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TCSN POWER

Merak CESS-2.5MW-5MWh



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1 Introduction

The supply scope of this project includes a 2.5 megawatt/5 megawatt-hour energy storage system and an EMS system. The energy storage system mainly consists of (but is not limited to) energy storage batteries, BMS (battery management system), PCS (power control system), EMS (energy management system), step-up transformers, auxiliary transformers, 10 kilovolt connection cabinets, ventilation equipment, heating equipment, air conditioning equipment, temperature control equipment, video surveillance equipment, fire alarm and fire linkage equipment, access control system (if any), prefabricated containers, and internal grounding devices.



Figure 1-1 Schematic diagram of the battery cabinet

Table 1-1 Battery cabinet parameter table

Id	Category	Technical parameters
1	Cell type	3.2V/314Ah, LFP
2	Rated energy of the system	5015.96kWh
3	Battery grouping method	4*104S*12P
4	System voltage	1040.0Vdc ~ 1497.6Vdc
5	Chargedischarge rate	≤0.5P
6	Battery efficiency	≥ 94%(excluding AC auxiliary power).
7	Operating temperature range	Discharge:-20~55°C; Charging: 0~55°C
8	Fire fighting methods	Aerosol firefighting
9	Methods of Communication	CAN、RS485、ModbusTCP、LAN
10	Cooling method	Liquid cooling
11	Ingress protection	IP54
12	Corrosion protection level	C3
13	weight	43T
14	Size (W*D*H)	6058x2438x2896mm(without lifting rings).
15	Humidity range	0~95%(no condensation).
16	Maximum working altitude	5000m (>3000m derating)
17	Authentication	GB_T 36276-2023, UN38.3, IEC62619

2 System Configuration

2.1 Battery Park



Figure 2-1 PACK Appearance Diagram

Table 2-1 Battery Box Parameter Table

1	Cell type	LFP
2	Charging rate	≤ 0.5P
3	discharge rate	≤ 0.5P
4	Composition	1P104S
5	Nominal capacity	314Ah
6	Nominal energy	104.5kWh
7	Nominal voltage	332.8V
8	Operating voltage range	260V ~ 379.6V
9	Voltage harvesting	Full collection + total positive/total negative
10	Temperature collection	10K /B
11	Maximum operating temperature range	Charging 0°C~55°C; Discharge -30°C~55°C
12	Optimal operating temperature	25°C±2°C;
13	Transport & Storage Temperature (Battery 30% SOC).	-20°C~45°C within one month; -20°C~25°C within 6 months
14	Insulation properties	Resistance ≥ 500MΩ@2500VDC

15	Withstand voltage	Leakage current ≤ 1mA @4500VDC, no spark and no breakdown
16	IP rating	≥ IP67
17	Ambient humidity	< 90% RH (non-condensing)
18	Cooling method	Liquid cooling
19	Product weight	310kg
20	Dimensions (W*D*.H)High.	795±2mm×2200±2mm×228±2mm

2.2 Battery Rack Specifications

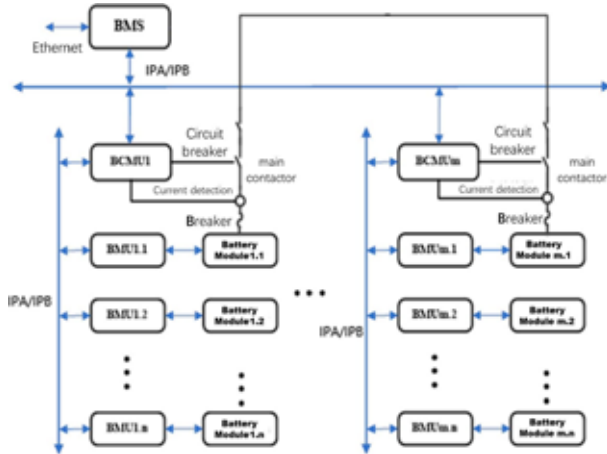
Rated Voltage(V)	1331.2Vdc	【4modules series】
Series & Parallels	1P416S	
Rated Capacity(Ah)	314	
Voltage range(V)	1040 ~ 1497.6	
continuous charge/discharge current(A)	157/157	
Rated Energy(kWh)	417.996	4modules series, singlecluster
Discharge cut-off voltage(V)	1040	
Charge voltage(V)	1497.6	
Cycle life (@25°C, 0.5C/0.5C,80%DOD)	> 6000	25±2°C, 0.5C/0.5C, 70%SOH
BatteryThermal Management	Liquid cooling	
Operating temperature	-20~55°C	
Operating humidity	5%~95%R.H.	
Communication	CAN/RS485	

2.3 Battery Management System

ESMU Technical Parameters	
Project	Parameters
Central Processing Unit	ARM platform, quad - core, with a maximum main frequency of 2.0GHz
Memory	4GB LPDDR4
Operating System	Linux
SD Card Storage	16GB eMMC 240G - 500G SSD 32G SD card (optional)
Number of Detectable Batteries	Up to 450 cells × 60 clusters
Liquid Crystal Screen	10.1 - inch true - color touch - screen LCD
Data Recording Interval	≥1S (configurable)
Query Methods	On - site panel query, remote access query, data export/download
Alarm Methods	Acoustic - optical alarm, display alarm content, fault output node closure
Communication Interfaces	3 - way LAN, 3 - way isolated CAN, 5 - way isolated RS485, 2 - way USB

DO/DI Interfaces	6 - way DIH IO input with photoelectric isolation 6 - way DIL IO input with electrical isolation 12 - way IO output with relay dry - contact mode 1 - way AC power - failure detection
Remote	Supports MQTT protocol; supports Modbus TCP, IEC61850 protocols
Event Log Database	>100000 event records, including anomaly types, occurrence times, and protection actions, supporting full - life - cycle data storage
ESMU Power Supply	DC24V
ESMU Power Consumption	<10W (initial state with screen on)
Communication Baud Rates	9600bps @ RS485, 250Kbps @ CAN, 100Mbps/1000Mbps @ LAN
Dimensions/Mass	288×190×41.2mm / 1.8kg
Material	Sheet metal
Process	Three - proof paint
Insulation Resistance	500MΩ 1500VDC
Operating Environment	Ambient temperature: -10 - +55°C, relative humidity: <95% (non - condensing), ambient magnetic field: <400A/m, no corrosive or flammable and explosive gases allowed in the surroundings

The energy storage system is equipped with a complete battery management system, adopts a three-level management architecture and three-level software protection, including module level, battery cluster level and system level, to achieve comprehensive control, management and protection of the battery system and ensure the safe and stable operation of the battery system.



2.4 High voltage box



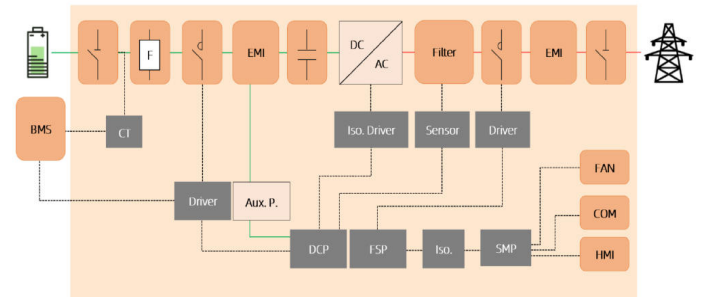
Table 2-2 Technical parameters of high-pressure box

ID	Name	Technical parameters
1	Current rating	250A
2	Operating voltage	1500V
3	SOC accuracy	5%

2.5 PCS



Electrical Connection



Product features

<p>Highly integrated</p> <ul style="list-style-type: none"> Integrated design of inversion and boosting, highly integrated to enhance space utilization, easy for installation and deployment with unique modular design, flexible power configuration 	<p>Efficient and stable</p> <ul style="list-style-type: none"> 1500V system, unique multi-branch connection on the DC side within a wide DC voltage range, avoiding direct parallel connection of battery clusters, effectively solving the problem of circulating current.
<p>Intelligent collaboration</p> <ul style="list-style-type: none"> Has an automatic operation strategy for peak shaving and valley filling Supports multiple operation modes including VSG, PQ, and VF Equipped with off-grid parallel operation and black start functions 	<p>Grid-friendly</p> <ul style="list-style-type: none"> Equipped with LVRT and HVRT functions Has the function of four-quadrant regulation of active and reactive power Powerful rapid response (< 10ms)

2.6 Thermal management system

Product Description

With automatic fluid replenishment function, the system can automatically replenish fluids when there is a slight fluid shortage.

Integrated design, reducing on-site installation and commissioning costs Standard equipped with RS485 communication interface, and optional CAN communication. It has the function of automatically starting upon receiving a call, and provides various alarm and protection functions. It is small in size, has a compact structure, and has a protection level of IPX5.

PTC heating is provided to meet the heating requirements of equipment in low-temperature scenarios.

It can operate continuously for 24 hours and has a design service life of more than 10 years.

Operating temperature range: -30°C to 55°C



Figure 2-3 Schematic diagram of a Air-cooled unit

Table 2-3 Technical parameters of Air-cooled unit

Project	Organization	Parameters
Rated AC input power supply	V/Hz	380±10%/50±1Hz
Refrigeration capacity	kW	60
Liquid supply flow rate	L/min	500
Supply pressure	kPa	210
Supply liquid temperature	°Celsius	18
Refrigeration input power	kW	30
Calorific value	kW	20
Overall dimensions (width * depth * height)	mm	1200 * 400 * 240
Installation method	/	Vertical installation
Maximum sound pressure level noise (at 1.5m, @ 40°C)	dB(A)	75 (18°C@35°C,RH50%)
Waterproof and dustproof rating	/	The entire machine is IP54 (the electrical control box is IP56)
Refrigerant	/	R410A
Life expectancy	Years	>10
Surface treatment	/	Electrophoresis + Electrostatic Spraying (RAL 7035)

2.7 Fire protection system

This product divides the energy storage system into multiple levels for protection.

PACK level: early detection and rapid extinguishing of root fire sources;

Cluster level: Focus on controlling external fire sources, preventing their spread, and suppressing their growth.

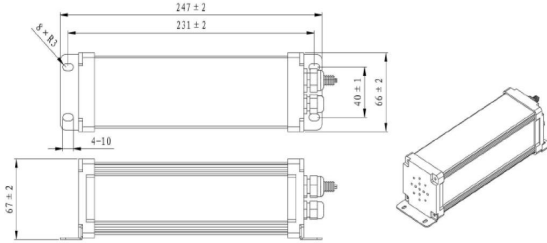


Figure 2-4 Schematic diagram of the fire extinguishing device

Table 2-4 Technical parameters of fire protection system

ID	Project	Performance/Parameters
1	Filling media	aerosol
2	The quality of the filling agent	5*40g(PACK level)+1*300g(cluster level).
3	Supply voltage	24V
4	Methods of Communication	CAN communication/485 communication
5	Protect the space	5m ³
6	expiration date	10 years

3 Precautions

3.1 Safety Precautions

- It must be operated by a professional electrical personnel or a trained technician.
- Make sure the high-voltage power switch is disconnected when installing.
- Please carefully inspect the materials before installation, if there is any missing or damaged, please do not install dangerously.
- Insulating gloves must be worn during installation, and the outside of the metal tool must be tightly wrapped with insulating tape before use.
- During installation, it is strictly forbidden to contact the total positive and total negative of the battery pack at the same time, so as not to hurt people with high voltage.
- Non-professionals are forbidden to disassemble the module shell, let alone touch the internal circuit board, so as not to cause electric shock accidents.
- Without the confirmation of the manufacturer's technical personnel, it is forbidden to modify or use this system on other projects to avoid serious accidents.

3.2 Guidelines for safe use

- Safeguard measures should be provided for the safe and reliable operating environment of the battery system.
- The power should not be greater than the rated power when in use, and the system should be kept away from fire, heat and water sources in use, if the battery leaks or emits peculiar smell, it should be stopped immediately, and the relevant personnel should be notified in time to deal with it.
- The battery system is fully charged and fully discharged every six months, and the recommended charge and discharge rate is 0.5C, and detailed records are made.
- Before the energy storage battery is stored for a long time and operated, the battery system must be inspected for safety to avoid equipment damage or system safety problems caused by loose connections, water vapor condensation, rust or mold.