LIVOLTEK

User Manual

125 kW/261 kWh Commercial & Industrial Energy Storage System

v1.0 2025.03



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About This Manual

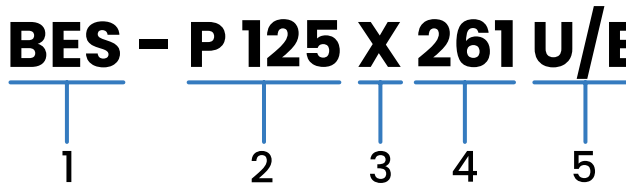
Validity

This manual is an integral part of Energy Storage System. It describes the installation, electrical connection, commissioning, maintenance and troubleshooting of the product. Please read it carefully before operating.

This manual is valid for the following products:

- BES-P125X261E
- BES-P125X261U

Model Description



1	**Product Name**	Battery Energy System.
2	**Power**	Rated power of the PCS. Value range: 75 (75 kW), 100 (100 kW), 110 (110 kW) and 125 (125 kW).
3	**Outdoor cabinet series**	X series Industrial & Commercial Battery System.
4	**Battery Capacity**	The battery capacity is 261 kWh.
5	**Standard**	U: Conforms to the American Standard. E: Conforms to the European Standard.

Target Group

This manual is suitable for operators of energy storage systems and electrical technicians with corresponding qualifications.

All installation operations must and can only be completed by professional technical personnel. Professional technical personnel need to meet the following requirements:

- Have received specialized training.
- Have read this manual in full and understand the safety matters related to the operation.
- Be familiar with local standards and safety regulations related to electrical systems.

Symbol Description

When installing, operating and maintaining the equipment, please read this manual first and follow all the safety precautions marked on the equipment and in the manual. In order to ensure the user better use of this product and to protect personal and property safety, the following symbols used to prompt, please read carefully.



DANGER

Indicates risk of Electric Shock which will result in death or serious injury if not avoided.



WARNING

Indicates a situation of moderate potential hazard that could result in death or serious injury if not avoided.



CAUTION

Indicates a low level of potential hazard that, if not avoided, could result in moderate or minor injury to personnel.



NOTE

Emphasis and additions to the content may also provide tips for optimizing the use of the product.

Release Note

Version	Version Update Record	Date
v1.0	Initial release.	2025-03-24

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1 Safety Instructions

1.1 General Safety

This equipment should be used in an environment that meets the design specifications, otherwise it may cause equipment failure, and the resulting abnormal equipment function or damage to parts, personal safety accidents, property damage, etc. Which are not covered by the equipment quality warranty. Local laws, regulations and codes should be observed when installing, operating and maintaining the equipment. The safety precautions in this manual are only supplementary to local laws, regulations, and codes. The Company shall not be liable in the event of any of the following occurrences.

- The installation and use environment exceed the provisions in the relevant international, national and regional standards.
- Do not operate under the conditions of use described in this manual.
- Unauthorized disassembly, alteration of products or modification of software code.
- Failure to follow the operating instructions and safety warnings in the product and documentation.
- Damage to equipment caused by abnormal natural circumstances (force majeure, such as earthquakes, fires, windstorms, floods, mudslides, etc.).
- Damage caused by the customer's failure to follow shipping and installation requirements.
- Damage caused by storage conditions that do not meet the requirements of the product documentation.
- Damage to the hardware or data of the device due to customer negligence, incorrect operation or intentional damage.
- Damage to the system caused by a third party or the customer, including damage caused by relocating and installing the system in a manner that does not comply with the requirements of this manual, as well as adjusting, altering, or removing identifying marks in a manner that does not comply with the requirements of this manual.
- Defects, failures or damages caused by acts, events, negligence or accidents beyond Seller's reasonable control, including power outages or electrical failures, theft, war, riots, civil commotion, terrorism, willful or malicious damage.

DANGER

The equipment is subject to high voltages, and unregulated operation may cause electric shock or fire, resulting in death, serious personal injury, or severe property damage. Please follow the operating sequence and safety precautions given in this manual and other related documents to standardize the operation.

- Check that the device's pre-installed cable connections are tight. Check the device for damage, such as holes, dents or other signs of possible internal damage. Check that the internal parts of the equipment are not displaced. Any unauthorized alteration of the equipment's structure, installation order, etc. is prohibited.
- Do not use water to clean electrical parts inside the equipment. If liquid is found inside the equipment, press the emergency stop switch immediately and notify the site manager.
- Do not carry out installation, wiring, maintenance and replacement operations with electricity. Measure the voltage at the point of contact before touching any conductor surface or terminal, and make sure that the protective earth wire of the equipment or parts to be serviced is reliably grounded and that there is no danger of electric shock.
- Do not approach the equipment except for the person who will operate it. Do not energize the equipment without completing the installation or without confirmation from a qualified person. Ensure that at least two persons are present when power is first applied or when the main circuit is energized.

NOTE

- Users in the transportation, handling, installation, wiring and maintenance of the process of operating behavior and operating tools, must meet the country, region, laws and regulations and relevant standards.
- When installing, operating, or maintaining, it is necessary to clean the top of the cabinet of any standing water, ice, snow, or other debris before opening the cabinet door to avoid debris falling into the cabinet.
- Reverse engineering, decompiling, disassembling, adapting, implanting or other derivative operations on the device software is prohibited, as well as researching the internal implementation of the device, obtaining the source code of the device software, stealing intellectual property rights, etc., In any way, or disclosing the results of any device software performance tests.

1.2 Electrical Safety

1.2.1 Cabling Requirements

- Please choose cables that meet the requirements of local laws and regulations. Cables of the same type should be tied together, and cables of different types should be laid separately, and it is prohibited to twist or cross lay each other.
- When wiring is completed or you leave for a short period of time during the wiring

process, you need to immediately seal the cable opening and close the cabinet door to avoid small animals from entering.

- The cables used in the energy storage system shall be firmly connected, well insulated, and in accordance with the specifications. The location of the cable through the pipe or over the hole, must be protected to avoid the cable by sharp edges, burrs and other damage.
- Cable wiring is completed, you need to use the cable bracket and cable clamps for reliable fixing, backfill the soil area of the cable to ensure that the ground is closely adhered to, to prevent backfilling soil, cable deformation or damage caused by force.
- Cables used in high temperature environments may cause the insulation to deteriorate and break, the distance between the cable and the periphery of the heat generating device or heat source area is at least 30mm.
- In order to ensure construction safety, all cables should be laid and installed above 0°C. When handling cables, especially when constructing in low-temperature environments, they should be gently held and placed.

1.2.2 Grounding Requirements

- Tampering with the grounding conductor is prohibited. The grounding body of the equipment should be permanently connected to the protective grounding grid. Before operating the equipment, check the electrical connections of the equipment to ensure that it is reliably grounded.
- The equipment grounding impedance meets the requirements of national standard GB 50054 and local electrical standards.
- Do not operate equipment without a grounding conductor. When installing equipment that requires grounding, install the protective earth conductor first; when removing equipment, remove the protective earth conductor last.

1.2.3 Inspection Requirements

- Before connecting or removing cables, disconnect the protective switch of the corresponding circuit.
- Use a multimeter of the corresponding voltage level to verify that it is not energized and to ensure that the equipment has been completely de-energized.
- If there is an electrically charged body nearby, cover or wrap it with an insulating board or tape.
- Use a grounding wire to reliably connect the circuit to be serviced to the grounding circuit before performing O&M.

NOTE

- Before connecting the cables, make sure that the cable labels are correctly labeled before connecting them.
- If the unit has multiple inputs, disconnect all inputs to the unit and wait until the unit is completely powered down before operating the unit.
- After completing the inspection, remove the grounding wire between the inspection circuit and the grounding circuit.

1.3 Mechanical Safety

WARNING

- The bottom board must be removed for fork transportation without wooden crate bottom bracket. Lifting and lowering should be carried gently and put down gently, avoiding impact or vibration.
- The center of gravity of the box should fall in the middle of the two forks of the forklift during transportation. It is prohibited to carry the box for long distance or invert or tilt it.
- When transporting the equipment, the operator's view may be blocked due to the large size of the equipment, so it is necessary to arrange for auxiliary personnel to assist in the completion of the task.
- In order to ensure the safety of drilling holes outside the body of the equipment, a suitable location should be selected before drilling to ensure that it will not cause short circuits and other effects. During the drilling process, the equipment should be covered to prevent debris from falling into the equipment, and the debris should be cleaned up in time after drilling.
- When carrying equipment by hand, you should be prepared to bear the weight and should wear protective gloves, anti-smash shoes and other safety gear.
- The equipment must be moved carefully during handling to avoid impact or dropping. Avoid scratching the surface of the equipment, damaging parts or cables.

1.4 Battery Safety

NOTE

We are not responsible for damage to the batteries supplied by us caused by the following reasons:

- Failure to charge and accept the battery in time due to the customer, resulting in overdue storage, loss of capacity or irreversible damage.
- Mechanical damage from dropping, liquid leakage, rupture, etc. caused by improper handling or failure to connect the battery as required.
- The customer or a third party may change the usage of the battery without informing us. This includes, but is not limited to, connecting additional loads to the battery, mixing it with other brands of batteries, mixing it with batteries of different rated capacities, etc.
- Due to the field equipment operating environment or external power parameters can not meet the environmental requirements of normal operation, the battery caused by direct damage. Including the actual operating temperature of the battery is too high or too low, poor power grid conditions and frequent power outages.
- Customers do not correctly set the battery operation and management parameters or improper maintenance caused by frequent over-discharge of the battery, the customer site expansion or long-term failure to fully charge.
- The customer has not properly maintained the battery in accordance with the operation manual of the supporting equipment, including but not limited to: not regularly checking whether the battery terminal screws are tightened.
- Batteries are lost by theft.
- Batteries that have exceeded the warranty period.

DANGER

- Do not expose the battery to high temperatures or around heat generating equipment, such as sunlight, fire, transformers, heaters, etc. Overheating of the battery may cause fire or explosion.
- It is prohibited to disassemble, modify or damage the battery (e.g., inserting foreign objects, immersing in water or other liquids, etc.), which may cause the battery to leak, overheat, catch fire or explode.
- Battery thermal runaway generates flammable gases, as well as harmful gases such as CO and HF. The accumulation of flammable gases after thermal runaway of the battery poses a risk of deflagration and explosion, which may cause personal injury and property damage.
- When installing and maintaining the battery, it is necessary to wrap the exposed cable terminals on the battery with insulating tape. At the same time, avoid foreign objects (e.g. conductive objects, screws, liquids, etc.) from entering the interior of the battery and causing a short circuit.

WARNING

- Batteries must be stored in a separate warehouse, and stored in the outer packaging, avoiding mixed storage with other materials, avoiding open storage, and avoiding stacking batteries too high. The site must be equipped with fire-fighting facilities that meet the requirements, such as fire sand and fire extinguishers.
- Batteries should be protected from impact. When handling the battery, it should be carried in the direction required by the battery, and inverted and tilted are prohibited.
- Please use the battery within the temperature range specified in this manual. When the ambient temperature of the battery is lower than the lower limit of the operating temperature, charging is prohibited to avoid internal short-circuiting of the battery due to crystallization that occurs with low temperature charging.
- Please dispose of used batteries in accordance with local laws and regulations, and do not dispose of batteries as household waste.
- If it has been more than 8 months since the battery was last charged, the battery needs to be recharged. Failure to recharge the battery as required may affect the performance and service life of the battery.

Battery Abnormal Handling Measures

DANGER

- When an electrolyte leak occurs or there is an unusual odor, avoid contact with the leaking liquid or gas. Non-professionals should stay away and contact a professional immediately to handle the situation.
- Electrolyte is corrosive and contact may cause skin irritation and chemical burns. If contact with battery electrolyte occurs, the contact area needs to be washed immediately with plenty of water and soap and medical help sought immediately.
- After dropping the battery (no matter with or without package), it is forbidden to continue to use it. If there is no obvious deformation or damage in appearance and there is no obvious odor, smoke or fire, transfer the battery to an open and safe place for 1h under the premise of ensuring safety, and contact our service engineer.
- When there is obvious odor, breakage, smoke or fire after the battery falls, evacuate people immediately and call the police in time. By professional personnel in the protection of safety, the use of fire fighting facilities to extinguish the fire.

1.5 Maintenance and Replacement

WARNING

- It is prohibited to open the cabinet door in rain, snow, lightning, dust, fog, etc.
- Before parts are removed from the cabinet, make sure that other parts on the cabinet are not loose.
- During equipment maintenance, nearby energized parts should be covered with insulating material.
- Prohibit any object from touching the operating fan (e.g., fingers, parts, screws, etc.) until the fan is powered off and stops rotating.
- Do not power up the unit before troubleshooting.
- When inspecting the system with electricity, pay attention to the hazard warning signs on the equipment and avoid standing at the cabinet door.
- Equipment other than battery packs must wait 15 minutes after powering down to ensure that the equipment is unpowered before operating the equipment.
- Manual wiring inspection is required to avoid abnormal system operation after power components of the energy storage system are replaced or wiring is changed.
- After completing the operation related to maintenance and replacement, lock the cabinet door in time and keep the key properly.

1.6 Symbols

The symbols below may be found on the electrical parts of the PCS unit. Make sure to read the following symbols and fully understand them before installing the equipment.



Follow the instruction in this manual for service and replacement.



CE Mark.



RCM mark of conformity.



RoHS Mark.



Complies with the requirements of the applicable UKCA guidelines.



Complies with the requirements of the applicable UKNI guidelines.



Warning: General warning sign



Caution: Risk of Electric Shock
Disconnect all incoming power and turn off the product before working on it.



Caution: Hot Surface
Metallic parts of enclosure may be hot during operation.



Caution: Risk of Electric Shock
Hazardous voltage is still present 5 minutes after all power sources have been disconnected. Wait for at least 5 minutes before maintenance to prevent electric shock.



WEEE Mark.
All electrical and electronic products should be disposed of separately from the municipal waste stream via designated collection facilities appointed by the government or the local authorities.
The correct disposal of your old appliance will help prevent potential negative consequences for the environment and human health.
For more detailed information about disposal of your old appliance, please contact your city office, waste disposal service or the shop where you purchased the product.

2 Products

2.1 System Description

- Commercial & Industrial PV and Storage Application Scenario

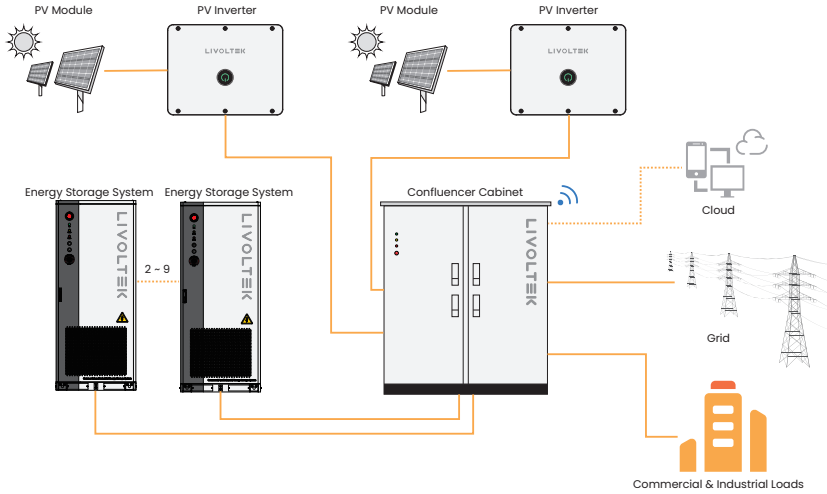


Figure 2-1 C & I PV and Storage Application Scenario

- Commercial & Industrial Storage Application Scenario

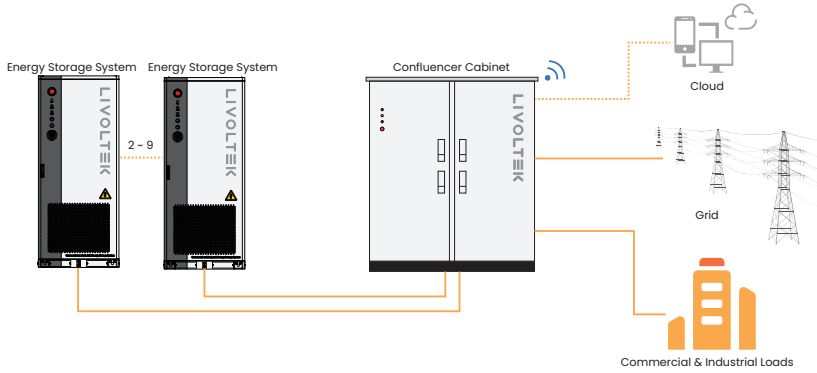


Figure 2-2 C & I Storage Application Scenario

NOTE

In the scenario of parallel operation, please refer to the combiner cabinet manual for guidance.

2.2 Product Overview

BES-X series energy storage system integrates high performance PCS, BMS, high-capacity battery modules, smart EMS, and advanced liquid cooling unit and fire protection mechanism in one cabinet. Adopting modularized PCS, it is easy to maintain and expand capacity, featuring safety and reliability, rapid deployment, low cost, high energy efficiency and intelligent management.

The operation strategy of the energy storage system for common application scenarios:

Peak Shaving and Valley Filling: During off-peak hours as per time-of-use tariffs, the energy storage cabinet automatically initiates charging and remains on standby once fully charged. Conversely, during peak hours, it discharges automatically, capitalizing on tariff differentials for arbitrage, thereby enhancing the economic efficiency of the solar storage and charging system.

PV (Photovoltaic) and Storage Integration: The system dynamically monitors local load demand, giving priority to using photovoltaic-generated power for self-consumption, with excess energy stored. In instances where photovoltaic output is inadequate to meet the immediate local load requirements, the stored energy in the battery is then utilized as a primary supplement.

2.3 Electrical Wiring Diagrams

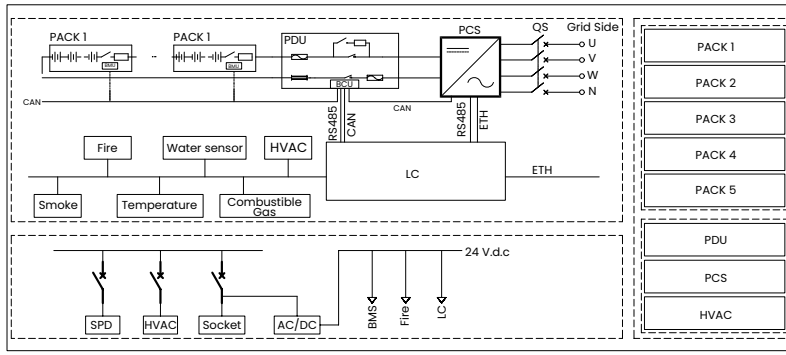


Figure 2-3 Circuit Diagram

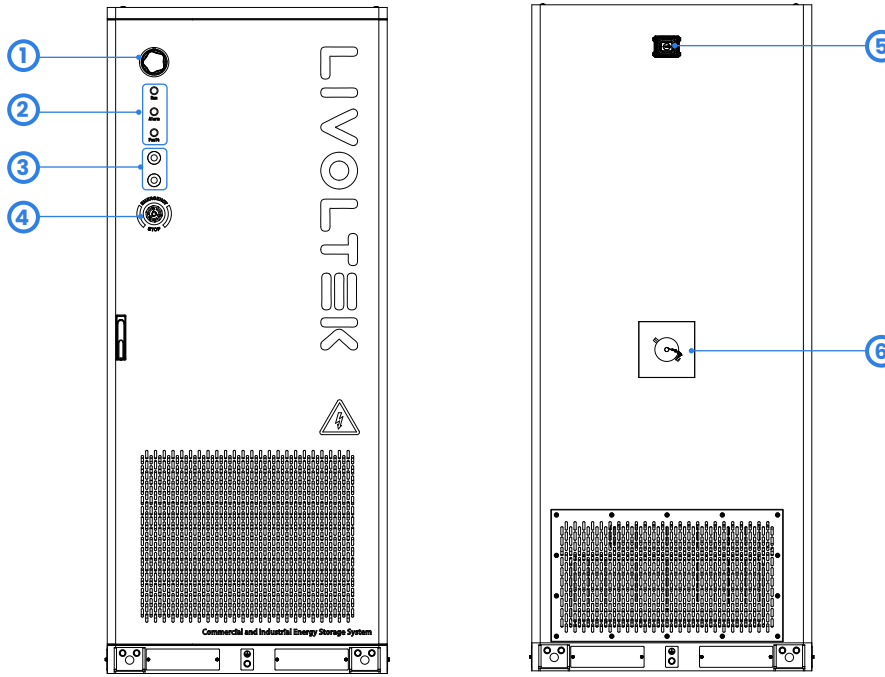
NOTE

Figure 2-1 for the system program with parallel off-grid, different projects with different configurations, the line is slightly different, the actual shipping attached drawings shall prevail.

2.4 Product Features

- System productization, integrating energy storage battery, PCS, energy management monitoring system, power distribution system, environmental control system and fire control system, etc., to fully control the system operation status and risk;
- Configuration of rack-type modular PCS, support for multiple parallel connection, good scalability; according to the system capacity requirements of micro-grid and other scenarios to select the number of PCS modules and the total battery power, the typical configuration is: 125 kW/261 kWh.
- With protection class IP55, it can perfectly cope with all types of weather outdoors;
- Built-in smoke sensing, temperature sensing, gas sensing, fire extinguishing system, real-time monitoring of the state of the electric cabinet, to ensure the safety of product operation;
- Efficient liquid cooling temperature control to maintain optimal operating status;
- Smart energy management cloud platform, cell-level refined monitoring and diagnosis.

2.5 Apperance



Front view Rear view

Figure 2-4 Apperance

Table 2-1 Appearance

No.	Item	Description
①	Sound and lighr alarm	Simultaneously emits sound and light alarm signals.
②	Indicators	To display status information of all processess running on the system.
③	Antenna	4G antenna for expanding data transmission. WiFi antenna.
④	Emergency stop button	To shut down the system in emergency circumstances.
⑤	Explosion relief valve	To prevent explosions of system or equiment due to excessive internal pressure.
⑥	Fire hose coupling	Connect to the interface of the water supply system.

2.6 Product Parameters

The following are the typical configuration parameters of BES-X series outdoor cabinet energy storage system, the actual supply is subject to the technical agreement.

Table 2-2 Parameters of the Energy Storage System

Items	Specifications	Note
	Cell	
Cell Capacity [Ah]	314 @ 25 °C, 0.5 C / 0.5 C	
Cell System	LFP	
Nominal Voltage [V]	3.2	
Energy Density [Wh/kg]	165.9	
	Module	
Format	CTP Module 1P13S	
	Battery Pack	
Nominal Energy [kWh]	52.24	
Module Composition	1P52S	5 Modules
Communication Method	CAN	

	PCS Module (AC Side)	
Rated power [kW]	125	
Output Voltage [Vac]	380/400/480	3W + N + PE
Full Load Voltage Range [V]	340 ~ 460 / 408 ~ 528	
Rated Frequency [Hz]	50/60 (±5)	
	Battery System	
Nominal Voltage [V]	832	
Total Energy [kWh]	261.2	25 °C, 0.5 C / 0.5 C
Operating Voltage [V]	741 ~ 936	
Number of Battery Packs	5	Maximum Number of Packs
System Components	1P260S	
Rated power [kW]	125	
Depth of Discharge	90% DOD	
Operating Temperature [°C]	Charge: 0 ~ 60 Discharge: -30 ~ 60	
Number of Parallel Connections on DC Side	On grid: 10 Off grid: 8	
Communication Method	RS485 / CAN / Ethernet / 4G / WiFi	
Thermal Management Methods	Liquid cooling + Liquid Heated	
Fire Fighting Methods	Aerosol	
Dimension (W × H × D) [mm]	1000 × 2380 × 1350	
Weights [kg]	2400 ± 50	

NOTE

The actual parameters have been set at the factory according to customer requirements.

2.7 Components

2.7.1 Battery System

Table 2-3 Battery System Parameters

Cell Parameters		
Battery Type	Lithium Iron Phosphate (LFP)	
Nominal Voltage [V]	3.2	
Voltage Range [V]	2.5 ~ 3.65	
Nominal Capacity [Ah]	314	
Maximum Operating Temperature Range, Charging [°C]	0 ~ 60	
Maximum Operating Temperature Range, Discharge [°C]	-30 ~ 60	
Pack Parameters		
Series-Parallel Connection Method	1P52S	
Rated Energy [kWh]	52.2	
Nominal Voltage [V]	166.4	
Voltage Range [V]	145.6 ~ 187.2	
Weight (Approx.) [kg]	330 ± 10	
Dimension (W × D × H) [mm]	790 × 1130 × 248.5	
Battery Cabinet Parameters		
Model	BHF-X261D	BHF-X209D
Rated Energy [kWh]	261.2	209
Rated Voltage [V]	832	665.5
System Voltage Range [V]	741 ~ 936	592.8 ~ 748.8
Series-Parallel Connection	1P260S	1P208S
Number of Battery Packs	5	4
Weight (Approx.) [kg]	2300 ± 50	1970 ± 40

2.7.2 Battery Management System

The Battery Management System (BMS) operates on a dual-layer structure comprising the Battery Management Unit (BMU) and the Battery Control Unit (BCU). The BMU, situated within the battery enclosure, is responsible for acquiring data pertaining to individual battery cells, relaying this data to the BCU, and executing cell balancing within the enclosure based on directives from the BCU.

Meanwhile, the BCU, housed in the main control cabinet, oversees battery cabinet management. It receives detailed data uploaded by the BMUs, samples the voltage and current of the entire battery cabinet, conducts State of Charge (SOC) calculations and calibrations, manages pre-charging and charging/discharging operations of the cabinet, and transmits relevant data to the Human Machine Interface (HMI).

NOTE

BMU, BCU is the name of two-class BMS by some battery manufacturers, which is different for different manufacturers.

2.7.3 Electrical System

The outdoor cabinet energy storage system adopts the PCS-125K. It achieves a maximum inverter efficiency of up to 99%, significantly improving energy utilization. The basic parameters of PCS power module are as follows:

Table 2-4 Parameters of the Converter

Model	PCS-125KMG1
Rated Power [kW]	125
Maximum Power [kW]	137.5
DC Operating Voltage Range [V]	700 ~ 950
DC Side Full Load Voltage Range [V]	728 ~ 950
Maximum DC Current [A]	188.9
Rated AC Voltage [Vac]	480, 3W + N + PE / 3W + N
Rated Frequency [Hz]	50 / 60, (± 5)
Rated AC Current [A]	150.4
Overload Capacity	110%, normal operation; 120%, 1 minute; 150%, 10 seconds

Model	PCS-125KMG1
Current Distortion	< 3% (rated power)
Power Factor Adjustment Range	-1 Leading ~ +1 Lagging
Ability To Carry Unbalanced Loads	100%
Adaptive Battery	Lithium
Charging Method	By BMS Command / Three-Stage
Operating Mode	Constant Voltage, Constant Current, Constant Power, MPPT, AC Voltage Source, DC Voltage Source, VSG
Maximum Efficiency	99%
Dimensions (W × D × H) [mm]	600 × 800 × 270
Weight (Approx.) [kg]	≤ 75
Isolation Method	non-isolated
Protection Class	IP66
Operating Temperature [°C]	-30 ~ +60 (> 40 °C derating)
Relative Humidity	0 ~ 100% (non-condensing)
Cooling Method	Forced air cooling
Static (In a Signal) [dB]	≤ 75
Altitude [m]	4000 (> 2000 m derating)
Communication Interface	RS485 / CAN (optional)

2.7.4 Environmental Control Systems

The energy storage system is equipped with comprehensive environmental monitoring and fire suppression systems, including devices like smoke detectors, temperature sensors, combustible gas detectors, water sensors, and fire extinguishers. These components collectively ensure full control over the system's operational status and immediate response to environmental anomalies. A schematic diagram illustrating the environmental control system is provided for reference.

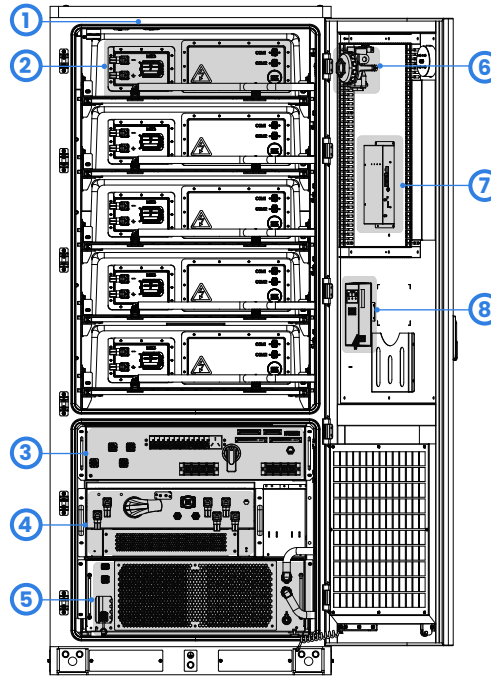


Figure 2-5 Cabinet Internal Structure

Table 2-5 Appearance

No.	Item	No.	Item
1	Smoke/Temperature detector	5	HVAC
2	Battery pack × 5	6	Combustible gas sensor
3	PDU	7	Local controller
4	PCS	8	Dehumidifier

2.8 Configuration List

In summary, the overall configuration list of the energy storage system in a typical configuration is as follows:

Table 2-6 Overall Configuration List of 125 kW / 261 kWh Outdoor Cabinet Energy Storage System

Name	Model number	Unit	Quantity	Note
Battery system	BES-X261	set	1	5 battery boxes, one high-voltage control box
Energy storage converter	PCS-125K	PCS	2	Modular converters
Air conditioning system	ITMM-S1HW050-FBRR	set	1	HVAC
Environmental monitoring system	Smoke sensing, temperature sensing, combustible gas detection, flooding, etc.	set	1	Environmental monitoring
Fire protection system	JAD300-U01	set	1	Electric start
Power distribution system	Power distribution box	pcs	1	Auxiliary equipment
Local management system	Lotus-ESS	set	1	

3 Installation with Wiring

3.1 Transportation and Handling

3.1.1 Product Transportation

- For better protection of the equipment, transportation with packaging is recommended;
- Transportation of equipment should be carried out in accordance with the marking requirements on the packaging to prevent personal injury and equipment damage;
- Energy storage batteries are not recommended for railroad transportation and air transportation. Speed limit requirements for land transportation: 80km/h on flat roads, 60km/h on rugged roads, in case of conflict, please refer to local traffic regulations.

3.1.2 Product Handling

- When using a forklift to move to ensure that the forklift has enough load capacity, and pay attention to the center of gravity of the equipment needs to fall between the feet of the forklift to prevent personal injury and equipment damage;
- Forklifts with batteries need to have a load capacity of ≥ 3 t; forklifts without batteries need to have a load capacity of ≥ 1.5 t;
- Recommended fork knife length ≥ 1.3 m, width 80 cm ~ 160 cm, thickness 25 mm ~ 60 mm.

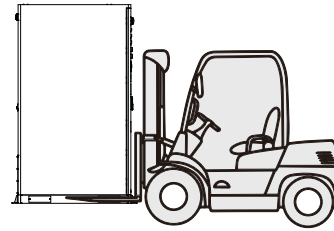


Figure 3-1 Schematic Diagram of Handling

3.2 Packaging and Storage

3.2.1 Product Packaging

In order to keep the product in a better state of protection during transportation, it is packed in specific wooden crates. The following basic parameters (including but not limited to) are available on the equipment package, which need to be checked carefully according to the project requirements:

Table 3-1 Packaging Parameters

Parameters	Clarification
Model number	Product Model
Sizes	The external dimensions of the fully packaged product, including all protective materials (e.g., foam, pallet, or crate).
Weights	The gross weight of the product, including the inverter cabinet, internal components, and all packaging materials
Markings	Symbols, icons, or text printed on the packaging to ensure safe transportation and storage. Face up, careful placement, center of gravity, etc.

3.2.2 Product Storage

The product shall not be stored in an exposed outdoor location if the product is not immediately transported or installed for use in a storage location that complies with the following conditions:

Table 3-2 Requirements for Product Storage Conditions

Parameters	Request
Storage temperature (without battery) [°C]	-25 ~ +60
Battery [°C]	10 ~ 30
Storage relative humidity	< 95% (no condensation)
Height above sea level [m]	< 4000

NOTE

Long-term storage of batteries is not recommended. There will be capacity loss in long term storage of lithium batteries, the general irreversible capacity loss of lithium batteries is 3%~10% after 12 months of storage at the recommended storage temperature. Battery packs should be stored and shipped for a total of no more than 6 months (counting time from shipment). Beyond 6 months a recharge and SOC calibration is required, at a minimum to 50% SOC. failure to recharge as required may affect the performance and service life of the battery.

3.3 Installation Site Selection

The layout of the energy storage system installation must meet the fire distance or fire wall requirements specified in local standards, including but not limited to GB 51048-2014 Design Code for Electrochemical Energy Storage Power Plants, NFPA 855 Standard for theInstallation of Stationary Energy Storage Systems. Code Requirements. The energy storage system is only applicable to outdoor scenarios and requires an outdoor arrangement and does not support indoor arrangements. The general requirements for siting are as follows:

- The level of the installation location should be above the highest historical water level in the area. The distance to airports, buried waste disposal sites, river banks or dams should be ≥ 2 km.
- Select a well-ventilated area. Do not block the ventilation openings and heat dissipation system while the equipment is in operation to prevent fire from high temperatures. Installation space is sufficient to ensure that the surrounding equipment will not be affected by the heat generated by the product; install in a location that ensures sufficient space for external wiring. Equipment with convenient transportation conditions and reliable fire suppression systems.
- Keep the installation location away from sources of ignition and do not place flammable or explosive materials around the equipment. If the equipment is installed in a place with lush vegetation, in addition to routine weeding, the ground underneath the equipment needs to be hardened to prevent overgrowth of weeds.
- Do not install the energy storage system outdoors in salt-affected areas to prevent equipment corrosion and fire. Salt-hazardous areas are defined as areas within 2km from the coast or affected by sea breezes.
- The energy storage system must be equipped with protective measures such as fences and walls, and safety warning signs must be erected for isolation to avoid entry of unauthorized personnel during the operation of the equipment, which may result in personal injury or property damage.
- The equipment is installed in an area away from liquids, and should not be installed below water pipes, air outlets and other locations that are prone to condensation; it should not be installed below air conditioning outlets, vents, server room outlet windows and other locations that are prone to water leakage, to prevent liquids from entering the interior and causing short circuits in the equipment.

Re-siting is recommended when the site cannot be safely spaced to meet relevant state standards. Site selection should avoid scenarios not recommended by industry standards and regulations, including, but not limited to, the following lots, areas, and places:

- Strong vibrations, strong noise sources and strong electromagnetic field interference areas.
- Places that generate or have dust, fumes, harmful gases, corrosive gases, etc.
- Places where corrosive, flammable and explosive substances are produced or stored. Within the range of blasting hazards.
- Places where underground facilities are already in place. Densely populated places, high-rise buildings, underground buildings.
- Undesirable geologic conditions such as rubbery and weak soils, ground prone to waterlogging and subsidence.

- Within the boundaries of a mining trap (stagger) area. Areas that could be inundated by a dam or levee failure.
- Earthquake faults and seismic zones with a defense intensity higher than nine degrees. Sections with direct hazards such as mudslides, landslides, quicksand and caves.
- Important sanitary protection areas for water supply sources.
- Historic Monuments and Sites Conservation Area.

If there is no more suitable site, it is recommended to install a firewall of not less than 3h fire resistance for safety protection, while considering the space requirements for equipment transportation, installation and maintenance. It is recommended to refer to T/CEC 373-2020: the length and height of the fireproof wall should exceed the outer contour of the energy storage cabinet by 1 m each.

3.3.1 Installation Foundation Requirements

According to the product size in advance to select the equipment installation location, good positioning and fixing; recommended foundation as shown below.

- Referring to the weight of the product, the selected mounting location needs to have sufficient load-bearing strength;
- Reliable grounding point, ensure that the grounding resistance is less than 4 Ω.

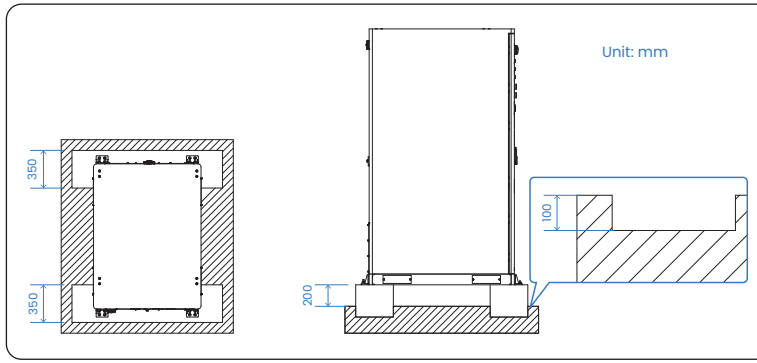


Figure 3-2 Foundation Requirements

3.3.2 Clearance Requirement

The installation clearance for a single and multiple cabinets should meet the following requirements:

- Reserve a minimal space of 600 mm around the left and right side of the cabinet.
- Reserve a minimal space of 1100 mm at the front, and a minimal space of 600 mm at the rear.

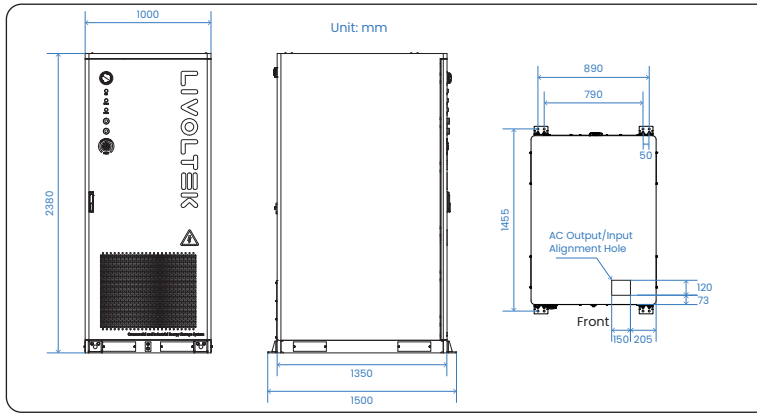


Figure 3-3 Base Reference Drawing

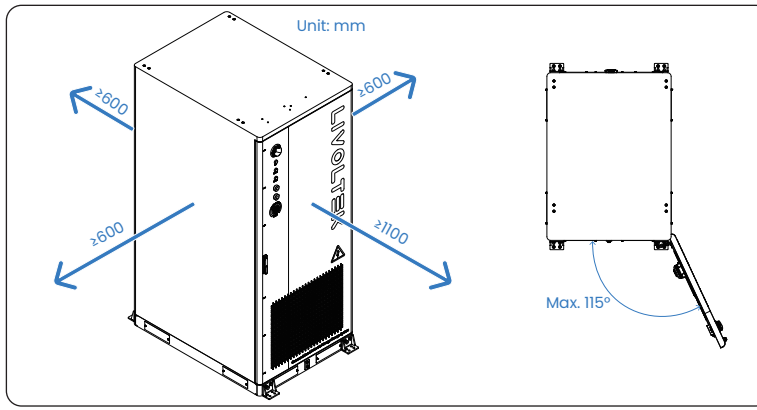
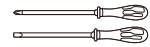


Figure 3-4 Single Cabinet Clearance Requirements

3.4 Tools Requirements


Multimeter

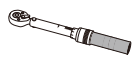

Pneumatic drill


Cross screwdriver
Straight screwdriver


Knife


Crane

Tube for wrapping


Torque wrench

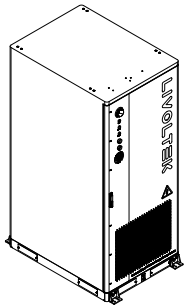

Wire crimper


Diagonal pilers

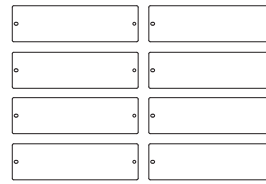

Forklift

3.5 Scope of Deliverly

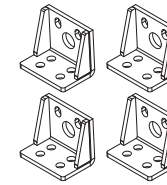
- Before installing the product, please inspect it for any signs of damage. If you detect any evidence of damage, retain the evidence and promptly contact Hangzhou Livoltek Power Co., Ltd.
- If you confirm that the product is in good condition, please proceed to check against the delivery list to verify the completeness of all components.



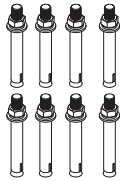
Cabinet
× 1 pc



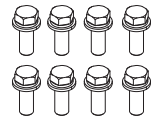
Cover plate
× 8 pcs



Angle support
× 4 pcs



M12 × 120 expansion bolt
× 8 pcs



M12 × 35 combination screw
× 8 pcs



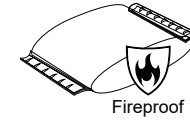
M5 × 10 combination screw
× 16 pcs



Certification of Conformity
× 1 pc



Factory inspection report
× 1 pc



Fireproofing mudsesiccant
× 2 pcs

3.6 Mechanical Installation

After making sure that there is no abnormality in the product and all accessories are complete, you can refer to the following suggestions for mechanical installation:

Step 1: After removing the packing crate, first remove the bottom enclosure of the equipment. The removed boards and screws should be put away and put back after the equipment is put into position.

Plan A

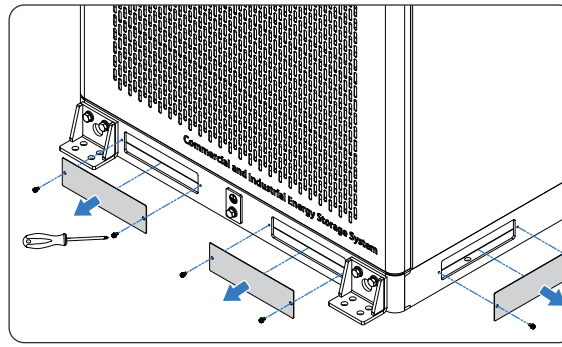


Figure 3-5 Schematic of the Bottom Enclosure of the Device

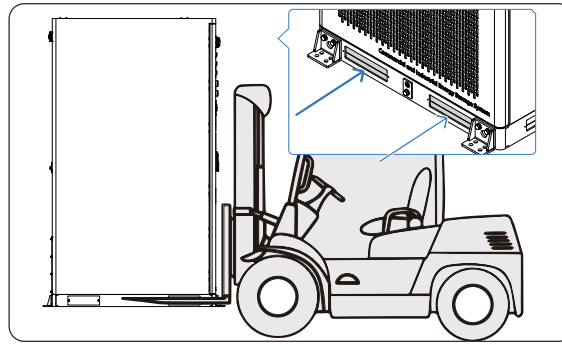


Figure 3-6 Lifting the Device by Forklift

Plan B

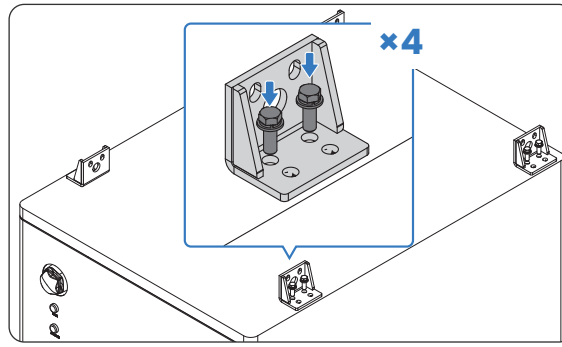


Figure 3-7 Securing the Support on the Top

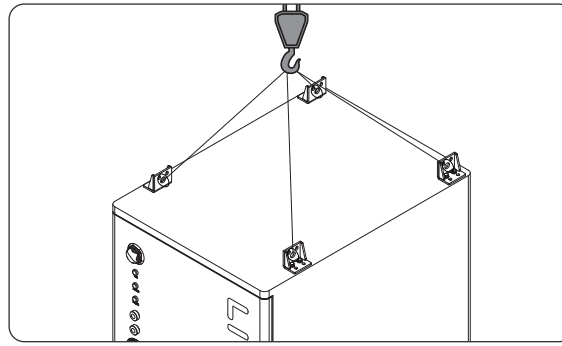


Figure 3-8 Lifting the Device by Crane

Step 2: After sitting the cabinet on the right position, remove the angle supports on the top by the way as the same as the Step 3.

Step 3: Remove the combination screws pre-fixed on the bottom of the cabinet.

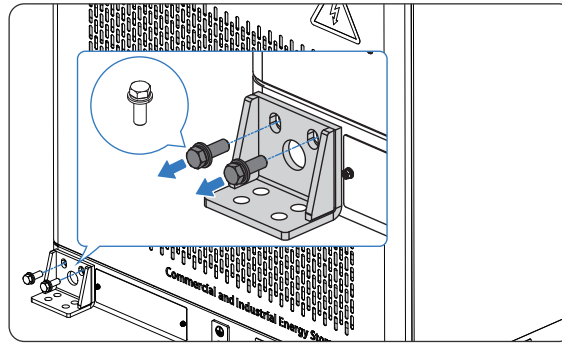


Figure 3-9 Removing Combination Screws

Step 4: Align the installation holes of the angle support to those of the cabinet, and then draw holes on the foundation surface.

Step 5: Drill holes (Ø 13 mm) with reference to the hole distances, then nail expansion bolts (M12 × 120) into the drilled holes, remove the nuts on the expansion bolts, and position the equipment on the foundation with a forklift truck so that the equipment fixing holes are aligned with the pre-buried expansion bolts on the foundation, and tighten the nuts.

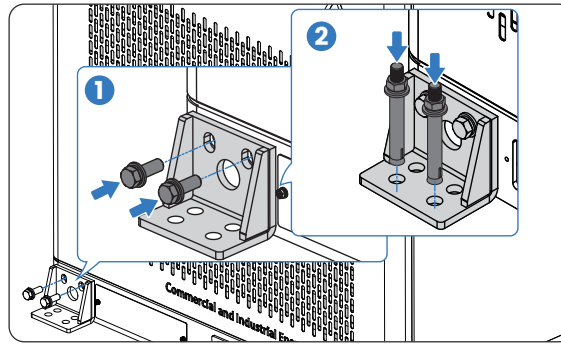


Figure 3-10 Securing the Cabinet

Step 6: Attach the cover plate, and then secure it. Follow the instruction to install altogether 4 cover plates at the front and rear sides of the cabinet bottom.

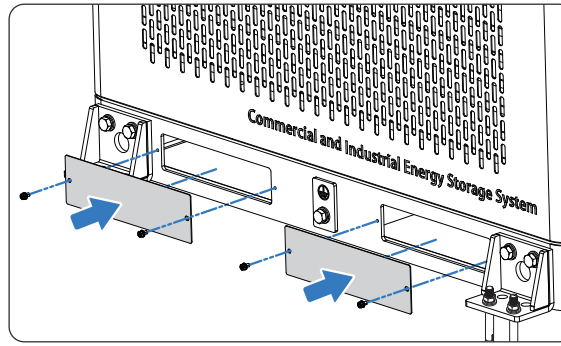


Figure 3-11 Securing the Plates

3.7 Electrical Cable Installation

3.7.1 Terminal Description

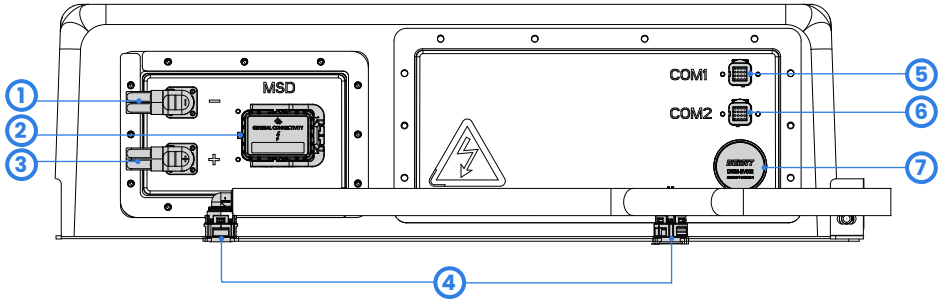


Figure 3-12 Terminals of Battery Pack

Table 3-3 Terminals of Battery Pack

No.	Item	Description
1	Negative terminal	To connect to negative power cable
2	MSD plug	To protect personnel and device safety during maintenance
3	Positive terminal	To connect to positive power cable
4	Coolant inlet and outlet	To inject and drain the coolant
5	COM 1 port	To connect to BMS or other battery packs for communication
6	COM 2 port	To connect to BMS or other battery packs for communication
7	Vent valve	For airtightness testing

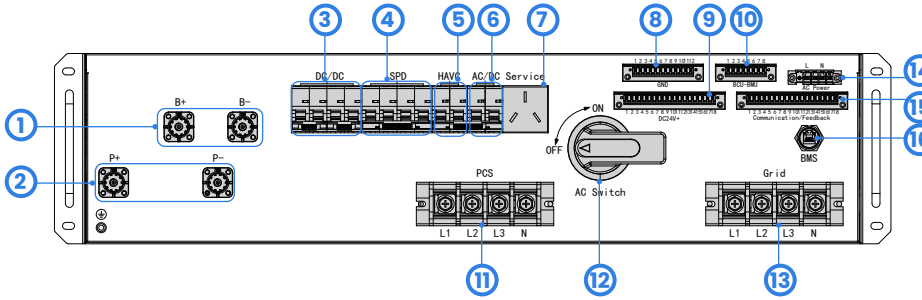


Figure 3-13 Terminals of PDU

Table 3-4 Terminals of PDU

No.	Item	Description
①	Battery output port	To connect to the battery pack's terminal
②	PCS port	To connect PCS's terminal
③	DC breaker	Disconnect the DC power supply of the auxiliary circuit
④	SPD breaker	To protect the system from voltage spikes
⑤	HVAC breaker	Disconnect the HVAC
⑥	AC/DC breaker	Disconnect the AC power supply of the auxiliary circuit
⑦	220V power supply port	Reserved
⑧	GND	0 Vdc
⑨	DC24V+	24 Vdc
⑩	BCU-BMU	Communication of BCU and BMU
⑪	PCS terminals	To connect the AC side of PCS
⑫	AC Switch	To disconnect AC connection
⑬	Grid terminals	To connect Grid
⑭	AC power terminals	The power supply of HVAC
⑮	Communication/ Feedback	High voltage box external interface
⑯	BMS COM port	To connect to BMS (reserved)

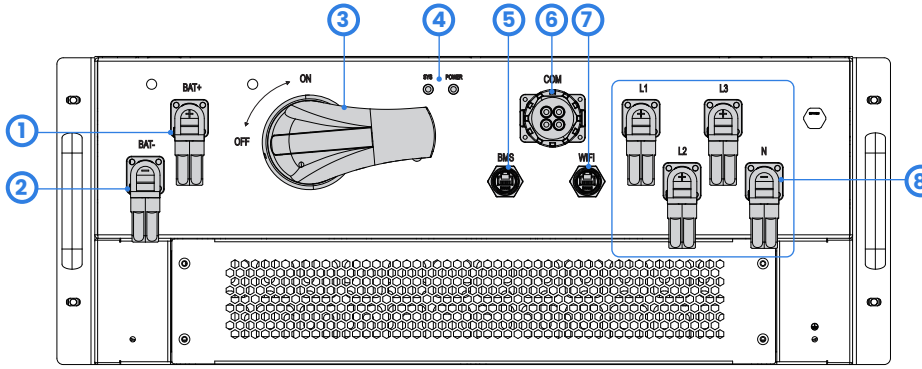


Figure 3-14 Terminals of PCS

Table 3-5 Terminals of PCS

No.	Item	Description
1	Battery positive port	To connect to the battery pack's positive terminal
2	Battery negative port	To connect to the battery pack's negative terminal
3	Battery switch	Disconnect the battery circuit if needed
4	Indicators	Display the status of the PCS
5	BMS COM port	To connect to BMS
6	COM port	Communication terminal
7	USB port	USB terminal
8	Grid terminals	Grid connection terminal

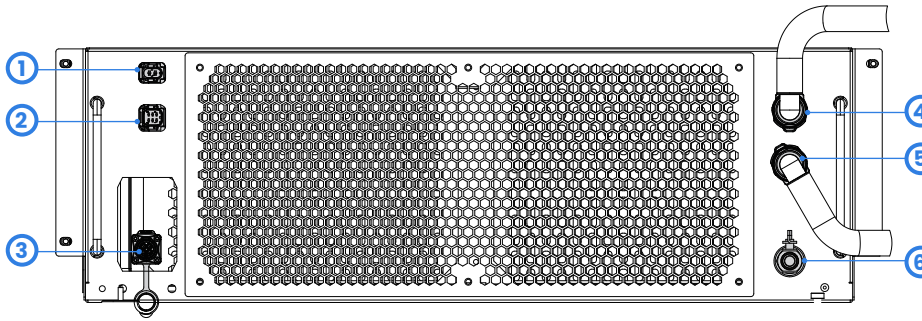


Figure 3-15 Terminals of HVAC

Table 3-6 Terminals of HVAC

No.	Item	Description
1	COM port	To communicate with LC
2	Debug port	To debug the unit
3	Power port	To supply power for the unit
4	Coolant inlet	/
5	Coolant outlet	/
6	Filler & drainage port	To inject and drain the coolant into and from the unit

3.7.2 Wiring

This product adopts the structure of all-in-one machine, the internal wiring of DC side has been completed, and only the AC side and external communication need to be installed on site with electrical cables. According to the power of the product, cable specifications provided in Table 3-5 wiring reference. Cable diameter selection should be in line with local cable standards. Factors affecting cable selection include: rated current, cable type, laying method, ambient temperature and maximum acceptable line loss.

Table 3-7 Cable Size Comparison Table

Capacity	AC cable	N cable	PE cable
50 kW	≥ 3 × 35 mm²	≥ 35 mm²	≥ 25 mm²
100 kW	≥ 3 × 70 mm²	≥ 70 mm²	≥ 50 mm²

DANGER

When performing an electrical installation, refer to the following recommendations for electrical installation:

1. Check that all switches in the equipment are disconnected before wiring to ensure that the equipment is not energized;
2. Disconnect the grid switch before wiring and make sure the cable is not energized;
3. To determine the correct phase sequence of the cable, you can add yellow, green, red and black different colors of insulation sheath or marking to distinguish, to prevent phase sequence error;
4. Cable terminals and copper row connections need to be compressed, screws to choose the right length, so as not to affect the insulation and tightening;
5. Lay communication and power cables as separately as possible, and ensure that the cable insulation is not damaged during the laying process;
6. The grounding cable must be reliably connected to the grounding copper row, and the cross-sectional area of the cable must meet the design requirements;
7. All AC cables should be connected to the appropriate phase sequence after entering the device through the access holes on the bottom of the device;
8. After the wiring is completed, use fireproof mud to seal the wiring leaks to prevent external insects and rodents from entering and damaging the equipment or cables.

In order to prevent the terminals from loosening under force and causing poor contact resulting in increased contact resistance and heat generation, etc., make sure that the bolts used to fasten the terminals meet the torque requirements.

Table 3-8 Torque

Screw Size	M4	M5	M6	M8	M10	M12	M14	M16
Torque (N × m)	1.8 ~ 2.4	4 ~ 4.8	7 ~ 8	22 ~ 29	44 ~ 58	76 ~ 102	121 ~ 162	189 ~ 252

Step 1: Remove the cover for the cable threading hole on the right side of the cabinet bottom.

Step 2: Use the key for the cabinet door to unlock the front door at the left side.

Step 3: Cut the sealing ring.

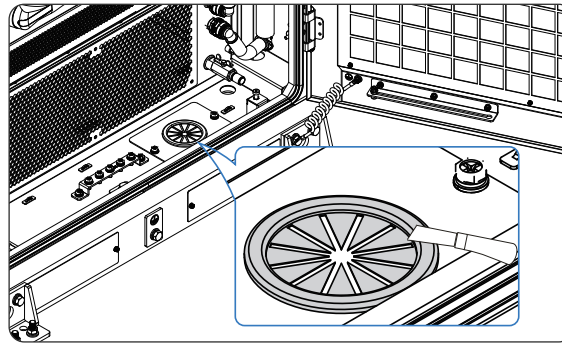


Figure 3-16 Cutting the Hole

The inlet and outlet of the energy storage system is lower inlet and outlet, after opening the baffle, the A/B/C/N copper rows at the lower end of the switch reserve Ø 8 mm openings for customers' wiring, or according to the customer's requirements for the size of the openings; the protective ground wire is connected to PE copper rows, and the equipment ground impedance meets the requirements of national standard GB 50054 and the local electrical standards.

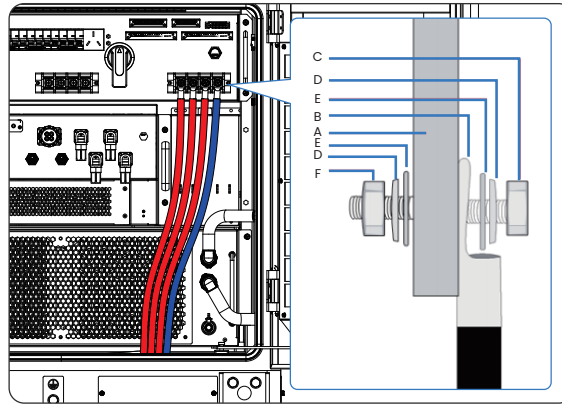


Figure 3-17 Wiring

The installation of the terminals and fixing screws and other parts used for system power cable wiring is shown below:

Table 3-9 Set Screw Installation Schematic

Serial No.	Name
A	Copper bar
B	Terminal block
C	Screw
D	Spring pad
E	Large flat washer
F	Nut

WARNING

- When using copper core cables or copper-clad aluminum cables, use copper terminal blocks.
- When aluminum alloy cables are used, use copper-aluminum transition terminals or aluminum terminals with copper-aluminum transition spacers.
- At least one large flat washer is required on one side of the screw to ensure a tight and reliable connection.

3.8 Communication Cable Installation

When installing external communication cables, it is essential to segregate them from power cables to minimize interference. The recommended minimum distance between communication lines and power cables is 300 mm. Where the communication line must cross a power cable, endeavor to ensure the angle of intersection is 90° between the two cable types. This helps to mitigate electromagnetic interference from the power cable affecting the communication line. Ideally, the communication line should run as close to the ground surface as feasible, utilizing supports like cable trays or metal conduits. If such supports are unavailable, secure the cables with basic fixtures to maintain their position.

4 Start-up and Commissioning

4.1 Pre-opening Check

Before running the product, please make sure that the product has been installed in accordance with the specifications, and carry out a comprehensive and detailed inspection of the machine to ensure that all indicators are in line with the requirements before starting the machine.

1 Appearance Check:

a. Appearance of the equipment is intact, no damage, no rust and no paint loss. If there is any paint loss, please carry out the paint refinishing operation;

b. Equipment labels are clearly visible and damaged labels should be replaced promptly.

2 Grounding check: the box has a grounding point, and grounding is secure; the box grounding conductor is reliably connected to the box grounding copper row.

3 Cable check:

a. The cable protection layer is well wrapped with no visible damage;

b. The terminals are made in accordance with specifications, and the connection is firm and reliable;

c. Each cable is clearly labeled at both ends, and the alignment meets the principle of separation of strong and weak power, leaving a margin at the turn, and shall not be strained;

d. Cable mounting bolts have been tightened, cable pulling without loosening; cable crossing hole blocking has been completed.

4 Copper row inspection: no obvious cracks or deformation of copper rows, fastening of screws at the lap joints, no misalignment of scribed markings, no debris on the copper rows.

5 Component Check: the circuit breakers are all in the open position; the lightning protector indicator mark is green.

4.2 Switch-on Operation

The product switch on and operating procedure is as follows:

1 Use a multimeter to confirm that the grid voltage is within the predetermined range (480 V ± 10%);

2 Close the battery high voltage control box DC load switch;

3 Close all auxiliary power switches on the system;

4 Close the main AC circuit breaker.

4.3 Trial Operation

After the equipment's electrical structure installation is complete and startup conditions are met, to ensure the reliable and stable operation of the energy storage system, initial commissioning must be conducted by professional electrical engineers and technicians. Configure the operation mode and relevant parameters in accordance with project specifications:

1 Set the device control mode to "Manual Mode" and set the active power to 5%;

2 Observe the parameters of the screen PCS and battery during operation, and stop the machine in time for testing if there is any abnormality;

3 Runs for 0.5 hours;

4 Set the active power to -5%, at which point the battery is charged at 5% of the system's rated power, the

5 Observe the parameters of the screen PCS and battery during operation, and stop the machine in time for testing if there is any abnormality;

6 Runs for 0.5 hours;

7 After completing the 1-hour test run without any abnormality, turn off the system in the "Switch" interface;

8 According to the project background and demand, you can choose the local manual power control mode or automatic peak shaving mode to put into operation formally, and then click "system power on" in the system interface.

4.4 Switch-off Operation

When the product needs daily maintenance, the shutdown operation is required. The normal shutdown operation of the product is as follows:

1 Operating the APP/WEB and the battery stops charging and discharging;

2 Disconnect the battery high voltage control box DC load switch;

3 Breaks the main AC circuit breaker;

4 Disconnect all auxiliary power switches of the system, and the unit completes shutdown.

4.5 Emergency Stop

When the product is malfunctioning or a critical situation requires emergency shutdown, you can perform the following emergency shutdown operations:

1 Press the emergency power-off button "EPO";

2 Referring to Figure 4-1, break out all auxiliary power switches of the system;

3 Reset the EPO button after determining that the fault or hazard is cleared and operation is required.

5 Alarms and Maintenance

Alarm levels are defined as follows:

- Failure: The device fails and the system stops operating (charging / discharging).
- Alarm: The device's output power decreases or part of its function fails due to external factors, but it does not affect the system's charging and discharging functions.

5.1 Alarm Handling

Table 5-1 Fault Alarm Handling Methods

Alarms / Faults	Components involved	Cause of the problem	Solutions
Rainstorm Malfunctions	Battery	Flooding of energy storage cabinets	1 Check for water buildup inside the cabinet; 2 Verify that the outdoor cabinet is not leaking and that the equipment inside the cabinet is intact.
Fire-fighting Malfunctions	Battery	Battery overheating or fire	1 Immediately press the EPO button and move away from the energy storage cabinet; 2 Observe continuously for 30 minutes from a safe distance. If there is smoke or fire, call the fire alarm; if neither is abnormal, manually clear this activity alarm and contact the manufacturer.
Lightning protector Warning	Electric silo	Failure of a lightning protector	1 Check for loose lightning arrester signal wire connections; 2 Check for discoloration of the lightning protector indicator; 3 Replacement of AC lightning arresters.
Compactors Warning	Refrigeration	1 Loose wiring 2 Compressor damage	1 Disconnect the power distribution switch and open the air conditioner junction box to check for loose wiring; 2 Observe the appearance of the compressor for visible damage and a burning smell, if so, contact the manufacturer.
Outdoor Fans warning	Refrigeration	1 Loose wiring 2 Damage to wind turbines	1 Disconnect the power distribution switch and open the air conditioner junction box to check for loose wiring; 2 Observe if the fan is visibly damaged and if there is a burning smell, if so, contact the service hotline.
Indoor Fans warning	Refrigeration	1 Loose wiring 2 Damage to wind turbines	1 Disconnect the power distribution switch and open the air conditioner junction box to check for loose wiring; 2 Observe if the fan is visibly damaged and if there is a burning smell, if so, contact the service hotline.
Grid overvoltage / undervoltage malfunctions	Grid / oil engine	Abnormal grid voltage	Check for abnormal grid voltage;

Grid overfrequency / underfrequency malfunctions	Grid / oil engine	Abnormal grid voltage	Check for abnormal grid voltage;
Crypto-protection malfunctions	Grid / oil engine	Abnormal grid voltage	Check for abnormal grid voltage;
High / Low Voltage Ride Through warning	Grid / oil engine	Abnormal grid voltage	Check for abnormal grid voltage;
Grid voltage imbalance malfunctions	Grid / oil engine	Abnormal grid voltage	Check for abnormal grid voltage;
Misphasing of the grid malfunctions	Grid / Diesel	Wrong phase sequence in the grid	Counterbalance any two of the three ABC cables
DC voltage high / low malfunctions	Batteries	Abnormal battery voltage	Check for abnormal DC input voltage
Busbar overvoltage malfunctions	Energy storage converter	1 load imbalance 2 software anomaly	1 Check for loose or abnormal DC wiring; 2 Contact Manufacturer
Busbar half-voltage unbalance malfunctions	Energy storage converter	1 load imbalance 2 software anomaly	1 Check for abnormal loads; 2 Contact Manufacturer
Overheating and derating warning	Energy storage converter	High internal temperature	1 Check the electrical bin inlet and outlet for blockages; 2 Check the internal fan for proper operation; 3 Contact Manufacturer
Power Tube Over Temperature malfunctions	Energy storage converter	High internal temperature	1 Check the electrical bin inlet and outlet for blockages; 2 Check the internal fan for proper operation; 3 Contact Manufacturer
Balance bridge over-temperature malfunctions	Energy storage converter	High internal temperature	1 Check the electrical bin inlet and outlet for blockages; 2 Check the internal fan for proper operation; 3 Contact Manufacturer
DC overcurrent malfunctions	Energy storage converter	DC Current Excess	1 Check for short circuits or broken lines on the DC side; 2 Replace the energy storage converter module or contact the manufacturer.
Balanced Bridge Overcurrent malfunctions	Energy storage converter	Internal current overrun	1 Check for off-grid load overload; 2 Replace the energy storage converter module or contact the manufacturer.
Output overload / overcurrent malfunctions	Energy storage converter	AC side power / current excess	1 Check that the grid voltage is normal; 2 Check for short circuits or broken lines on the DC side; 3 Check for off-grid load overload; 4 Replace the energy storage converter module or contact the manufacturer.

Current limit on a wave-by-wave basis Malfunctions	Energy storage converter	AC side current excess	1 Check that the grid voltage is normal; 2 Check for off-grid load overload; 3 Replace the energy storage converter module or contact the manufacturer.
Communications blackout Malfunctions	Local Controller for Energy Storage Converters	Communications blackout	1 Check whether the communication network cable between modules is loose and abnormal; 2 Check whether the local controller communication network cable is loose and abnormal;
Parallel / Synchronous malfunctions	Energy storage converter	Parallel / Synchronized Signal Interrupt	1 Check the parallel cable for looseness or abnormality; 2 Check that the parallel setting is not abnormal; 3 Hardware circuitry is damaged.
Relay open / short malfunctions	Energy storage converter	1 Internal relay abnormality 2 software anomaly	1 Replacement of energy storage converter modules 2 Contact factory to replace internal boards
Leakage current malfunctions	Energy storage converter	1 Excess leakage current 2 software anomaly	1 Check the leakage current hall for loose or abnormal wiring; 2 Check that the ground wire is not disconnected;
Abnormal insulation impedance malfunctions	Energy storage converters / batteries	1 Low insulation to ground 2 software anomaly	1 Check the AC and DC cables for breakage or short circuit to ground; 2 Check for broken battery wiring or a short to ground.
Loss of modules warning	Energy storage converter	Module-to-screen communication interruption	Check whether the communication network cable between modules is loose and abnormal;
Low DC voltage warning	Energy storage converter	Battery not turned on	Check if the battery is on

WARNING

The above alarms and faults are common alarms or faults, if any faults other than those in Table 5-1 occur, please contact the manufacturer directly.

5.2 Routine Maintenance

Affected by ambient temperature, humidity, dust, vibration and aging of internal components of the inverter, the system may have some potential problems during operation. In order to enable the energy storage system to operate in a long-term and stable manner, it is necessary to arrange regular inspections by maintenance personnel according to Table 5-2, so that problems can be found and dealt with in a timely manner. Quarterly maintenance is recommended for systems installed in areas with severe sand and dust, high salt spray or heavy industrial parks, and semi-annual maintenance is recommended for energy storage systems in areas with favorable climatic environments.

Table 5-2 Routine Maintenance Tasks

Maintaining the image	Movements	Reference standard
Cabinet	• Check the appearance of the whole machine • Checking the vents • Checking the condition of door locks	• No visible coating flaking, scratching or rusting • No visible signs of water leakage • No dust buildup in vents • No damage to door locks
Refrigeration	• Check for noise and vibration • sweep the filters	• Compressor rotation is normal, no jamming, strange noise • Filter surfaces are clean and not clogged
Energy storage converter	• Check for noise and vibration • Check the front panel vents • Checking the contact surface of the copper row at the rear end	• Front panel vent surfaces are clean and free of clogs • No corrosion and discoloration of copper rows and contact surfaces, no dust accumulation
Electronic	• Inspection of lightning protectors • Check cable copper contact surface	• Lightning protector normal • No loose screw socket connecting wires coming off • No corrosion and discoloration of copper rows and contact surfaces, no dust accumulation
Battery pack	• Check for noise and vibration • Check cable copper contact surface	• Battery pack fan rotates without jerks or rattles • Front panel vent surfaces are clean and free of clogs • No loose screw socket connecting wires coming off • No corrosion and discoloration of copper rows and contact surfaces, no dust accumulation

5.3 Warranty Service

5.3.1 Warranty Period

The warranty period agreed in the commercial contract shall prevail in case of correct use of the product.

5.3.2 Warranty Coverage

Within the warranty period, if a product failure arises due to a quality issue inherent to the product, Hangzhou Livoltek Power Co., Ltd. will address the situation, including the replacement of the product. Customers are requested to allow a reasonable timeframe for the company to perform necessary maintenance and execute product replacements. It is essential for customers to present proof of purchase and ensure that the product's trademark is clearly discernible. Failure to do so may result in the company exercising its right to withhold warranty services.

5.3.3 Disclaimer

In the event of the following circumstances, the Company reserves the right not to carry out the warranty, but may still provide repairs for a fee.

- Out of warranty;
- Proof of purchase of the product cannot be provided;
- Damage caused during transportation, loading and unloading;
- Damage caused by incorrect installation, modification or dismantling by unauthorized personnel;
- Damage caused by operation under abnormal conditions of use or environment;
- Malfunction or damage to the machine caused by the use of parts or software other than ours;
- Failure due to irresistible factors such as fire, earthquake, flood, etc.

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