

**2.15MWh 储能项目系统方案**

**2.15MWh Energy storage system proposal**

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## 目录 Content

1. 系统方案设计 System scheme design .....	3
1.1. 系统概述 System Overview .....	3
1.2. 方案设计 Scheme design .....	3
2. 电池系统配置 Battery System Configuration .....	6
2.1. 锂电池 Lithium battery .....	6
2.2. 电池模组 Battery Module .....	7
2.3. 电池簇 Battery Cluster .....	8
2.4. 簇控盒 Cluster Control Box .....	9
2.5. 智能传输开关柜 Smart Transfer Switch Cabinet .....	11
2.6. 接地系统 Grounding system .....	12
2.7. 消防系统 Fire fighting system .....	13
2.8. 电池管理系统 ( BMS ) Battery BMS .....	16
2.9. 储能变流器 Power conversion system ( PCS ) .....	19
2.10. 能量管理系统 Energy management system(EMS) .....	20

## 1.系统方案设计 System scheme design

### 1.1 系统概述 System Overview

根据项目需求，需要配备 1 个 20HQ 集装箱，装箱容量为 2.15MWh According to the project demand, one 20HQ container is needed to place the energy storage containers with the energy storage capacity of 2.15MWh.

### 1.2 方案设计 Scheme design

方案配置 Scheme configuration

表 1-1 方案配置表 Table 1-1 Scheme Configuration

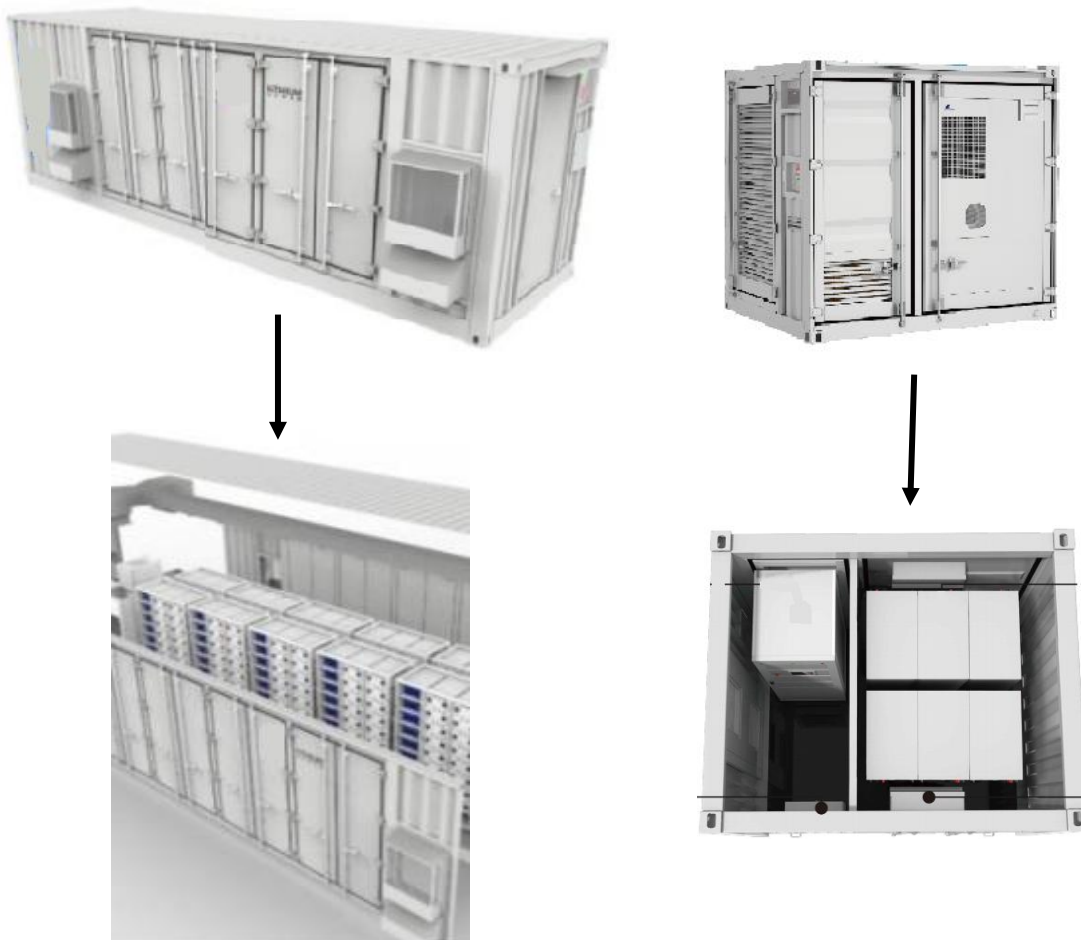
序号 No.	名称 Name	单位 Unit	数量 Qty	说明 Description
1	电池集装箱(20 尺) Battery container (20ft)	台 Tai	1	电能量存储部分，额定容量为 2.15MWh Electric energy storage part, rated capacity 2.15MWh
2	电池集装箱 ( 10 尺 ) Battery container (10ft)	台 Tai	1	装变压器 1PCS 智能切换柜 1PCS PCS 逆变器 2PCS Install transformer 1 PCS intelligent switching cabinet 1PCS PCS, inverter 2 PCS
3	电池簇 Battery cluster	台 Tai	10	每簇电量 215kWh ( 模组 1P20S,280Ah , 12 包 ) ，电池架 ， BMS 电池管理系统 Each cluster power 215kWh (module 1P20S,280Ah, 12packs), battery rack, BMS battery management system
4	智能切换柜 Smart switching cabinet	台 Tai	1	并离网切换 Parallel off grid switching
5	变压器 transformer	台 Tai	1	1000kVA Uk=6%
6	工业空调 Industrial air conditioner	套 Set	1	总制冷量 10kW ( 实际以设计为准 ) 10KWhRefrigerating capacity (The actual situation is subject to the design )
7	消防系统 Fire fighting system	套 Set	1	七氟丙烷气体灭火系统+灭火器、手动报警系统 Heptafluoropropane gas fire extinguishing system + fire extinguisher, manual alarm system
8	照明系统 Lighting system	套 Set	1	照明灯，应急照明等 Floodlights, emergency lighting, etc
9	箱体及配件 Boxes and accessories	套 Set	1	集装箱 ( 20HC+10HC ) 或 ( 40HC ) ，电缆 Container ( HC ) cable

10	PCS 逆变器 PCS power conversion system	台 Tai	2	500kVA(Battery DC-AC load)
11	能量管理系统 Energy management system(EMS)	套 Set	1	电站管理，能量调度 Power station management, energy dispatching
12	自动转换开关电器 Automatic transfer switching equipment	套 Set	1	

空间布局 Space layout

本方案储能系统配置在集装箱内，集成了电池系统、PCS、系统柜、温控、消防、辅助系统等，布局如图。

The energy storage system is configured in a container, which integrates the battery system, PCS, system cabinet, temperature control system, fire control system, auxiliary system, etc. The layout is shown in the figure.

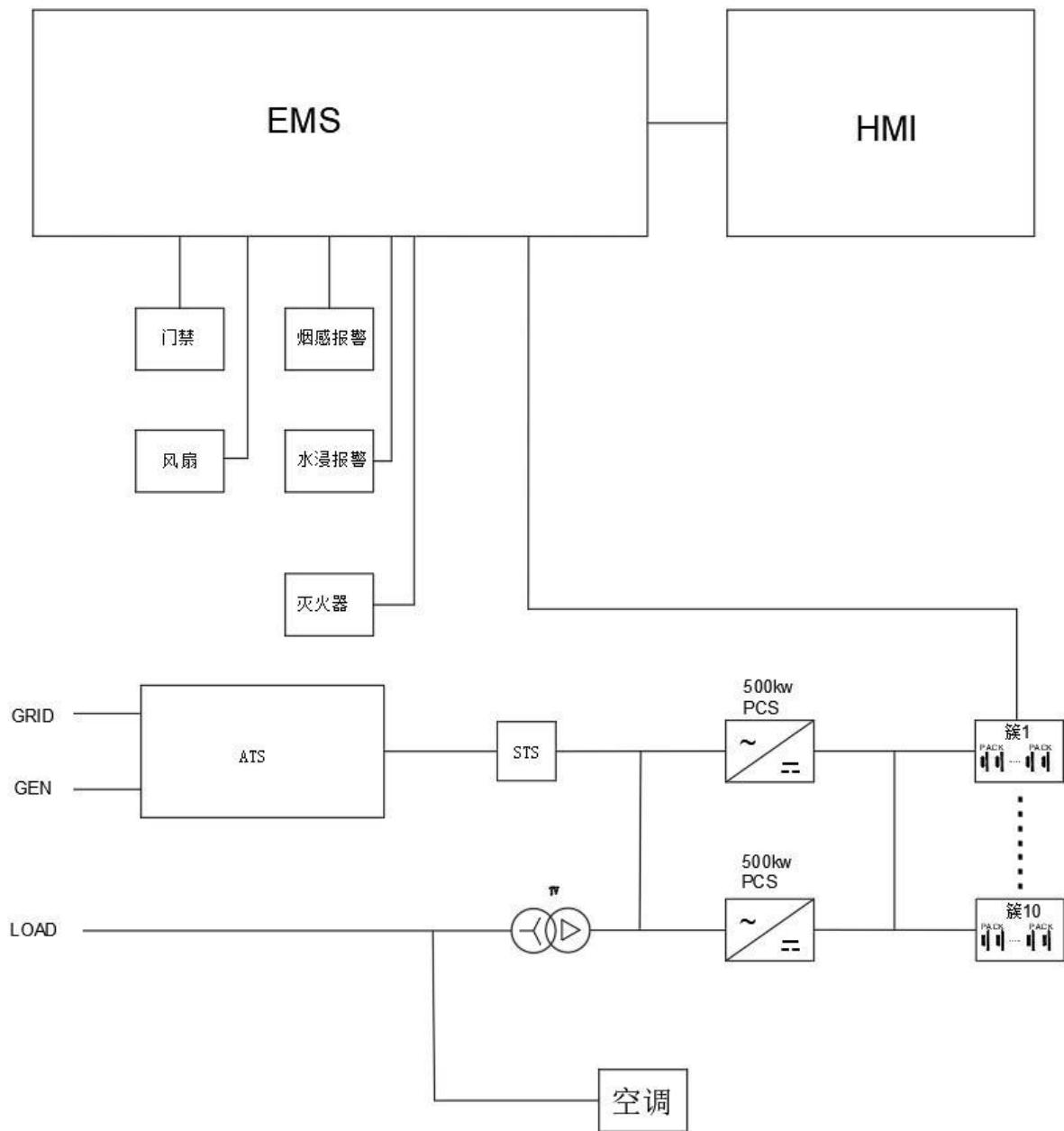


储能集装箱布局图 Energy storage container layout

储能电站主接线图 Main wiring diagram of energy storage station

2.15MWh 储能系统集装箱内有 10 个电池簇，接至 2 台 500KVA PCS 逆变器，直流侧变流后可输出 340-440Vac 电网电压范围，如图所示：

There are 10 battery clusters in the container of the 2.15MWh energy storage system, connected to two 500KVA PCS inverters. The DC side converter can output a voltage range of 340-440Vac in the power grid, as shown in the figure:



储能集装箱主接线图 Main wiring diagram of energy storage container

## 2. 电池系统配置 Battery System Configuration

### 2.1. 锂电池 Lithium battery

本方案选用的磷酸铁锂电池（LFP），磷酸铁锂电池具有比能量高、循环寿命长、成本低、性价比高、可大电流充放电、耐高温、高能量密度、无记忆、安全无污染等特点，已广泛应用于储能系统。

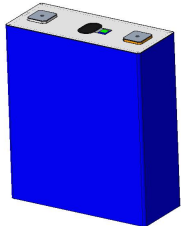
This program adopts lithium iron phosphate (LFP), lithium iron phosphate with high specific energy, long cycle life, low cost, high cost performance, high current charge and discharge, high temperature resistance, high energy density, no memory, safe and pollution-free, etc., has been widely used in energy storage systems.

锂电池标称电压 3.2V，标称容量 280Ah，其它基本性能参数如表 2-1 所示。

The nominal voltage is 3.2V and the nominal capacity is 280Ah. Table 2-1 lists other basic performance parameters of the lithium battery.

表 2-1 电芯规格参数表 Table 2-1 Specifications of the cell

序号 No.	项目 Item	规格 Specification	备注 Remark
1	电池类型 Battery Type	LFP	硬包 Hard package
2	容量 Capacity	$\geq 280\text{Ah}$ ( $25\pm 5^\circ\text{C}$ , 1C)	
3	电芯重量 Cell Weight	$6.0\pm 0.5\text{kg}$	
4	能量密度 Energy density	$145\pm 10\text{Wh/kg}$	
5	标称电压 Nominal voltage (V)	3.2V	
6	初始内阻 Initial Impedance	$\leq 0.5\text{m}\Omega$ AC 1KHz measured	
7	充电截止电压 Charge cut-off Voltage	3.65V	
8	放电截止电压 Discharge Cut-off Voltage	在 $25^\circ\text{C}\pm 5^\circ\text{C}$ 的环境下；以 1C 恒流充至 3.65V；然后以 3.65V 恒定电压充电；截至电流为 0.01C。 At $25^\circ\text{C}\pm 5^\circ\text{C}$ ; Charge at 1C constant current to 3.65V; Then charge at a constant voltage of 3.65V; The cut-off current is 0.01C	
9	标准充电 Standard charge	在 $25^\circ\text{C}\pm 5^\circ\text{C}$ 的环境下；以 1C 恒流放电至 2.5V At $25^\circ\text{C}\pm 5^\circ\text{C}$ ; Charge at 1C to 2.5V	
10	标准放电 Standard discharge	在 $25\pm 5^\circ\text{C}$ 的环境下；以 2C 恒流放电至 2.5V。 At $25\pm 5^\circ\text{C}$ ; Constant discharge at 2C to 2.5V	
11	最大持续放电电流 Max. continuous discharge current(A)	在 $25\pm 5^\circ\text{C}$ 的环境下；以 2C 恒流放电至 2.5V At $25\pm 5^\circ\text{C}$ ; Constant discharge at 2C to 2.5V	

12	工作环境 Working environment	充电：0°C-35°C，最大湿度 85% (0°C-10°C充电电流≤0.2C，10-20°C电流充电≤0.5C，20°C-35°C充电电流1C)；放电：-20~50°C，最大湿度 85% Charge: 0°C-35°C, maximum humidity 85% (0°C-10°C charge current ≤0.2C, 10-20°C, charge current ≤0.5C, 20°C-35°C charge current ≤1C); Discharge: -20~50°C, max. humidity 85%	
13	储存环境 Storage environment	小于 0.5 年：10~30°C，85%R.H MAX (循环) Less than 0.5 years: 10~30°C, 85% R.HMAX (cycle) 注意：以 50%充电态贮存(单电芯) Note: Storage at 50% charge state (single cell)	
14	工作温度 Operation temperature(°C)	电池在 10 ~ 35°C环境下会正常持续运行；-20 ~ 10°C, 35 ~ 50°C环境中运行，电池性能会有所下降 The battery can run normally and continuously at 10 ~ 35°C. Operating at -20 ~ 10 °C and 35 ~ 50 °C, the battery performance will be degraded	
15	循环次数 Cycle time (70%DOD)	RT 0.5C / 0.5C 6000 次≥70%SOC (3.65V-2.5V)	
16	电芯外形图 Cell shape diagram		

## 2.2 电池模组 Battery Module

电池模组由 12 块 280Ah/3.2V 磷酸铁锂电池和 1 个电池管理单元 BMU 组成，电池按 1 并 20 串组合方式组装而成。BMU 电池管理单元是电池管理系统的最小模组单元，BMU 由电源模块、单体采集模块、温度采样模块、通道切换模块、均衡控制模块、通讯模块、CPU 及其外围电路组成，实时测量单体电池电压、电池串总电压、外部工作电源电压、电池环境温度、均衡电压（过欠压保护）、均衡电流（充电/放电），并能通过 CAN2.0 通讯总线将实时监测数据主动上报给电池簇管理单元 BCMS 并接受 BAMS 控制指令。

The battery module is composed of 12pcs 280Ah/3.2V lithium iron phosphate batteries and a battery management unit (BMU). The batteries are assembled in 1S20P combination mode. The BMU battery management unit is the smallest module unit of the battery management system. The BMU consists of power module, single collection module, temperature sampling module, channel switching module, balance controlling module, communication module, CPU and its peripheral circuits. It measures single battery voltage, the battery

string total voltage, the external working power voltage, the battery ambient temperature, the balanced voltage (overvoltage and undervoltage protection), and the balanced current (charge/discharge) in real time. It can actively report the real-time monitoring data to the battery cluster management unit BCMS through the CAN2.0 communication bus and receiving the BCMS control command.

表 2-2 电池模组规格参数表 Table 2-2 Battery module specification & parameter

序号 No.	名称 Name	参数 Parameter
1	电芯 Cell	3.2V 280Ah LFP Cell
2	成组方式 Group mode	1P20S
3	额定容量 Rated capacity	280Ah
4	额定电压 Rated voltage	64V
5	额定能量 Rated energy	17.92kWh
6	标准充电条件 Standard charge condition	恒定功率 Constant power ( CP )、恒定电流 constant current(CC)、恒定电压 constant voltage(CV)
		功率 Power : 3.548kW ( 0.2CP )
		终止电压 Cut-off discharge voltage : 73V
7	标准放电条件 Standard discharge condition	恒定功率 Constant power(CP)、恒定电流 constant current(CC)
		功率 Power : 3.548kW ( 0.2CP )
		终止电压 Cut-off discharge voltage : 50V
8	最大放电功率 Max. discharge power	8.960kW ( 0.5CP )
9	主体尺寸 Main Size	940*460*230mm ( 深度 D*宽度 W*高度 H )

### 2.3. 电池簇 Battery Cluster

20 尺电池集装箱由 1 种规格的电池簇组成，每一簇包含 12 包 1P20S 电池模组，包含 1 台簇控盒，1 台检修开关(MSD)，电池架方案为 2 列 7 层，整个 20 尺集装箱安装 1 堆(共 10 簇)。设计综合考虑电池集装箱热设计需求，使整个集装箱内温场尽量保持一致。电池簇基本参数详见表 2-3。

The 20' battery container consists of 1 size of battery clusters, each cluster contains 12 packs of 1P20S battery modules, including 1 cluster control box, 1 service switch (MSD), battery racking scheme of 2 columns and 7 layers, and the whole 20' container is installed with 1 stack (10 clusters in total). The design takes comprehensive consideration of the thermal design requirements of the battery container, so that the temperature field in the entire container is kept consistent as much as possible. The basic parameters of the battery cluster are detailed in Table 2-3.



表 2-3 电池簇基本参数表 Table 2-3 Basic battery cluster parameters

序号 No.	名称 Name	参数 Parameter	备注 Remark
1	电池模组数 Battery modules qty	12	
2	控制盒数量 Control boxes qty	1	
3	检修开关(MSD)数量 Number of maintenance switches(MSD)	1	
4	电池模组串联方式 Battery system series & parallel mode	20S	
5	电池簇额定能量 Battery Cluster rated energy (kWh)	215kWh	
6	额定直流电压 ( V ) Rated DC voltage ( V )	960V	
7	额定容量 Rated capacity ( Ah )	280	
8	尺寸 Size(mm)	1110*950*2000mm ( W*D*H )	预估 Estimate

## 2.4 簇控盒 Cluster Control Box

电池簇每簇含 1 台簇控盒，簇控盒内含电池簇管理系统(BCMS)，由 3 个直流接触器、1 个直流熔断器、1 个分流器、1 个铝壳电阻和 1 个风扇组成。是电池簇和系统柜的中间管理单元，实现储能电池簇的控制、保护和数据通讯功能。簇控盒原理图详见图 2-4，簇控盒基本参数详见表 2-4：

Each battery cluster contains one cluster controller box. The cluster controller box contains the battery cluster management system (BCMS), which is composed of three DC contactors, one DC fuse, one diverter, one aluminum shell resistor, and one fan. It is the intermediate management unit of battery cluster and system cabinet, realizing the control, protection and data communication functions of energy storage battery cluster. For details about the schematic diagram of the cluster control box, see Figure 2-4. For details about the basic parameters of the cluster control box, see Table 2-4.

图 2-4 簇控盒原理图 Figure 2-4 Schematic diagram of a cluster control box

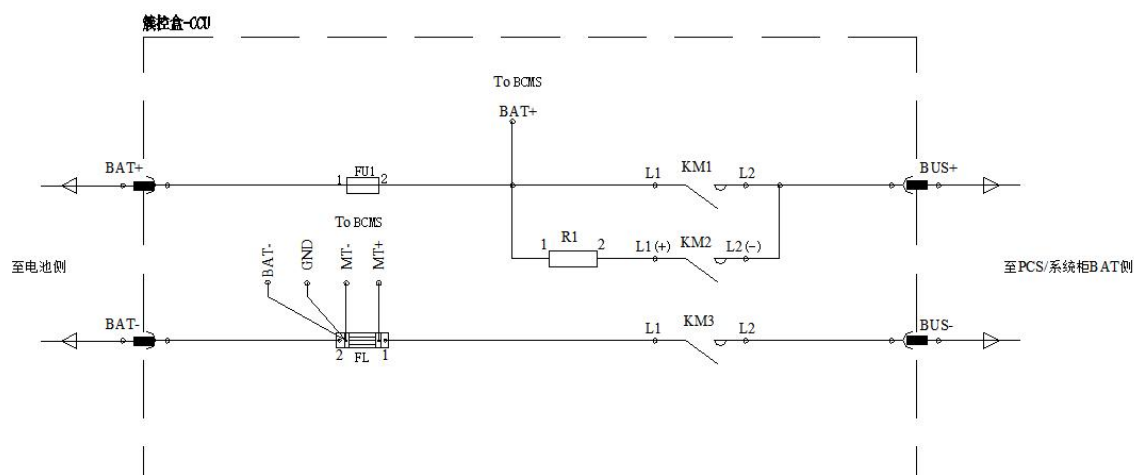


表 2-4 簇控盒基本参数表 Table 2-4 Basic parameters of a cluster control box

序号 No.	符号 Symbol	名称 Name	参数 Parameter
1	BAT+/BUS+	正极连接器插座 Positive connector sockets	额定电压 Rated voltage 1000Vdc, 额定电流 Rated current 200A, 橙色 Orange
2	BAT-/BUS-	负极连接器插座 Negative connector sockets	额定电流 Rated current 1000Vdc, 额定电压 Rated voltage 200A, 黑色 Black
3	FU1	直流熔断器 DC Rated Fuses	额定电压 Rated voltage 1000Vdc, 额定电流 Rated current 300A
4	FL	分流器 shunt	额定电压 Rated voltage 50mV, 额定电流 Rated current 300A
5	KM1/KM3	直流接触器 DC contactor	额定电压 1000Vdc, 额定电流 300A 控制电压 Control voltage 24Vdc
6	KM2	直流接触器 DC contactor	额定电压 Rated voltage 1000Vdc, 额定电流 Rated current 300A 控制电压 Control voltage 24Vdc

## 2.5.智能传输开关柜 Smart Transfer Switch Cabinet

表 2-5 智能传输开关柜主要参数 Table 2-5 Main parameters of the intelligent transmission switchgear

Nominal output power	1000
Nominal grid voltage	1500A
Input grid range	-15%~15%
Output grid range	-15%~15%
AC frequency	50Hz/60Hz (±4.5Hz)
Long-term output overload capacity	1.1
Grid-tied/off-grid switch time	<200ms
Nominal current	3039A @380Vac, 2887A@400Vac
Max. current	3343A@380Vac, 3176A@400Vac (1.1 times )
The maximum efficiency	99.5% (full load)
Communication interface	RS485, CAN and Ethernet
Wiring method	3P4W
Auto-protection	Over-temperature、 AC over-voltage or under voltage、 AC reverse sequence、 E-STOP、 fan fault、 output overload
Programmable protection	AC voltage protection upper & lower limit, AC frequency protection upper & lower limit
Grid access	1 input
PCS access	1 input ( less than 2000KW )
Load access	1 input
Weight	600Kg
IP degree	IP20
Temperature range	-20°C~50°C
Dimension (W×D×H)	800*800*2160 mm
Display	LCD

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## 2.6.接地系统 Grounding system

在储能集装箱设计中，所涉及的接地主要有保护接地和功能部分接地。集装箱对外提供保护接地和功能接地分别接地的接地点。

In the design of energy storage container, the grounding involved mainly includes protection grounding and function part grounding. The container provides a ground point for protection and functional grounding.

功能接地主要是机柜外壳保护接地和防雷接地，其中的保护接地主要是机壳安全接地，它是将系统中平时不带电的金属部分（机柜外壳，操作台外壳等）与地之间形成良好的导电连接，以保护设备和人身安全。原因是系统的供电是强电供电（380、220 或 110V），电池汇流部分直流电压最高有接近 1500V，通常情况下机壳等是不带电的，当故障发生（如主机电源故障或其它故障）造成电源的供电火线与外壳等导电金属部件短路时，这些金属部件或外壳就形成了带电体，如果没有很好的接地，那么这带电体和地之间就有很高的电位差，如果人不小心触到这些带电体，就会通过人身形成通路，产生危险。因此，必须将金属外壳和地之间作很好的连接，使机壳和地等电位。防雷接地是作为防雷措施的一部分，其作用是把通过防雷器的电涌引入大地。电气设备的防雷主要是用防雷器的一端与被保护设备相接，另一端连接地装置，当发生直击雷时，防雷器将产生的电涌引向自身，电涌电流经过其引下线和接地装置进入大地，从而避免电气设备损坏或危及人身安全。

Function grounding is mainly cabinet shell protection and lightning grounding, where the protection grounding is mainly chassis safety grounding, it is the usual non-electric metal part of the system (cabinet shell, operating table shell, etc.) and the ground between the formation of a good conductive connection to protect equipment and personal safety. The reason is that the system power supply is strong power supply (380, 220 or 110V), the battery sink part highest DC voltage close to 1500V, usually the housing is not charged, when a fault occurs (such as host power or other faults) caused by the power supply fire line, shell and other conductive metal parts short circuit, these metal parts or shells form a charged body, if there is no good ground, then this charged body and the ground between a high potential difference, if people accidentally touch these charged body, will form a pathway through the person, resulting in danger. Therefore, it is necessary to make a good connection between the metal enclosure and the ground, so that the enclosure and the ground are equipotential. Lightning grounding as part of the lightning protection measures, its role is to introduce the surge through the lightning protector to the earth. Electrical device lightning protection is mainly used to protect one end of the device with the protected device, the other end even ground device, when a direct lightning strike, the lightning protector

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will generate a surge to itself, the surge current through its lead wire and ground device into the earth, thereby avoiding damage to electrical device or endanger personal safety.

功能接地主要是集装箱内控制器件、端子、测量设备、屏蔽电缆等接地。可提高储能系统二次设备的抗干扰能力，降低其产生异常状况的机率，保障储能系统中二次回路的安全可靠性。

Function grounding is mainly the grounding of control devices, terminals, measuring equipment, shielding cables, etc. in the container. It can improve the anti-interference ability of the secondary equipment of the energy storage system, reduce its chance of generating abnormal conditions and guarantee the safety and reliability of the secondary circuit in the energy storage system.

## **2.7 消防系统 Fire fighting system**

依照 GB50116-2013 《火灾自动报警系统设计规范》、GB50370-2005 《气体灭火系统设计规范》，在系统防护区内设置高灵敏度的火灾报警系统，配备温感、烟感探测器，在检测到火灾险情后通过警铃和声光报警器发出火灾报警，把火灾信息上传至消防主机，并同时启动七氟丙烷柜式灭火系统进行灭火。系统具有自动检测火灾、自动报警、自动启动灭火和自动上传消防状态功能，同时具有自检功能，定期自动巡查、监视故障及故障报警，保障储能电站的消防安全。

In accordance with GB50116-2013 "*Design Code for Automatic Fire Alarm System*" and GB50370-2005 "*Design Code for Gaseous Fire Extinguishing System*", a high-sensitivity fire alarm system is installed in the protection area of the system, equipped with temperature and smoke detectors, which will send out fire alarms through alarms and sound and light alarms after detecting fire hazards, upload fire information to the fire fighting host, and simultaneously start The system is equipped with temperature and smoke detectors. The system has the functions of automatic fire detection, automatic alarm, automatic fire extinguishing and automatic uploading of fire status, and also has the function of self-test, regular automatic inspection, monitoring fault and fault alarm to ensure the fire safety of energy storage power station.

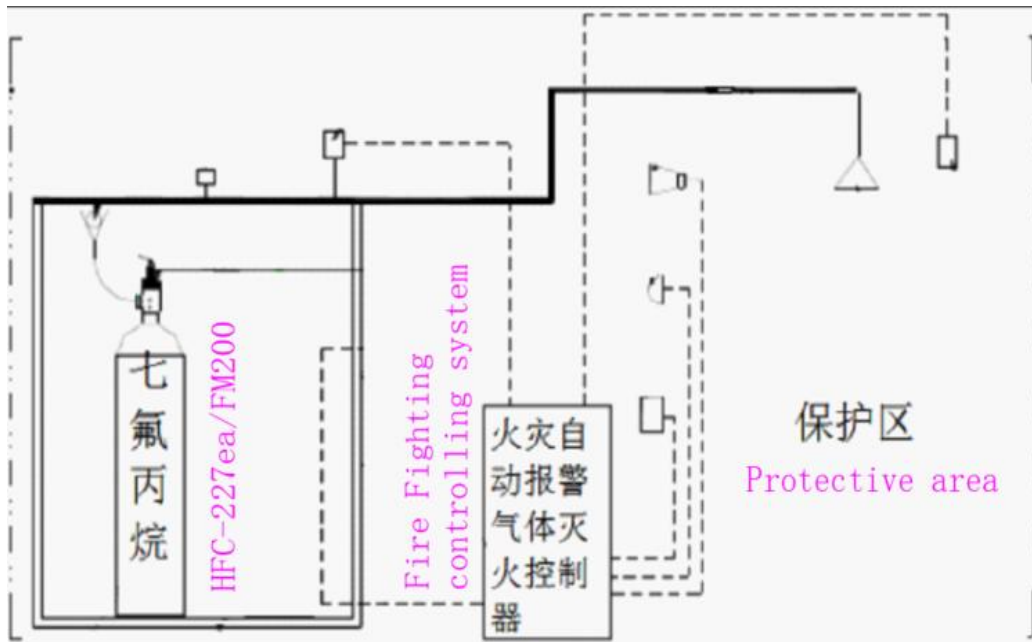


图 2-7 储能箱七氟丙烷气体灭火示意图 FM-227EA gas extinguishing in energy storage tank schematic diagram

设备防护区采用全淹没灭火方式，采用柜式七氟丙烷灭火装置自动灭火，系统具有自动、手动及机械应急三种启动方式。

The protection area of the equipment adopts the fully submerged fire extinguishing mode, and the cabinet HFC-227ea fire extinguishing device is used to extinguish the fire automatically. The system has three starting modes: automatic, manual and mechanical emergency.

自动启动：灭火控制器设置在自动状态时，若防护区发生有烟雾或温度异常上升，该防护区的感烟(或感温)探测器动作并向灭火控制器送入一个火警信号（感温探测器温度达到 54°C 或 1 分钟内温升 3°C 就启动报警），灭火控制器即进入单一火警状态，同时驱动消防警铃发出单一火灾报警信号，此时不会发出启动灭火系统的控制信号。随着该防护区火灾的蔓延，温度持续上升或产生烟雾，另一回路的感温(或感烟)探测器动作，向灭火控制器送入另一个火警信号，灭火控制器立即确认发生火灾并发出复合火灾报警信号及联动信号(关闭送排风装置和防火阀、防火卷帘等)。经过设定（30s）时间的延时，灭火控制器输出信号启动灭火系统，灭火剂经输送管道施放到该防护区实施灭火。灭火控制器接收到压力信号器的反馈信号后显亮防护区门外的放气指示灯，避免人员误入。

Automatic start: when the fire suppression controller is set in the automatic state, if there is smoke or abnormal temperature rise in the protection area, the smoke (or temperature) detector in the protection area acts and sends a fire alarm signal to the fire suppression controller (temperature detector temperature reaches 54°C or 3°C within 1 minute to start the alarm), the fire suppression controller enters a single fire alarm state and drives the fire alarm to send a single fire alarm signal. At this time, no control signal will be issued to start the fire

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suppression system. With the spread of fire in the protection area, the temperature continues to rise or smoke, another circuit of the temperature (or smoke) detector action to the fire suppression controller to send another fire alarm signal, fire suppression controller immediately confirm the occurrence of fire and issue a composite fire alarm signal and linkage signal (to close the air supply and exhaust devices and fire damper, fire shutter, etc.). After a set (30s) time delay, the fire suppression controller outputs a signal to start the fire suppression system, and the fire suppressant is applied to the protection area through the delivery pipe to put out the fire. After receiving the feedback signal from the pressure signal, the fire extinguisher controller lights up the air release indicator outside the door of the protection area to prevent people from entering by mistake.

手动启动：当防护区经常有人工作时，可通过防护区门外主机上的手动 / 自动转换开关，使系统从自动状态转换到手动状态，当防护区发生火警时，报警控制器只发出报警信号，不输出动作信号。由值班人员确认火警，按下控制器面板或击碎防护区门外紧急启动按钮，即可立即启动灭火装置，喷放七氟丙烷灭火剂。

Manual start: When there are often people working in the protection area, the manual/automatic changeover switch on the main unit outside the door of the protection area can be used to change the system from automatic to manual state. When a fire occurs in the protection area, the alarm controller will only send out an alarm signal and will not output an action signal. The fire alarm is confirmed by the duty personnel, press the controller panel or break the emergency start button outside the door of the protection area, then the fire extinguishing device can be started immediately and the heptafluoropropane extinguishing agent can be sprayed.

机械应急启动：当防护区发生火灾时，因控制系统出现故障不能启动灭火系统，此时应由值班人员确认火警，认为关闭联动设备，拔出储瓶间内对应防护区启动瓶组上的手动保险销，用力压下手动按钮，即可使启动瓶组阀门开启，启动气体释放后打开相应的选择阀、容器瓶组，释放七氟丙烷灭火器进行灭火。

Mechanical emergency start: When a fire occurs in the protection area, due to the failure of the control system can not start the fire extinguishing system, at this time, the duty officer should confirm the fire alarm, that close the linkage equipment, pull out the manual safety pin on the corresponding protection area start bottle group in the storage bottle room, force down the manual button, you can make the start bottle group valve open, start the gas release to open the corresponding selection valve, container bottle group, release the heptafluoropropane fire extinguisher to put out the fire.

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## 2.8 电池管理系统 ( BMS )

储能电池管理系统主要部件：电池堆管理系统(BAMS)、电池簇管理系统(BCMS)、电池管理单元(BMU)和人机界面(HMI)。

The main components of the energy storage battery management system are: Battery Stack Management System (BAMS), Battery Cluster Management System (BCMS), Battery Management Unit (BMU) and Human Machine Interface (HMI).

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电池堆管理系统(BAMS)主要是获取电池堆、电池簇、电池模组的电压、电流、温度等信息进行处理，计算电池堆 SOC、SOH、可充放电量、系统运行告警与保护状态等，根据获取到的数据、计算结果执行对应的调度策略、温控策略、均衡方案等，记录各个重要操作、告警与保护日志文件，实时记录系统运行中电池堆所有运行信息，同时可以接受 EMS 调度，上送数据至云平台、ESS 管理平台等。

Battery stack management system (BAMS) mainly obtains voltage, current, temperature and other information of battery stack, battery cluster and battery module for processing, calculates battery stack SOC, SOH, chargeable and dischargeable amount, system operation alarm and protection status, etc. According to the obtained data and calculation results, it executes corresponding scheduling strategy, temperature control strategy, equalization scheme, etc., records each important operation, alarm and protection log file, and records all operation information of battery stack during system operation in real time, at the same time, it can accept EMS dispatch and send data to cloud platform, ESS management platform, etc.

电池簇管理系统(BCMS)主要是获取电池簇、本簇电池模组的电压、电流、温度等信息进行处理，计算电池簇 SOC、SOH、可充放电量、簇运行告警与保护状态等，并将获取到的数据、计算结果数据上送给 BAMS，记录各个重要操作、告警与保护日志文件，实时记录系统运行中电池簇所有运行信息，同时执行 BAMS 下发的调度、控制指令等。

The Battery Cluster Management System (BCMS) mainly obtains the voltage, current, temperature and other information of the battery cluster and the battery module of the cluster for processing, calculates the SOC, SOH, chargeable and dischargeable amount, cluster operation alarm and protection status, etc., and sends the



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obtained data and calculation result data to BAMS, records each important operation, alarm and protection log files, records all the operation information of the battery cluster during the system operation in real time, and executes the scheduling and control commands issued by BAMS.

环境监测管理单元(EMMU)主要是采集环境、动力、安防、消防等设备的运行状态，获取箱内温湿度数据，计算箱内热分布数据，根据箱内电池及各设备数据，控制风扇、空调等调节箱内温度，记录系统运行过程中的重要日志、事件、温度等数据，同时上传数据至 BAMS、ESS、云平台等。

Environmental Monitoring Management Unit (EMMU) is mainly to collect the operation status of environment, power, security, fire and other equipment, get the temperature and humidity data inside the box, calculate the heat distribution data inside the box, control the fan, air conditioner, etc. to adjust the temperature inside the box according to the data of the battery and each equipment inside the box, record the important logs, events, temperature and other data during the operation of the system, and upload the data to BAMS, ESS, cloud platform, etc. at the same time.

电池管理单元(BMU)主要是采集电池单体电压、温度、均衡电压、均衡电流、电池串总电压、压力数据、风扇转速等，计算电池特征信息、告警与保护状态等，记录电池模组运行过程中的重要日志、事件等数据，执行 BCMS 下发的温控策略、均衡策略等，同时上报电池相关数据给 BCMS。

The Battery Management Unit (BMU) mainly collects battery cell voltage, temperature, equalization voltage, equalization current, total battery string voltage, pressure data, fan speed, etc., calculates battery characteristic information, alarm and protection status, etc., records important logs and events during battery module operation, executes temperature control strategy and equalization strategy issued by BCMS, and reports battery related data to BCMS.

人机界面(HMI)是系统和用户之间进行交互的媒介，用户能够通过 HMI 直观地查看电池堆、电池簇、电池包等数据信息，同时可以对系统进行控制操作(如阈值设置、断路器状态设置等)。

The human-machine interface (HMI) is the medium of interaction between the system and the user. The user can visually view the data information of the battery stack, battery cluster and battery pack through the HMI, and at the same time can control the system (such as threshold setting, circuit breaker status setting, etc.).

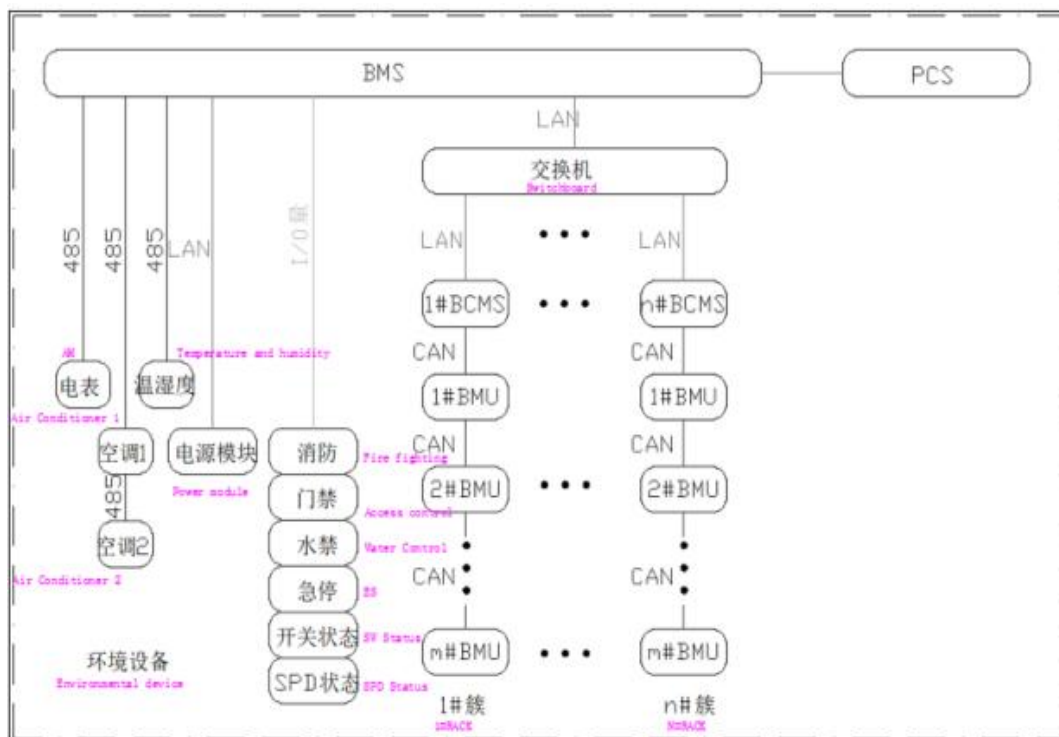


图 2-8 通讯拓扑图 Figure 2-8 Communication topology

## 2.9 储能逆变器 ( PCS )

储能逆变器规格参数表 Specification parameter table of PCS energy storage inverter

型号Model	
交流接入方式 三相四线 AC access mode three-phase four-wire	三相三线 Three-phase Three-wire
电池侧参数 Battery side parameters	
额定功率 Rated power rating	550KW
直流电压范围 Dc voltage range	600V ~ 900V
每路最大直流电流 Maximum DC current per circuit	880/440/220/110A
交流侧参数 Ac side parameters	
额定功率 Rated power rating	500kVA
最大交流功率 Maximum AC power	550kVA
额定电网电压 Rated grid voltage	400V,3W+PE
允许电网电压 Permissible grid voltage	380/400 ( -15%~15% ) Vac
额定电网频率 Rated network frequency	50/60 ( -2.5~2.5 ) Hz
额定功率下总谐波畸变率 at rated power	≤3%

功率因数 Power factor	0.99/-1~1
系统特性 System Characteristics	
最大转换效率 Maximum conversion efficiency	98.3%
防护等级 IP Grade	IP20
工作环境温度 Operating temperature	- 20°C ~ +60°C ( > 50°C降容Reduced capacity )
允许湿度范围 Permissible humidity range	0 ~ 100% , 无凝露No condensation )
不降额海拔高度 No derating altitude	3000m
冷却方式 Mode of cooling	风冷 Wind cold
通讯接口 Communication interface	RS485/CAN/Ethernet
外形尺寸 Size	1100×2160×800 mm
重量 Wight	600kg

## 2.10 能量管理系统 ( EMS )

