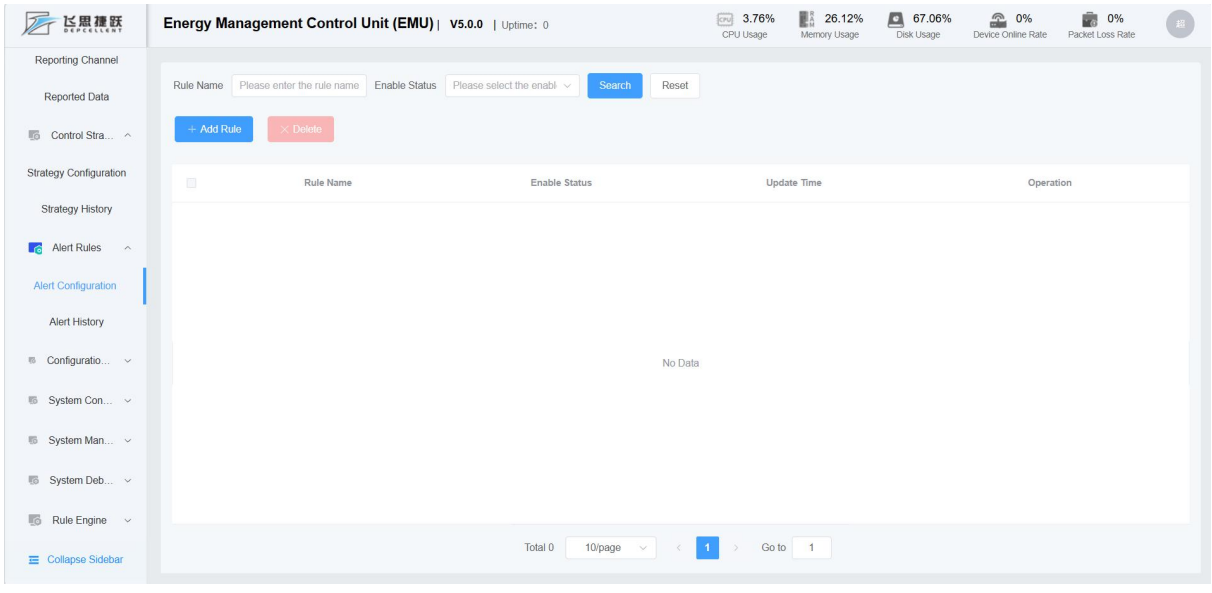


Figure 2.5.7-1 Alarm Configuration

2.5.7.2. Alarm History

After configuring the rules, the system records the generation time and other details of each rule execution. When a rule is triggered, you can manually process the alarm event. As shown in Figure 2.5.7-2 Alarm History:

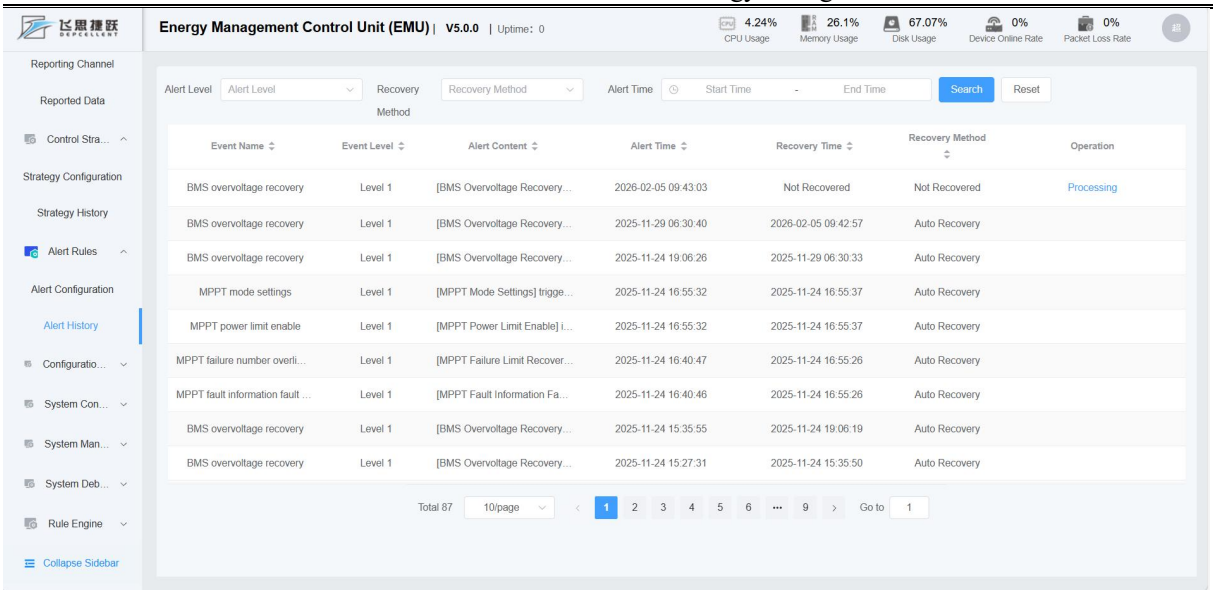


Figure 2.5.7-2 Alarm History

2.5.8. Configuration Management

2.5.8.1. Configuration List

The configuration list displays the power station overview, PCS, BMS, and other pages. Users can configure the required pages through this interface, allowing them to visually monitor the current operational status of the equipment. As shown in Figure 2.5.8-1 Configuration Management:

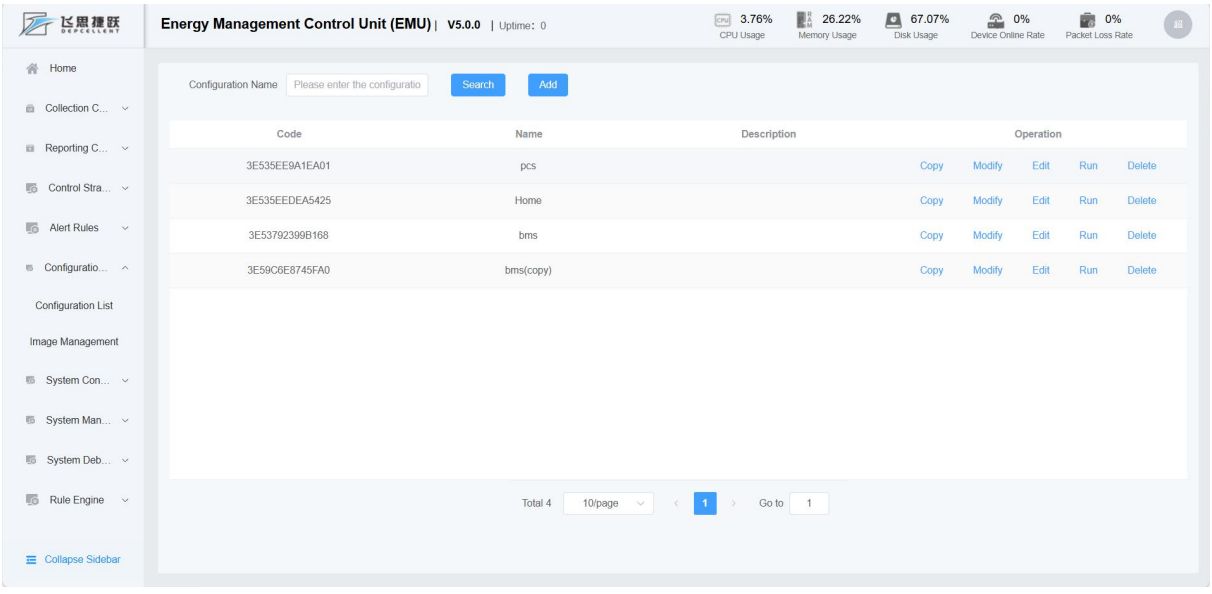


Figure 2.5.8-1 Configuration Management

2.5.8.2. Image Management

Image management is a feature for organizing configuration images, featuring a built-in collection of configuration images. It categorizes and organizes these images while providing an upload interface. See Figure 2.5.8-2 for details.

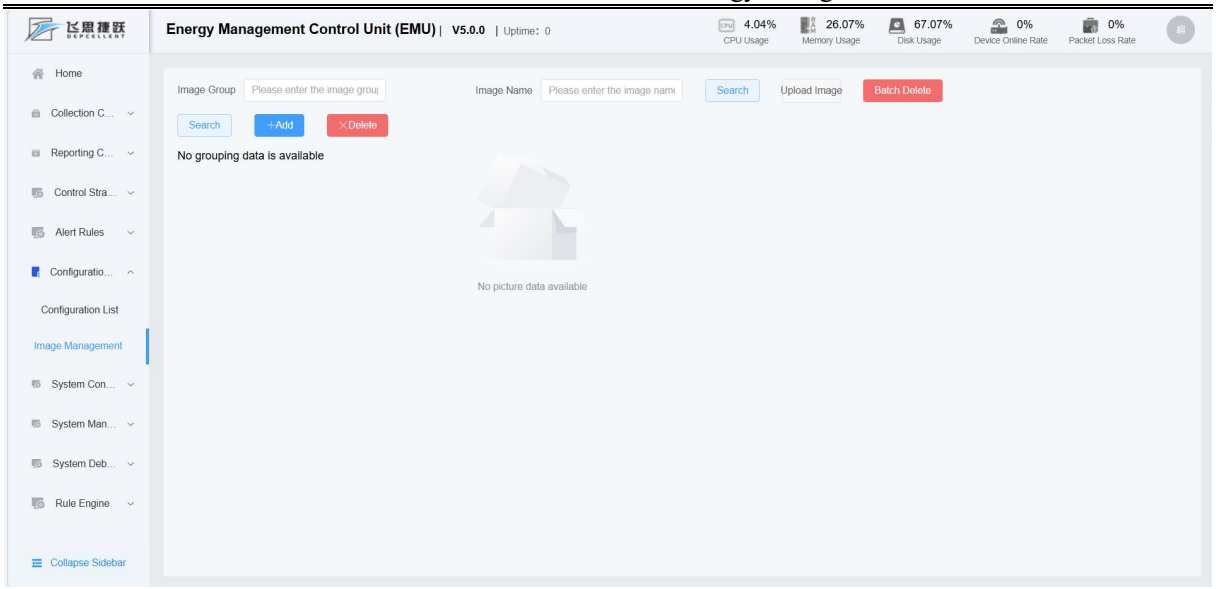


Figure 2.5.8-2 Image Management

2.5.9. System Configuration

2.5.9.1. Storage Settings

Configure data storage parameters in the system, including report data storage and historical storage. See Figure 2.5.9-1 Storage Settings:

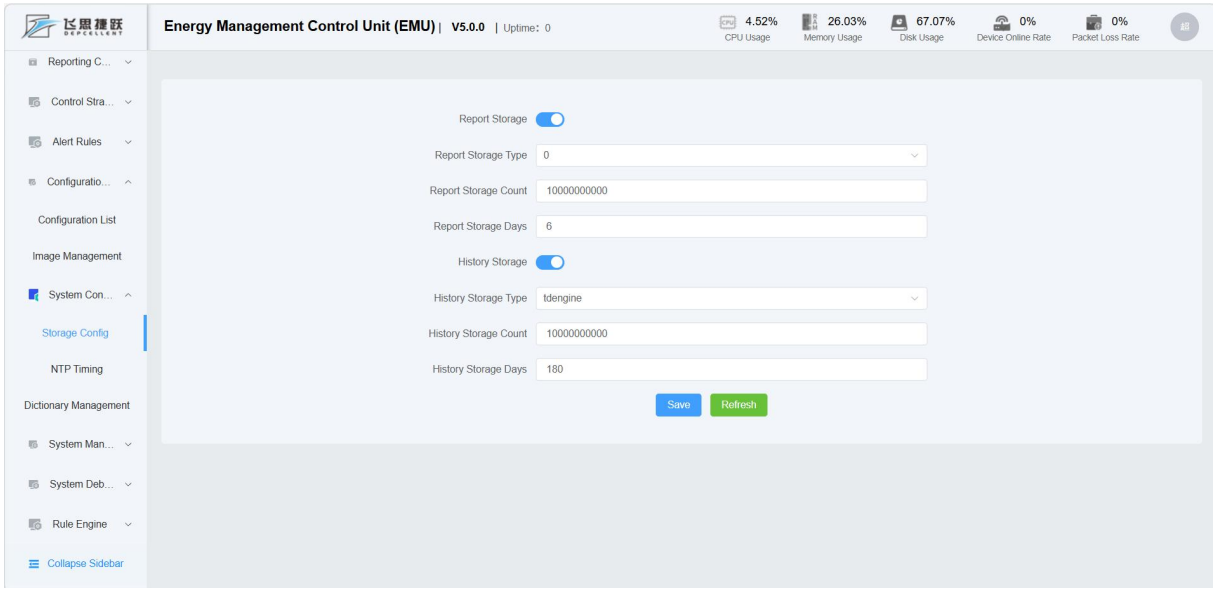


Figure 2.5.9-1 Storage Settings

2.5.9.2. NTP Calibration

The system's time synchronization feature automatically calibrates the system time via a Network Time Protocol (NTP) server, as shown in Figure 2.5.9-2.

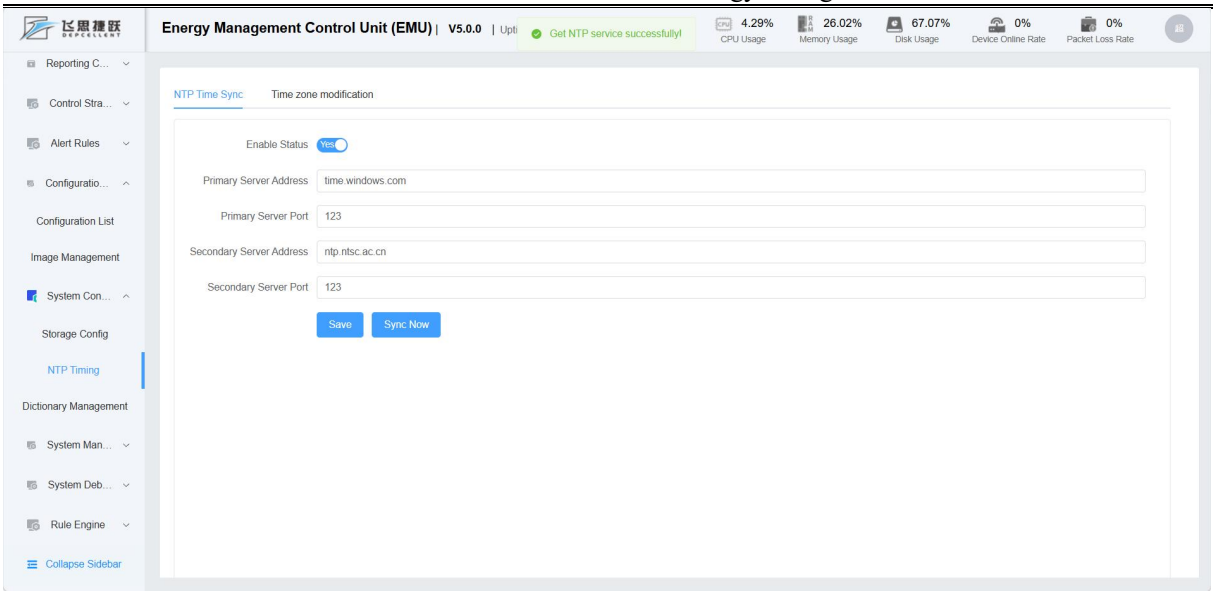


Figure 2.5.9-2 NTP Time Synchronization

2.5.9.3. Dictionary Management

The maintenance system utilizes various data dictionaries, allowing users to view, add, modify, and delete dictionary entries to ensure the standardization and consistency of system data. As shown in Figure 2.5.9-3:

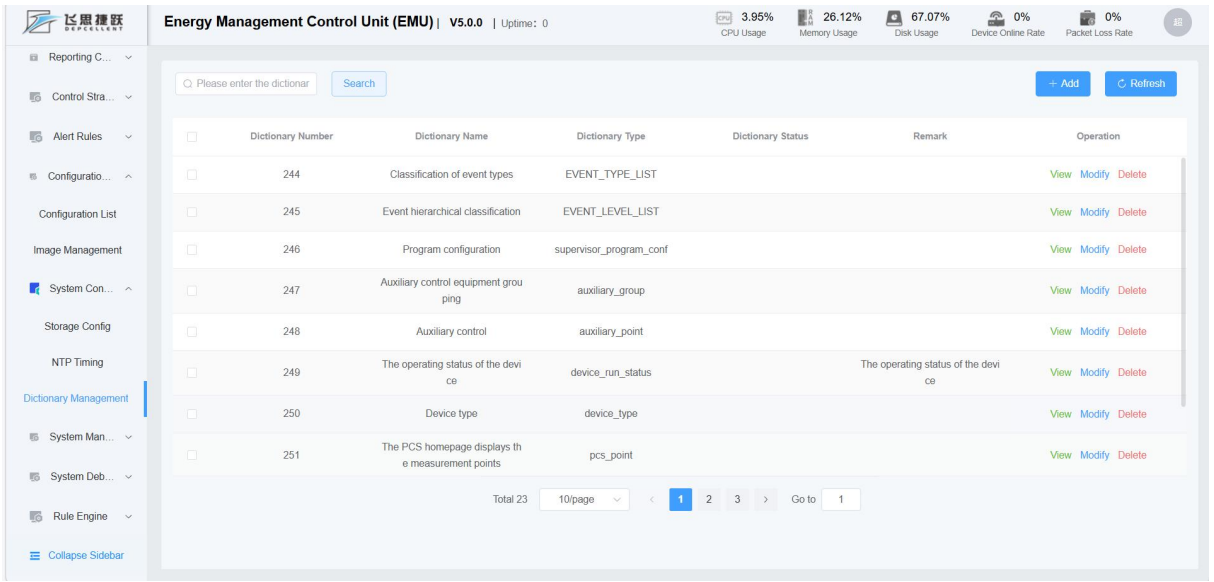


Figure 2.5.9-3 Dictionary Management

2.5.10.System Management

2.5.10.1. User Management

Manage users in the system, including adding, querying, editing, and deleting users, as well as resetting user passwords. See Figure 2.5.10-1:

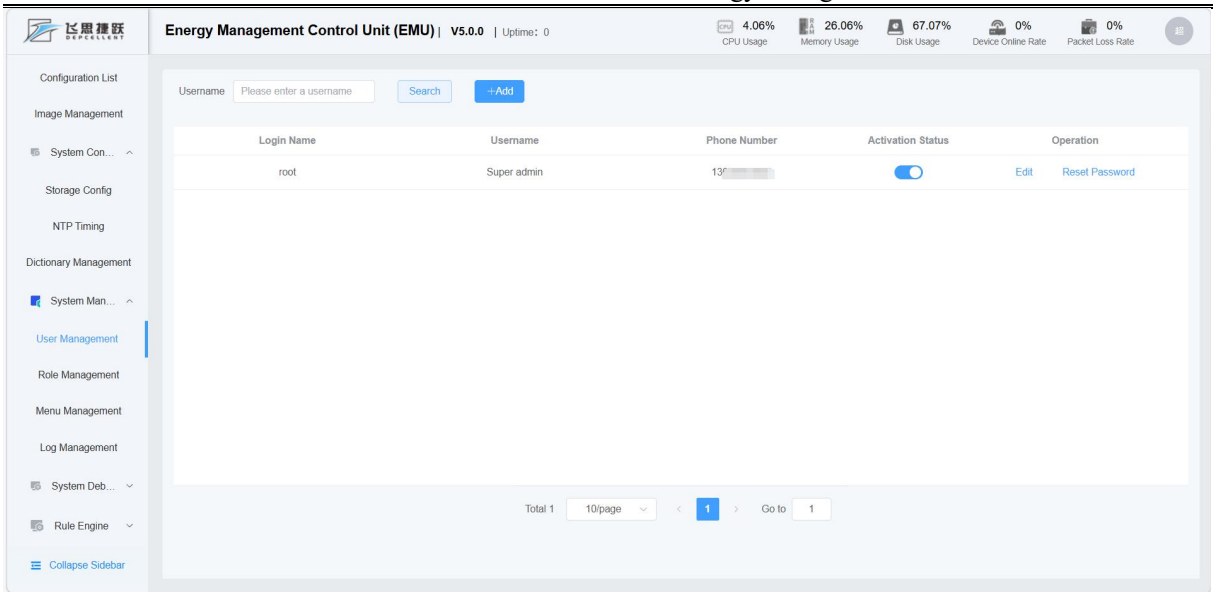


Figure 2.5.10-1 User Management

2.5.10.2. Character Management

It is used to manage roles in the system, including operations such as adding, querying, editing, and deleting roles, as well as updating user status and configuring menus. As shown in Figure 2.5.10-2:

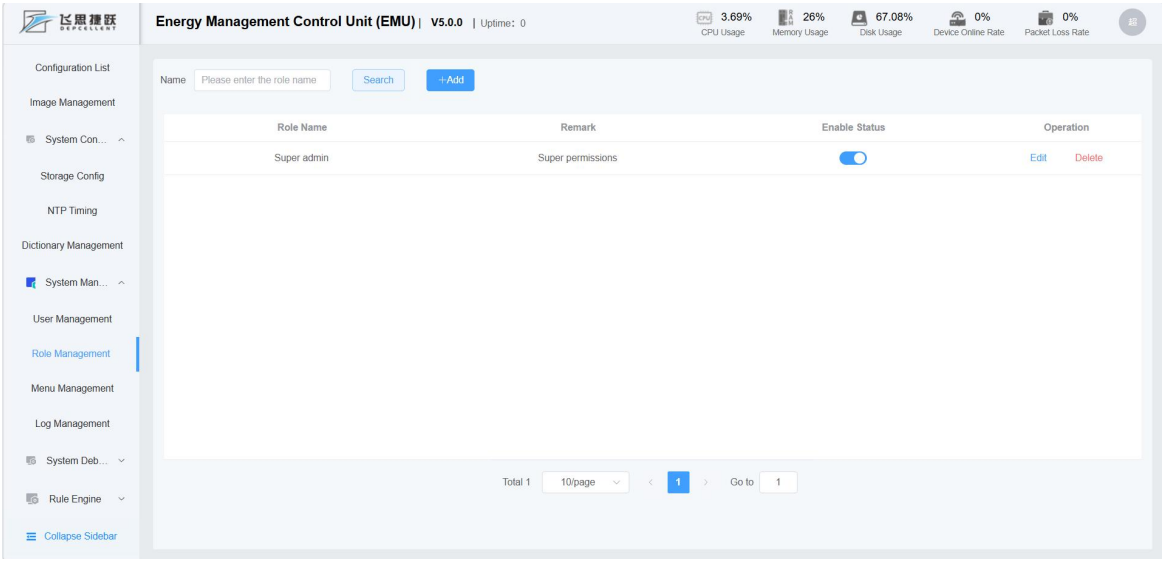


Figure 2.5.10-2 Character Management

2.5.10.3. Menu Management

Manages menus in the system, including adding, querying, editing, and deleting menus, as well as sorting menus. See Figure 2.5.10-3:

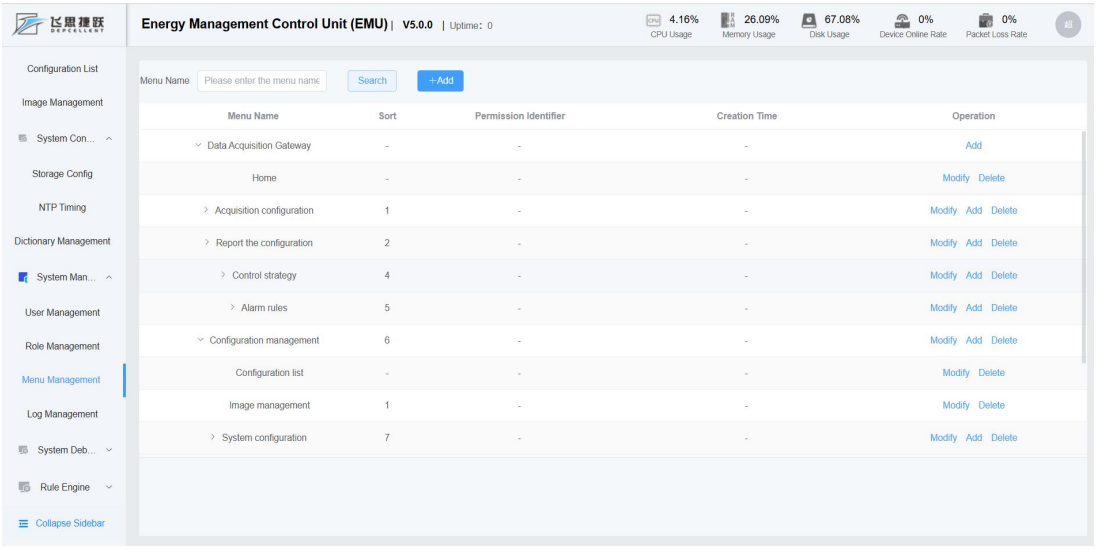


Figure 2.5.10-3 Menu Management

2.5.10.4. Log management

The log management system records critical user data such as IP addresses and login timestamps, enabling real-time tracking and auditing of user activities to ensure platform security and regulatory compliance. As shown in Figure 2.5.10-4:

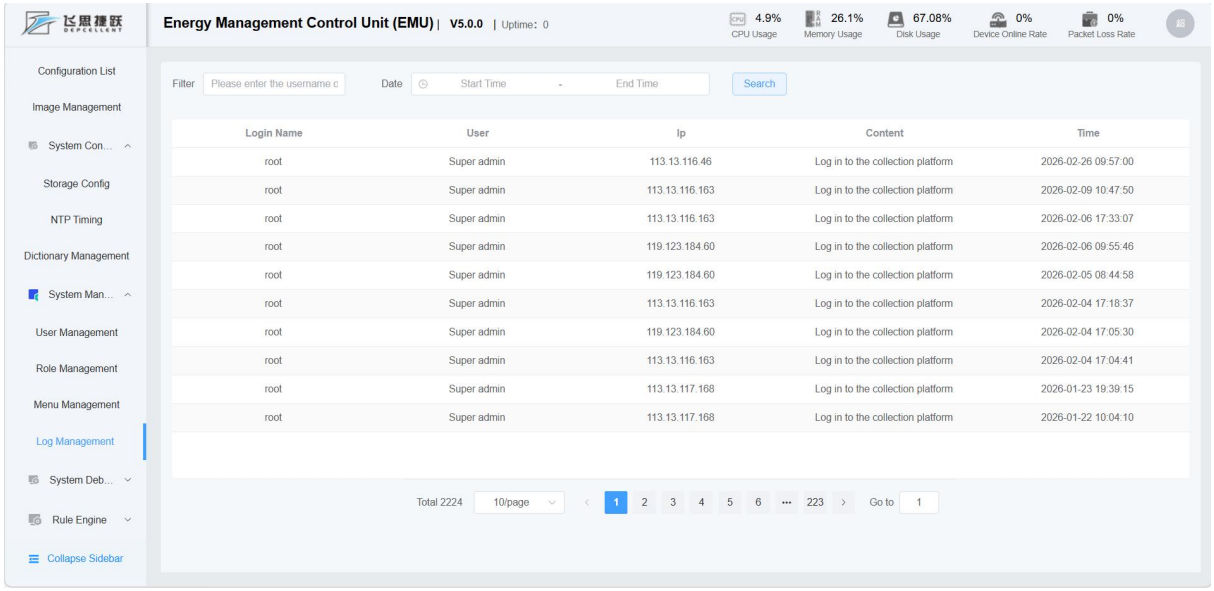


Figure 2.5.10-4 Log Management

2.5.11. System Debugging

2.5.11.1. Channel Debugging

Ensure smooth debugging channels and accurate message verification data by enabling serial ports, CAN ports, and TCP clients, as shown in Figure 2.5.11-1.

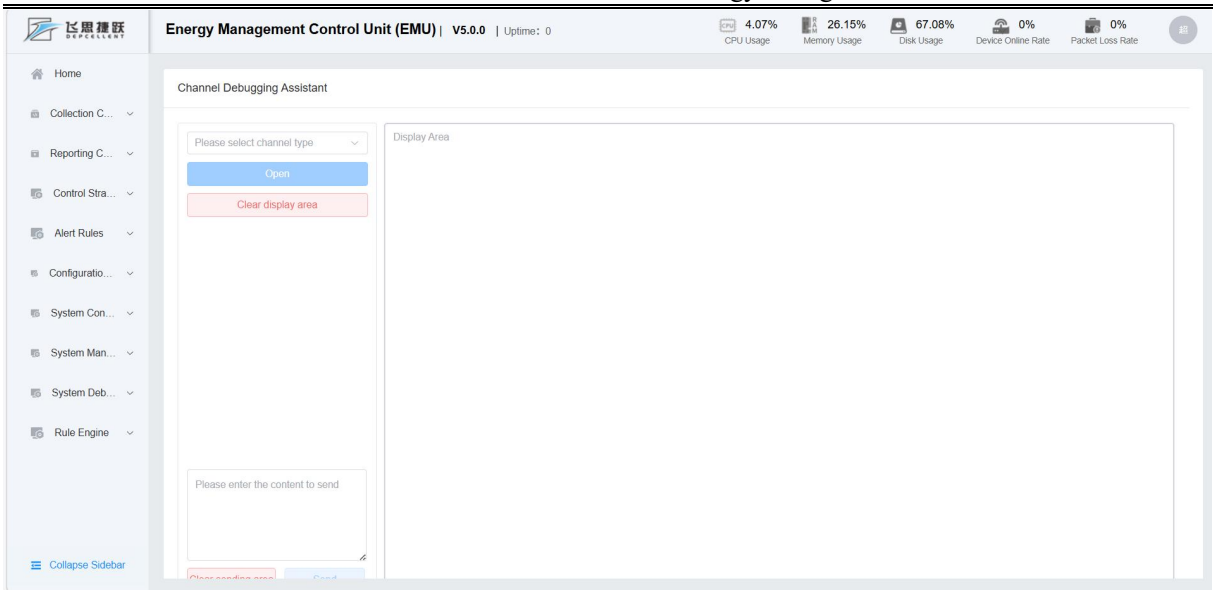


Figure 2.5.11-1 Channel Debugging

2.5.11.2. System Logs

View and analyze log information generated during system operation to monitor its status and troubleshoot errors. As shown in Figure 2.5.11-2:

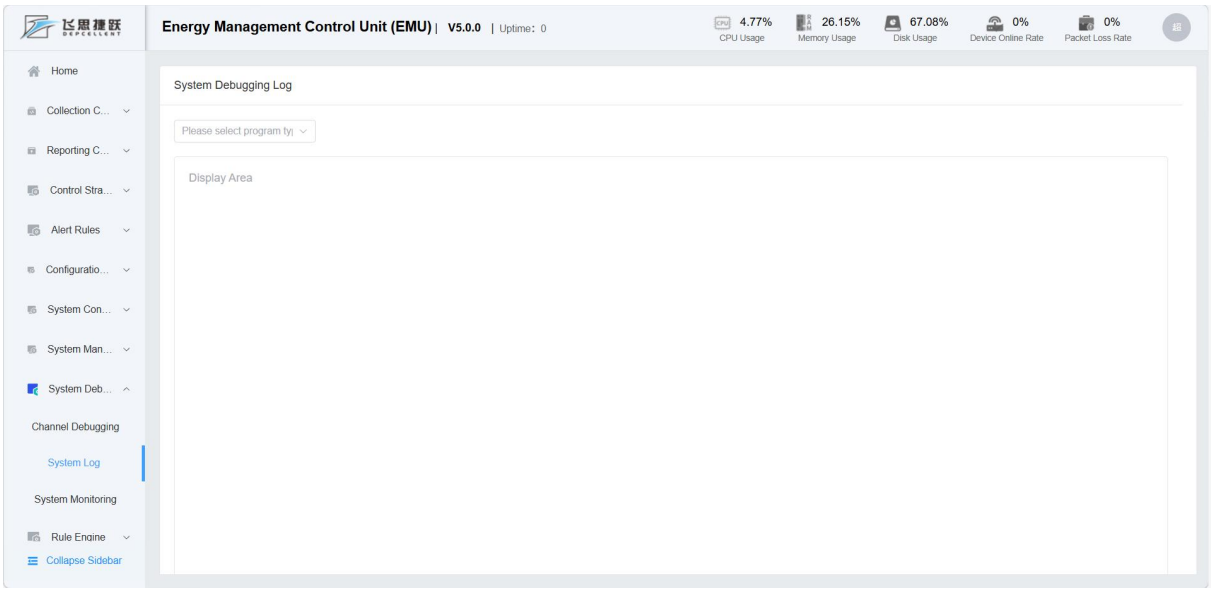


Figure 2.5.11-2 System Log

2.5.11.3. System Monitoring

The system monitoring tracks all performance metrics in real time to ensure stability and reliability. As shown in Figure 2.5.11-3:

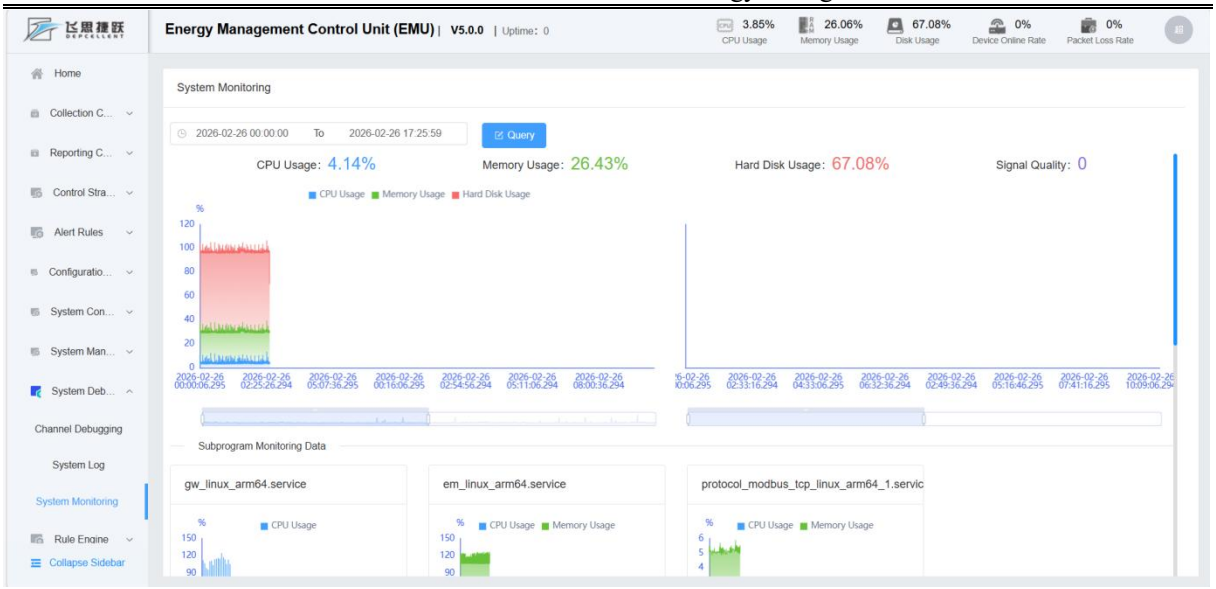


Figure 2.5.11-3 System Monitoring

2.5.12. Rule Engine

2.5.12.1. Rule Configuration

Rule configuration manages and configures rules. Users can create new rules, set trigger conditions and actions, and view, edit, or delete configured rules. As shown in Figure 2.5.12-1:

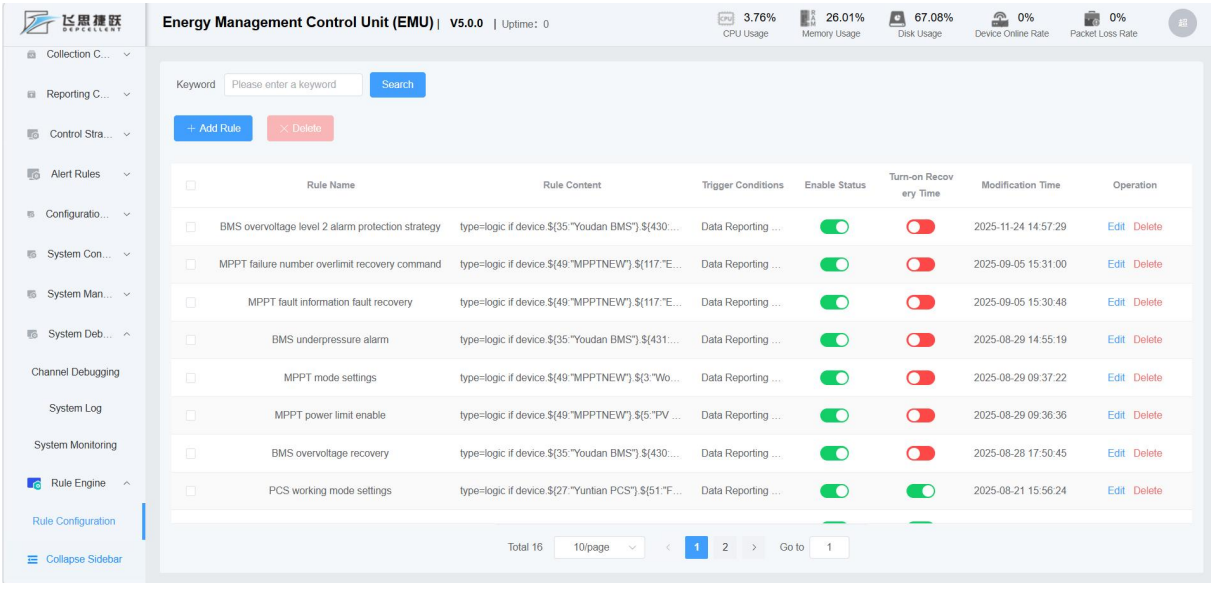
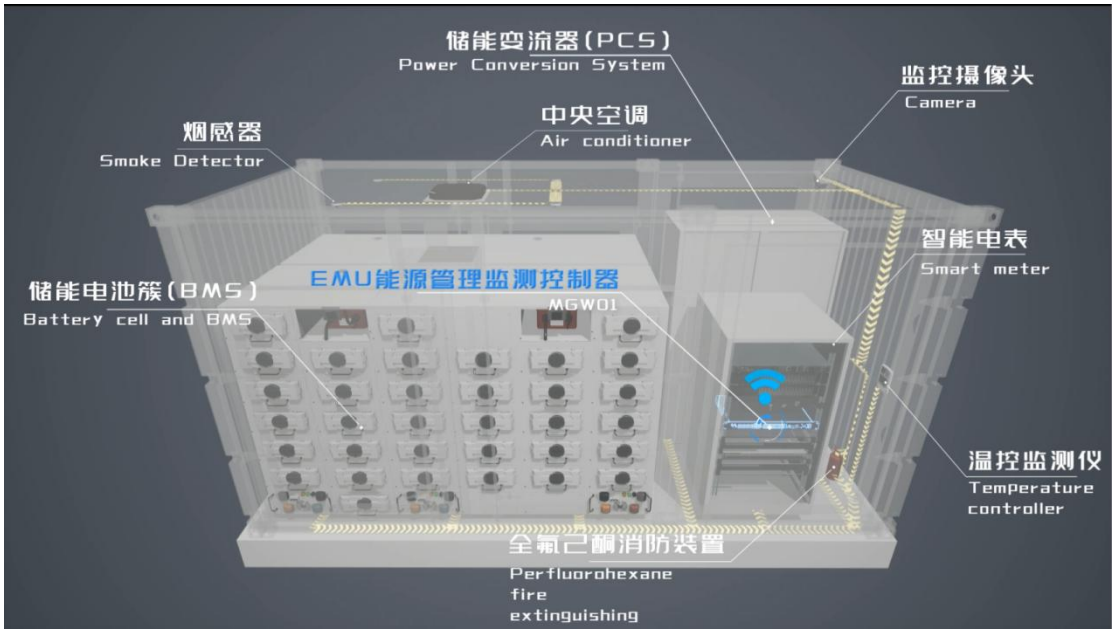


Figure 2.5.12-1 Rule Configuration

3. EMU Hardware Requirements

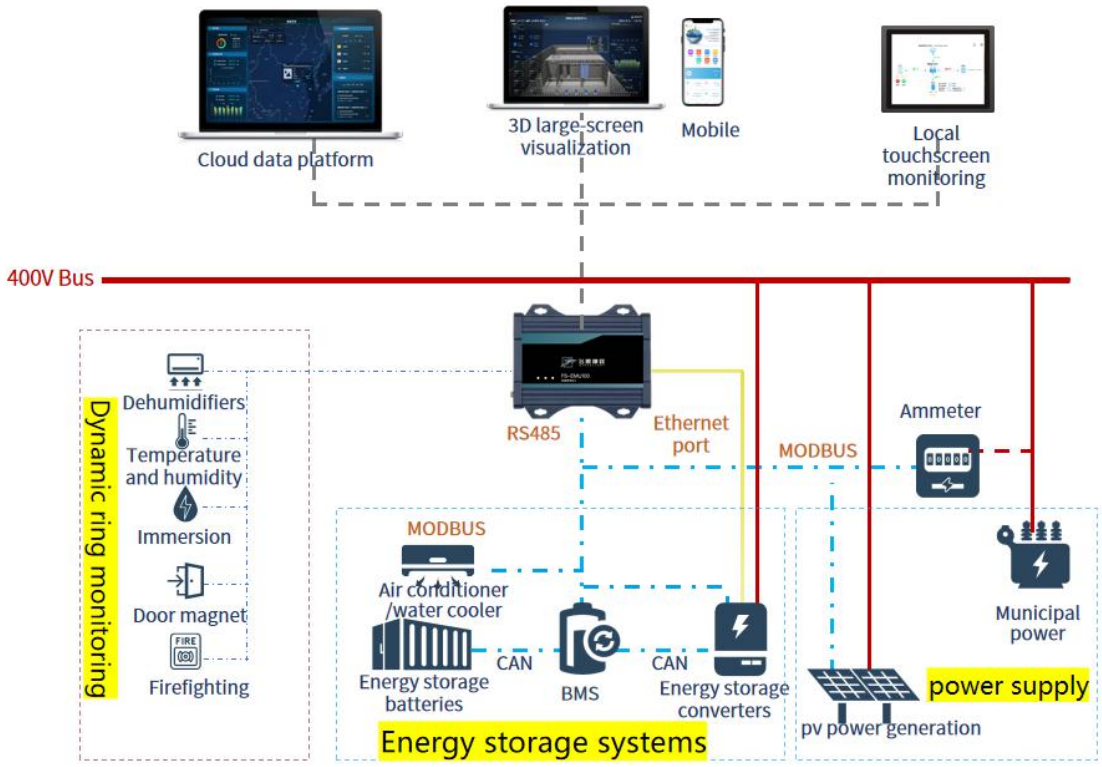
The EMU-100 Energy Management Monitoring Controller is an innovative solution with outstanding advantages, specifically designed for energy storage and microgrid scenarios. Compared to traditional devices like 4G routers, 5G routers, and PLC controllers, EMU

enables integrated management, simplifies system architecture, reduces equipment count, and lowers maintenance costs. It provides efficient energy management through real-time monitoring and intelligent control, optimizing energy storage and utilization. The controller precisely controls energy storage devices and offers flexible energy scheduling strategies to enhance efficiency, stability, and reliability. Whether for industrial, commercial, or residential users, the EMU Energy Management Monitoring Controller delivers convenience and benefits, making it an ideal solution for energy storage systems. Developed using mainstream domestic RK-series CPUs (supporting domestic CPUs) and operating systems (supporting domestic OS), this intelligent edge control product boasts high efficiency, performance, and cost-effectiveness, supported by 128/256MB DDR3 memory and 8GB eMMC storage.



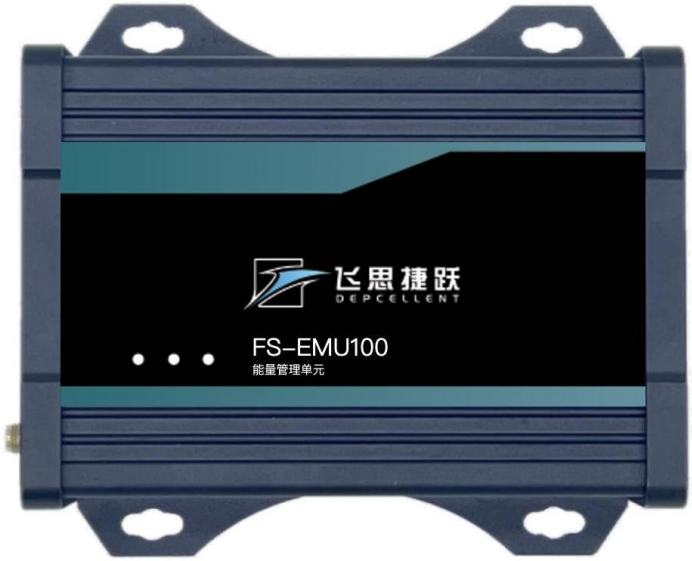
3.1. Product Features

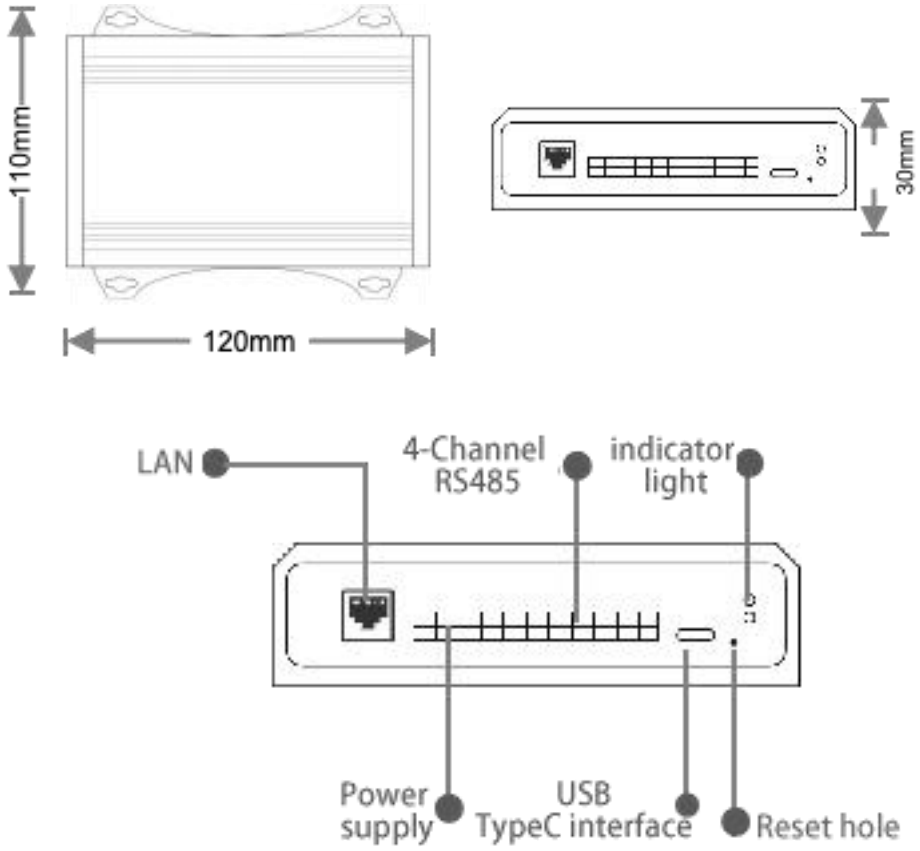
EMU provides comprehensive monitoring for energy storage management systems, enabling real-time collection of operational data from PCS/BMS and auxiliary control devices while supporting IO control outputs.



Ideal for small and medium-sized energy storage applications, designed for multi-cabinet consolidation.

3.2. Product View





3.3. EMU Parameter

3.3.1. Hardware Parameters

Device	Detailed description
CPU	ARM core platform，Quad-core ARM Cortex-A7 processor, 1.5 GHz
RAM	128/256MB DDR3
storage	8GB eMMC；
4G	1 4G port, supports standard SIM card
Ethernet port	1 RJ45 network port (100M)
serial port	4-channel RS485 with isolation capability
watchdog	CPU built-in watchdog
Console	TYPE-C Debugging

Electric Source	DC 24V（Wide Pressure 9V-24V）
Heat Dissipation Method	Passive cooling, fanless
Machine dimensions	120*110*30mm
Working Environment	Humidity: 5%~95%, no condensation; Operating temperature: -30℃~70℃; Storage temperature: -40℃~85℃

Make Energy Storage Safer and More Efficient

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