SOLUNA

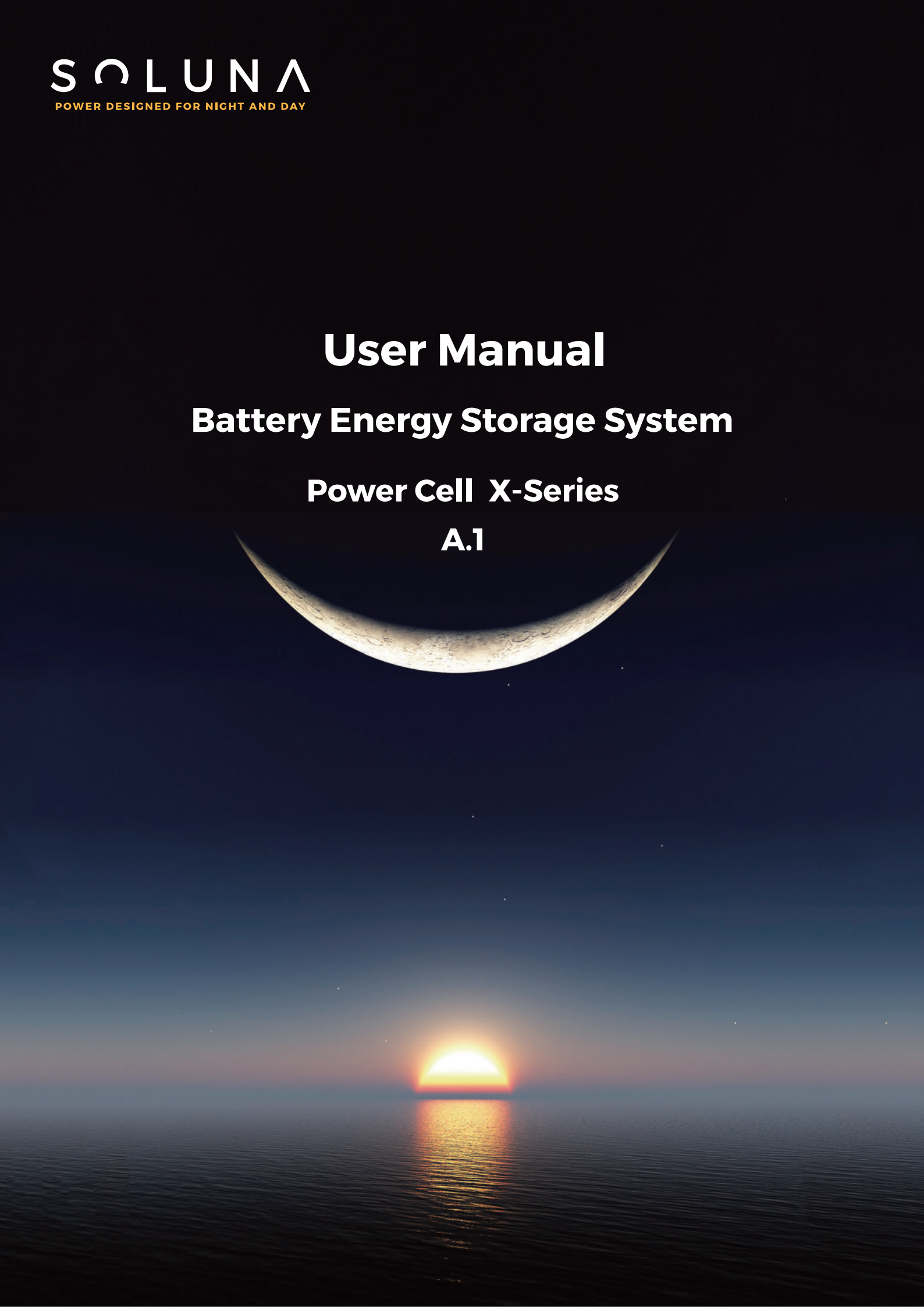
POWER DESIGNED FOR NIGHT AND DAY

User Manual

Battery Energy Storage System

Power Cell X-Series

A.1



About this Specification

This manual provides comprehensive instructions for installing the Power Cell X-Series battery. It is imperative to thoroughly read this manual before attempting to install the product and to follow the instructions diligently throughout the installation process. If you have any doubts about the requirements, recommendations, or safety procedures described in this manual, please contact Soluna immediately for advice and clarification.

The information contained in this manual is accurate at the time of publication. However, due to ongoing updates to product design and technical specifications, our company reserves the right to make changes at any time without prior notice. Additionally, the illustrations included in this manual are intended to aid in explaining system configuration concepts and installation instructions. The items depicted in the illustrations may differ from the actual items at the installation site.

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Contents

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Contents

1 Introduction

The Power Cell X-Series is an advanced LFP lithium battery product designed to meet the highest standards of performance and safety. Equipped with a sophisticated Battery Management System (BMS), this high-voltage battery module features CAN communication for seamless integration and monitoring. It includes comprehensive protections against under-voltage, over-voltage, over-current, over-temperature, and under-temperature, en-suring optimal performance and safety under various conditions.

With its high energy density, long lifespan, and robust reliability, the Power Cell Series stands out as a green environmental product you can trust. Its innovative design not only enhances efficiency but also contributes to sustainability, making it an ideal choice for Backup Power, Micro-grid Solutions, and Small Industrial & Commercial Energy Storage Systems.

Features

Below are the main features of this product, showcasing its advanced capabilities and benefits.

- **Excellent Safety Performance**
  Ensures the highest level of safety under various conditions.
- **Long Cycle Life**
  Designed for extended usage without significant performance degradation.
- **Support for CAN Communication**
  Allows seamless integration and communication with other systems.
- **High Energy Density**
  Provides more power in a compact size.
- **Advanced Battery Management System**
  Monitors and manages the battery's functions for optimal performance and safety.
- **Expandable Battery Units**
  Offers flexibility to scale the system as needed.
- **Wi-Fi Monitoring**
  Enables remote monitoring and management.
- **LCD Display and Settings**
  Provides easy access to system information and configuration.
- **Fire, Smoke, and Water Detection**
  Includes comprehensive safety protections.
- **Built-in Air Conditioning with Adjustable Temperature**
  Maintains optimal operating conditions.
- **Supports Up to 5 Parallel Connections**
  Allows multiple batteries to be connected, enhancing system capacity and reliability.

3 Safety Precautions

3.1 Warning signs

Warning signs are essential indicators designed to alert you to conditions that could result in severe injury or significant damage to the device. They serve as critical reminders to exercise caution and take necessary precautions to prevent hazardous situations. The table below outlines the warning signs used in this manual and their meanings:

Sign	Description
	High Voltage Warning: This battery pack operates at high voltage,which can cause severe injury due to electric shock.Description
	Correct Polarity: Ensure the battery polarity is correctly connected.
	Fire Safety: Keep the battery pack away from open flames or ignition sources.
	Child Safety: Store the battery pack out of reach of children.
	Installation Manual: Thoroughly read the manual before installing and operating the battery pack.
	Heavy Weight Warning: The battery pack is heavy, and improper handling may result in severe injury. Utilize proper lifting techniques.
	Electrolyte Leakage: The battery pack may leak corrosive electrolyte. Handle with care and adhere to appropriate safety procedures.
	Explosion Risk: The battery pack may explode under certain conditions.
	Disposal Instructions: Do not dispose of the battery pack with household waste at the end of its working life. Follow local regulations for disposal.
	Compliance Requirement: Failure to follow the provided requirements and guidelines may lead to physical injury or damage to the device.
	Do not short circuit.
	Grounding conductor This symbol indicates the position for connecting a groundingconductor.

3.2 Safety instructions

For safety reasons, it is crucial that installers thoroughly familiarize themselves with the contents of this manual and all associated warnings prior to commencing the installation.

General Safety Precautions

Failure to adhere to the precautions outlined in this section can result in serious injury or property damage. Please observe the following safety guidelines:

3.2.1 Risks of explosion

- Avoid subjecting the battery pack to strong impacts.
- Do not crush or puncture the battery pack.
- Never dispose of the battery pack in a fire.

3.2.2 Risks of fire

- Do not expose the battery pack to temperatures exceeding 60˚C.
- Keep the battery pack away from heat sources, such as fireplaces.
- Avoid exposing the battery pack to direct sunlight.
- Ensure the battery connectors do not come into contact with conductive objects like wires.

3.2.3 Risks of electric shock

- Refrain from disassembling the battery pack.
- Do not touch the battery pack with wet hands.
- Keep the battery pack away from moisture or liquids.
- Ensure the battery pack is kept away from children and animals.

3.2.4 Risks of damage to the battery pack

- Prevent the battery pack from coming into contact with any liquids.
- Avoid subjecting the battery pack to high pressures.
- Do not place any objects on top of the battery pack.

3.3 Battery handling guide

- Use the battery pack strictly as directed in the manual.
- Do not use the battery pack if it appears defective, cracked, broken, or fails to operate correctly.
- Do not attempt to open, disassemble, repair, tamper with, or modify the battery pack as it is not user serviceable.
- Handle the battery pack with care during transportation to avoid damage.
- Avoid impacting, pulling, dragging, or stepping on the battery pack.

3.4 Response to emergency situations

The Power Cell X-Series consists of multiple batteries designed to prevent hazards resulting from failures. However, Soluna cannot guarantee absolute safety. Please familiarize yourself with the following emergency procedure.

3.4.1 Leaking batteries

If the battery pack leaks electrolyte, avoid contact with the leaking liquid or gas. Electrolyte is corrosive and contact may cause skin irritation and chemical burns. If exposed to the leaked substance, follow these steps:

3.4.2 Inhalation

- Evacuate the contaminated area immediately.
- Seek medical attention without delay.

3.4.3 Eye contact

- Rinse eyes with flowing water for at least 15 minutes.
- Seek medical attention immediately.

3.4.4 Skin contact

- Wash the affected area thoroughly with soap and water.
- Seek medical attention immediately.

3.4.5 Ingestion

- Induce vomiting.
- Seek medical attention immediately.

3.4.6 Fire response procedures

In the event of a fire, always have an ABC or carbon dioxide extinguisher on hand.

The battery pack may ignite if heated above 150˚C. If a fire occurs where the battery pack is installed, follow these steps:

- **Extinguish Early**
  Attempt to extinguish the fire before the battery pack ignites.
- **Safe Relocation**
  If extinguishing is not possible but time allows, move the battery pack to a safe area before it catches fire.
- **Evacuate**
  If the battery pack has already caught fire, do not attempt to extinguish it. Evacuate the area immediately.

Caution: If the battery catches fire, it will emit noxious and poisonous gases. Do not approach the fire.

3.4.7 Wet batteries

If the battery pack becomes wet or submerged in water, do not attempt to access it. Contact Soluna or your distributor for technical assistance immediately.

3.4.8 Damaged batteries

Damaged batteries are hazardous and must be handled with extreme caution. They are unfit for use and may pose a danger to people or property.

If the battery pack appears damaged, pack it in its original container and return it to Soluna or your distributor.

Leakage and Flammability: Damaged batteries may leak electrolyte or produce flammable gas. If you suspect such damage, contact Soluna for advice and information immediately.

3.5 Qualified installers

This manual, along with the tasks and procedures described herein, is intended for use by skilled professionals only. A skilled professional is defined as a trained and qualified electrician or installer who possesses all of the following skills and experience:

- **Functional Knowledge**

  Understanding of the principles and operation of on-grid systems.

- **Risk Awareness**

  Awareness of the dangers and risks associated with installing and using electrical devices and the acceptable methods for mitigating these risks.

- **Installation Proficiency**

  Expertise in the installation of electrical devices.

- **Adherence to Guidelines**

  Knowledge of and compliance with this manual, including all safety precautions and best practices.

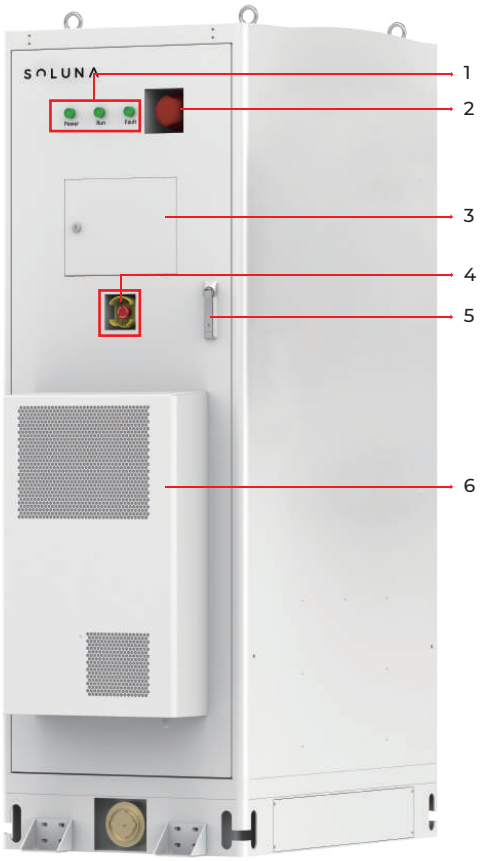
- **Battery Maintenance**

  Only authorized personnel should perform maintenance.Turn off the battery before maintenance.Periodically check voltage, SOC, and cables for damage or wear.Perform balancing maintenance (fully charge) every three months.

- **Installation Environment Requirements**

  Avoid flammable, explosive, or corrosive materials. Keep out of children's reach and avoid high temperatures.Ensure proper ventilation and avoid electromagnetic interference.Install in a sheltered, well-ventilated area, within the appropriate temperature and humidity range, and below 2000 meters altitude.

4 Appearance



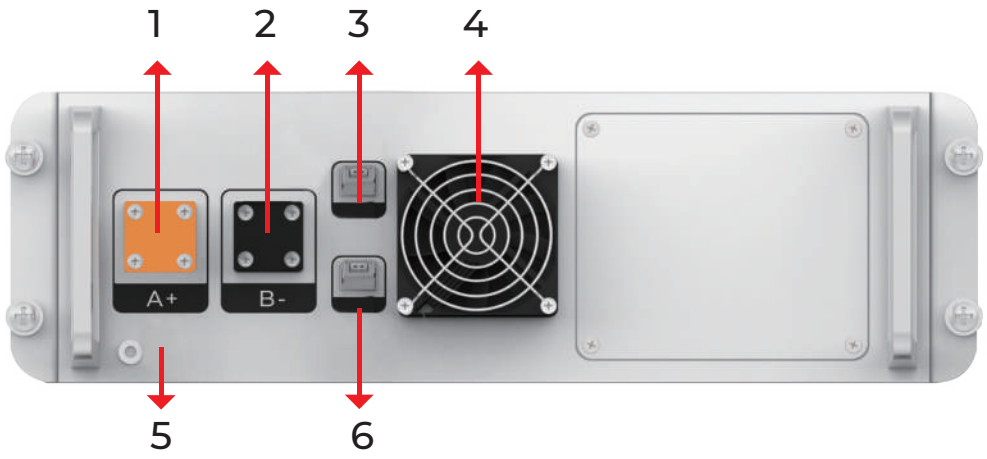
No	Name	Description
1	Status Indicator Light	Indicates the current working status of the battery system
2	Acousto-optic alarm	Issue an alarm when a fault occurs
3	Operation display	View and set battery system parameters
4	Emergency stop button	In case of an accident, press this button
5	Door lock	Safety protection device
6	Air conditioner ①	Adjust the temperature inside the battery system

① Suitable for Use with European Grid Only: 230V 50Hz

4.2 Dimensions introduction

Width	700	mm
Depth	1000	mm
Height	2010	mm

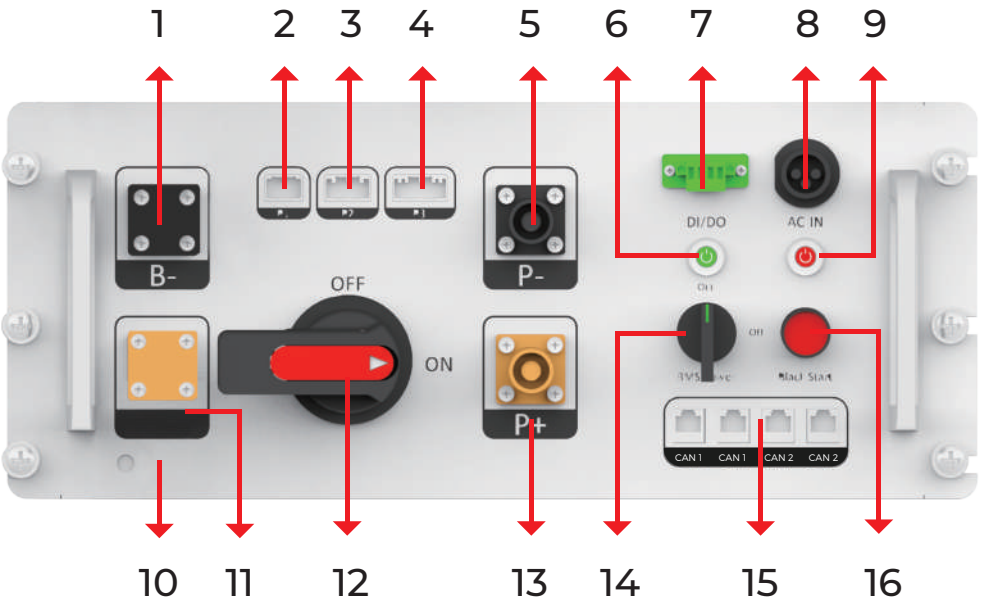
4.3 Battery module introduction



Battery module interface diagram

No	Name	Description
1	B+	Battery Module Positive Port: Connects to the positive terminal of the battery system.
2	B-	Battery Module Negative Port: Connects to the negative terminal of the battery system.
3 / 6	P1	Battery Module Expansion Port: Allows for the expansion of the battery system.
4	Fan	Heat Dissipation Function: Manages and dissipates heat to maintain optimal operating temperature.
5	PE	Battery Module Ground Point: Provides a grounding connection for safety.

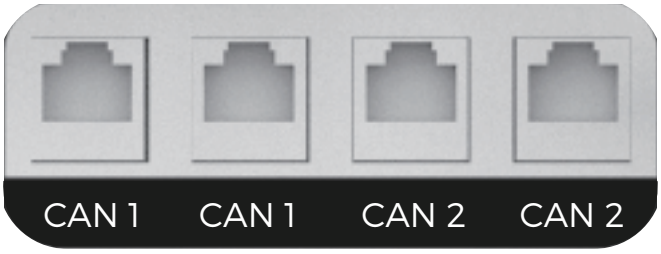
4.4 Main control module introduction



No	Name	Description
1	B-	Battery Module Negative Port: Connects to the negative terminal of the battery module.
2	P1	Battery Module Expansion Port: Allows for the expansion of the battery system.
3	P2	Emergency Stop, Fire, Sound and Light Alarm, Access Switch Control Port: Provides connections for emergency stop, fire alarms, and other safety controls.
4	P3	LCD Communication, Air Conditioning Communication, RS485 Communication Port: Supports communication for LCD, air conditioning, and RS485 protocols.
5	P-	Output Negative of Battery Module: Connects to the negative output terminal of the battery module.

6	BMS Power Indicator Light	BMS Power Indicator: Indicates that the Battery Management System (BMS) is powered on.
7	DI/DO	LED Light Power Connection Port: Connects power to the LED light.
8	AC-IN	AC Input Port: Connects to the alternating current (AC) input.
9	Black Start Signal Indicator	Black Start Function Indicator: Indicates that the battery has entered the black start function.
10	PE	Ground Point: Provides a grounding connection for safety.
11	B+	Battery Module Positive Port: Connects to the positive terminal of the battery module.
12	Battery Circuit Switch	Battery Output Switch: Controls the on/off state of the battery output.
13	P+	Output Positive of Battery Module: Connects to the positive output terminal of the battery module.
14	BMS Power Switch	BMS Power Control: Used to control the power-on and power-off of the BMS.
15	Communi–cation Port	CAN1 and CAN2 Ports: CAN1 is used for battery parallel connections; CAN2 is used to communicate with the inverter.
16	Black Start Button	Battery Voltage Output: Press and hold for about 10 seconds to output the battery voltage.

CAN1 and CAN2 communication interface definition as follows:



CAN1 port (for battery communication)

CAN1

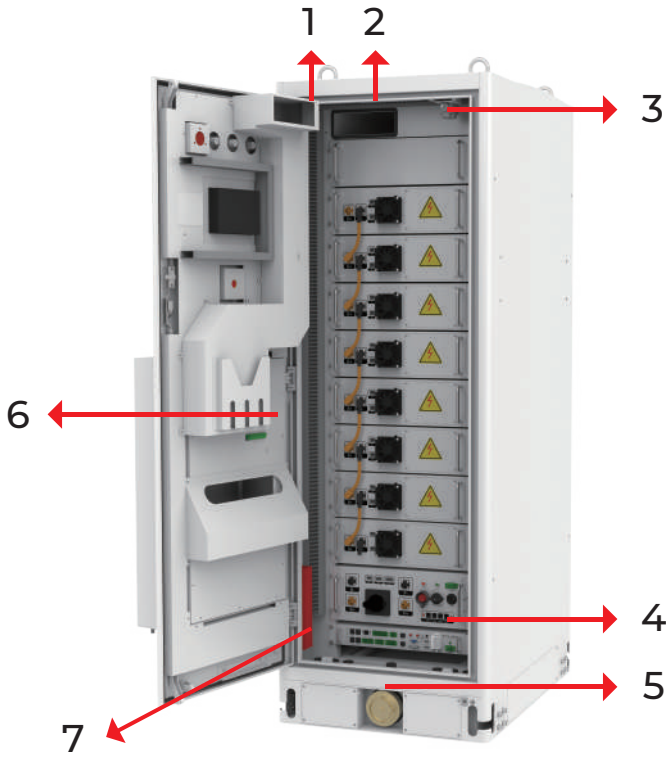
1	2	3	4	5	6	7	8
—	—	—	CAN-H	CAN-L	—	—	—

CAN2 port (for battery communication)

CAN2

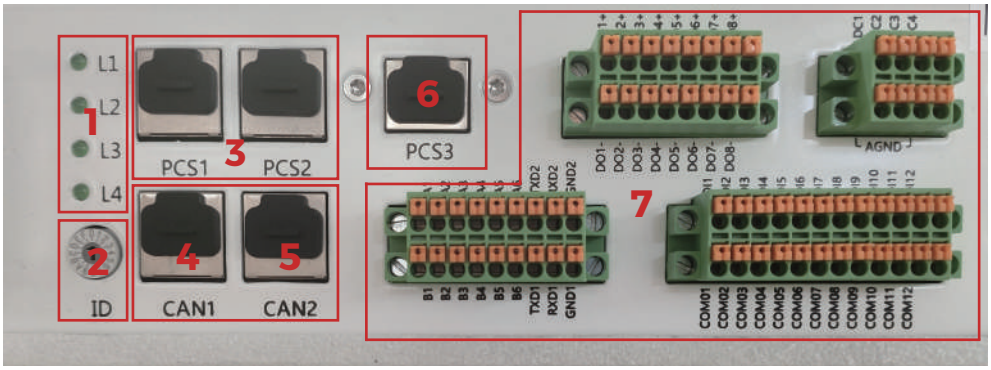
1	2	3	4	5	6	7	8
			CAN-H	CAN-L			

4.5 Battery system internal introdution



No	Name	Description
1	Smoke Detector	Photoelectric Smoke Detector: Used for smoke detection.
2	Light	Cabinet Lighting: Provides illumination inside the cabinet.
3	Door Status Sensor	Door Status Monitor: Monitors the opening and closing status of the door.
4	AC Breaker	AC Power Switch: Switches the AC power supply of the battery system on or off.
5	Water Sensor	Water Detection: Detects water based on the resistance change between both electrodes.
6	Air Conditioning Operating Panel	Air Conditioner Temperature Adjustment: Used to adjust the temperature of the air conditioner.
7	Fire Protection Device	Fire Extinguishing: Used for extinguishing fire.

4.5.1 Left Panel Interface



1. **LED status indicator**

   Used to display battery status information. Different blinking and lighting patterns represent the current battery status, such as charging, discharging, firmware upgrade, battery level, and alarm information. The blinking patterns and their corresponding battery status are detailed in the user manual.

2. **Rotary ID switch**

   The pointer points to different numbers, representing the selection of different inverter protocols. The default value is usually 0, with other protocols available. Please refer to the user manual for details.

3. **PCS 1 / 2 communication ports**

   The two communication ports are parallel, and there is no difference between them. They are responsible for communication with external inverters.

4. **CAN1**

   It connects to any CAN1 on the battery control cabinet through an RJ45 cable in the wiring, and is responsible for internal network communication.

5. **CAN2**

   It connects to any CAN2 on the battery control cabinet through an RJ45 cable in the wiring and is responsible for external network communication.

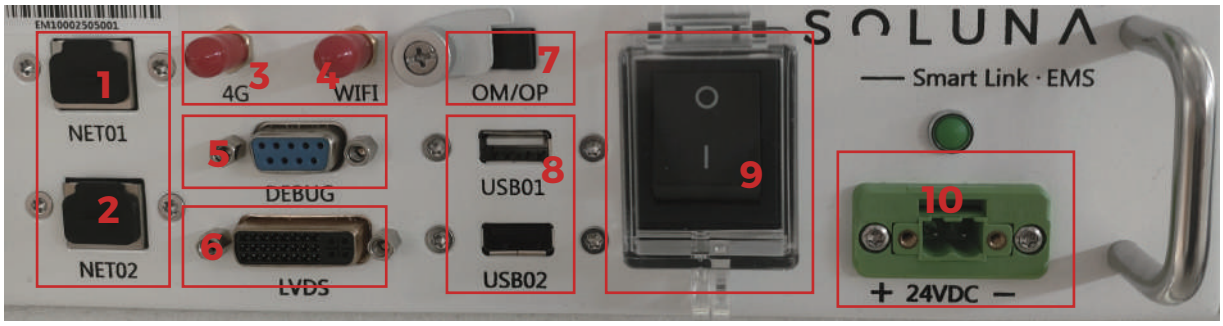
6. **PCS3**

   Connects the cabinet display to Smart Link. After connection, the display can be upgraded through Smart Link.

7. **Function expansion port**

   Currently, no functions are implemented. Future functionalities may be added based on actual conditions.

4.5.2 Right Panel Interface



1. **NET01**

   Wired network interface, which can provide a wired network to Smart Link via an RJ45 cable.

2. **NET02**

   Debugging and upgrade port. By connecting to a host computer via an RJ45 cable, it allows debugging and updating of Smart Link.

3. **SMA interface**

   4G communication antenna. After inserting the card, an external antenna can be connected to enable 4G network remote communication.

4. **SMA interface**

   WiFi communication antenna. This antenna enables connection to a wireless network for communication.

5. **DEBUGE serial port**

   Connects to a specific host computer via a DB9 cable, allowing modification of various internal software parameters of the device. This port is generally not open for customer use.

6. **LVDS**

   Display port. Connects to an external display via a DVI24+5 cable to monitor the system's operation. However, since the commercial storage already has a cabinet display, this port is currently not in use.

7. **Toggle switch**

   Toggle left or right to switch between OM mode and OP mode. OM is the manual mode, where,after Smart Link is activated, the battery relay will not close, allowing for safe operation. OP is the automatic mode, where, after Smart Link is powered on, the system will immediately prepare for startup and, after a brief period, send a closing command to the battery, enabling the system to run with power.

8. **USB 01/02**

   Two USB interfaces, used for upgrading Smart Link programs via a USB drive and exporting battery operation parameters. However, these two functions are not yet fully implemented.

9. **Rocker switch**

   The main power switch for Smart Link. Pressing it powers on and starts Smart Link.

10. **2P interface and LED light**

    The external power interface for Smart Link. When the rocker switch is pressed and the system is powered on, the LED light stays on. When the switch is turned off, the LED light goes off.

5 Technical Parameters

Model	Power Cell X 2404	Power Cell X 2405	Power Cell X 2406	Power Cell X 2407	Power Cell X 2408	Power Cell X 2409
Physical characteristics						
Dimensions (W * D * H)	700*1000*2010mm					
Weight(kg)	640	710	780	850	920	990
Electrical characteristics						
Battery type	LFP					
Number of modules	4	5	6	7	8	9
Number of cell strings	96	120	144	168	192	216
Total energy capacity(kWh)	30.72	38.4	46.08	53.76	61.44	69.12
Usable energy capacity(kWh)	24.57	30.72	36.86	43	49.15	55.29
Battery nominal capacity (Ah)	100					
Voltage range(V)	268.8-336	336~420	414.4~518	470.4~588	537.6~672	604.8~756
Nominal voltage(V)	307.2	384	460.8	537.6	537.6	691.2
Charge voltage(V)	328.3	410.4	492.4	574.5	656.6	738.7
Discharge cut-off voltage(V)	288	360	432	504	576	648
Nominal charge/ discharge current (Al)	50A/50A					
Max charge/ discharge current (A)	100A/100A					
Recommend Depth of Discharge	80%①					
Cycle life	≥6000 times(25℃/under standard charge and discharge conditions charge 0.2C,discharge 0.2C)②					
Number of expandable battery units	5					

5 Technical Parameters

Model	Power Cell X 2404	Power Cell X 2405	Power Cell X 2406	Power Cell X 2407	Power Cell X 2408	Power Cell X 2409
BMS						
Monitoring parameters	System Voltage/System Current/Cell Voltage/Cell temperature					
Communication	CAN					
Operating conditions						
Condition	Can be used indoors and outdoors					
Operating temperature	-20~50℃ ③					
Fire protection system	Aerosols					
Storage temperature	-20~60℃	≤7 days				
	-20~45℃	≤1 month				
	0~45℃	≤3 months				
	0~25℃	≤1 years				
Humidity	5%~95%					
Altitude	Max. 2,000m					
Cooling strategy	Fans and air conditioning					
Operating temperature (Recommended)	15~30 ℃					
Reliability & Certification						
Certificates	IEC62619/IEC62477/UN38.3/RoHS					
Protection grade	IP55					
Warranty						
Please refer to Soluna WARRANTY CONDITIONS						

5 Technical Parameters

1 :Test Conditions: 100% Depth of Discharge (DOD), 0.2 ℃ charge and discharge at +25±2°C for the battery at the beginning of its life. Usable energy may vary with different inverters.

2: Note: At 25±2°C of cell under 0.5C/0.5C test condition and 70% End of Life (EOL).

3: For long-term storage: Store battery cells in a temperature range of 5~45 ℃, with relative humidity below 65%, and in a non-corrosive environment. Charge to50-55% SOC before storage to prevent significant cycle life reduction.

NOTE

- When a level 1 alarm is triggered, the charge or discharge rate will be reduced.
- When a level 2 alarm is triggered, charge and discharge operations will be limited to 0A.
- Prolonged discharging at currents below 0.5A may lead to inaccuracies in the State of Charge(SOC)calculation.
- Storage SOC: Maintain a State of charge (SOC) between 30% and 50% for storage, and cycle the charge-discharge process every 6 months.
- Store the battery at a temperature range of 15~30 ℃, for periods not exceeding one year.

6 Equipment Inspection And Storage

6.1 Warning signs

Before signing for the product, please check the following details:

- **Outer Packaging**

  Inspect for any damage such as holes, deformation, cracks, or other signs that could have harmed the device inside. If any damage is detected, do not open the package and contact your distributor immediately.

- **Equipment Model**

  Verify that the model received is correct. If it is incorrect, do not open the package and contact your distributor.

- **Delivered Parts**

  Check if the delivered parts are the correct type and quantity, and inspect them for damage. If any parts are damaged or incorrect, please contact your distributor.

6.2 Delivery list

After unpacking the product, ensure that all delivery are present and complete. If any components are missing or incomplete, please contact your distributor promptly.

No	Name	Quantity	Picture
1	Power Cell Series battery system	1 PCS	
2	Battery charging connector	1 Pair	
3	Screw	1 Bag	

6.3 Device storage

If the battery system is not put into immediate use, please follow these storage guidelines:

- **Clean Environment**
  Ensure the storage environment is clean, with appropriate temperature and humidity ranges, and no condensation.
- **Professional Check**
  After long-term storage, have the device checked and confirmed by professional personnel before use.
- **Packing Case**
  Store devices in their packing case, with desiccant included, and seal the case.
- **Unpacked Devices**
  If the device is not installed within 3 days after unpacking, return it to its packing box.
- **Extended Storage**
  For storage periods longer than 30 days, adjust the State of Charge (SOC) to 30%-45% and fully charge and discharge the battery every three months.
- **Storage Temperature Ranges**
  - -20℃ to 60℃: Storage should not exceed 7 days.
  - -20℃ to 45 ℃: Storage should not exceed 7 months.
  - 0℃ to 45 ℃: Storage should not exceed 3 months.
  - 4.0℃ to 25 ℃: Storage should not exceed 1 year.
- **Humidity Range**
  Ensure the humidity is between 5-95% with no condensation. Do not install the interface if it is wet or congealed.
- **Storage Location**
  Store the device in a cool place, away from direct sunlight.
- **Hazardous Materials**
  Keep the equipment away from inflammable, explosive, corrosive, and other hazardous items.
- **Transportation and Storage**
  Ensure the battery system is not damaged during transportation and storage.
- **Fire Safety**
  Never put the battery into a fire to avoid the risk of explosion. Be cautious of high ambient temperatures as they can increase the risk of fire.

7 Installation

7.1 Installation requirements

7.1.1 Installation environment requirements

- **Flammability, Explosives, Corrosion**
  Do not install the device in an environment that is flammable, explosive, or corrosive.
- **Child Safety**
  Keep the installation position out of reach of children and away from easily accessible locati-ons.
- **Ventilation and Space**
  The installation space must meet the requirements for ventilation, heat dissipation, and operational space.
- **Protection Level**
  Ensure the device's protection level meets the requirements for outdoor installation, with ambient temperature and humidity within the appropriate range.
- **Installation Location**
  The device must be installed on the outdoor ground and cannot be installed indoors or on the roof of a building.
- **Temperature Management**
  Do not place the device in a high-temperature environment. Ensure there is no heat source near the device.
- **Ease of Operation and Maintenance**
  Install the device at a height that is easy to operate and maintain. Ensure device indicators and all labels are easy to view, and wiring terminals are accessible.
- **Altitude**
  The installation altitude of the energy storage system must be lower than 3000 meters above the maximum working altitude.
- **Electromagnetic Interference**
  Stay away from strong magnetic field environments to avoid electromagnetic interference.

Notice

To ensure optimal performance and longevity of the battery system:

- **Sun Exposure**
  Do not expose the battery system directly to sunlight. It is recommended to build a sunshade to protect it.

- **Cold Area Installation**
  Equipment installed in cold areas should be equipped with a heating system.

If the ambient temperature falls outside the operating range, the battery pack will stop operating to protect itself. The optimal operating temperature range for the battery pack is 15˚C to 30˚C. Frequent exposure to extreme temperatures can degrade the performance and shorten the lifespan of the battery pack.

7.1.2 Installation angle requirements

Ensure that the device is installed horizontally. It must not be tilted, placed horizontally on its side, or installed upside down.

7.1.3 Installation foundation support requirements

- **Base Material**
  The device must be installed on a concrete or other non-combustible surface base.
- **Base Condition**
  Before installation, ensure that the base is level, firm, smooth, dry, and capable of bearing the necessary load without sagging or tilting.
- **Cable Routing**
  A trench or cable outlet hole must be reserved in the base to facilitate cable routing.

7.1.4 Installation tools requirements

You are advised to use the following installation tools. If necessary, other auxiliary can be used on-site.

Item	Photo	Name
1		Phillips-screwdriver bit
2		Wire cutters

3		Wire stripper
4		Tape measure
5		Drill
6		Open end wrench
7		Hydraulic clamp
8		Multimeter

When handling the battery pack , it is essential to wear the appropriate safety gear to protectagainst potential hazards , installers must adhere to the relevant reguirements of international standards , such as IEC 60364 , or comply with domestic legislation.

1		Safety goggles
2		Safety shoes
3		Insulated gloves

7.1.5 Installation materials

The installers should prepare the following materials.

No	Name	Description
1	Charging Cables	Battery Charging and Discharging: Connect the battery to the inverter to facilitate both charging and discharging processes.
2	Communication Line	Communication Connection: Connect the battery to the inverter for seamless communication.
3	DC Breaker	Control Disconnect: Use the control feature to disconnect the battery from the inverter when necessary.

7.2 Installation battery system

7.2.1 Remove the battery system

Caution

- **Compliance**

  Ensure that all transportation, handling, installation, and other operations comply with the laws, regulations, and relevant standards of the country and region.

- **Professional Training**

  To protect the equipment from damage during transportation, ensure that transportation personnel are professionally trained. Record the operation procedure during transportation and maintain the device's balance to prevent it from falling.

- **Pre-Installation Movement**

  Before installation, move the energy storage system to the installation site. To avoid personal injury or device damage, adhere to the following guidelines:

- **Personnel and Tools**

  Prepare the necessary personnel and tools according to the weight of the device. Failure to do so may result in injuries due to the weight of the device.

- **Balance**

  Ensure that the device is kept balanced to avoid falling.

- **Locked Cabinet Door**

  Ensure that the cabinet door is locked during device transportation.

Notice

- **Hoisting and Transport**
  The energy storage system can be hoisted or transported to the installation site using a forklift.

- **Lifting Devices**
  When lifting devices, use flexible straps or slings. Each strap must have a load-bearing capacity of at least 3 tons.

- **Forklift Capacity**
  When using a forklift to move devices, ensure the forklift's bearing capacity is at least 3 tons.

7.2.2 Installation of the battery system

Caution

- **Vertical Installation**
  Ensure that the energy storage system is pressed vertically to the ground to avoid any tipping risk.

- **Secure Installation**
  Ensure that the energy storage system is securely installed to prevent personnel from falling over.

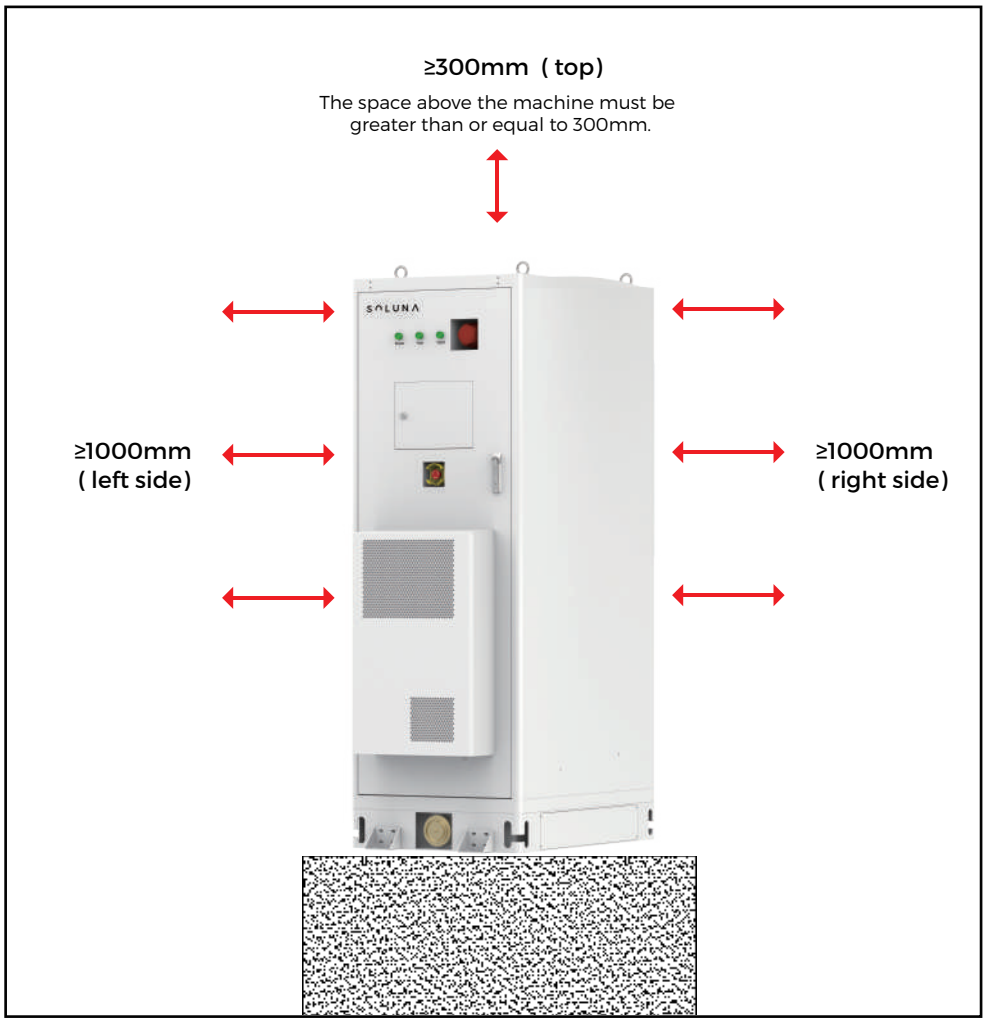
Installation preparation

- **Base Installation**
  The cabinet should be installed on the ground with a base height greater than 200mm.

- **Ventilation**
  Maintain good ventilation on both sides of the cabinet, and ensure the minimum gap between both sides and the top, as shown in the following illustration.

- **Inverter Installation**
  Inverters can be installed on both sides of the cabinet.

The distance from the back of the machine to the wall must be greater than or equal to 500mm.



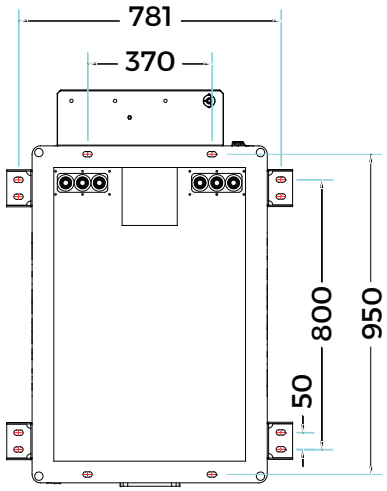
Installation dimension diagram

The key requirements for the base are a height greater than 300mm and a load-bearing capacity greater than 3000kg, with a strong emphasis on ensuring safety and firmness to provide a robust and secure solution. The distance between the front of the cabinet and any other object must be at least 1.5 meters.The foundation is crucial as it supports the entire structure, ensuring stability and durability.

Installation guidance

- **Step 1**
  Install the front and rear mounting brackets on the cabinet using M8 screws.
- **Step 2: Fix the Base**
  Drill 4 holes in the ground according to the actual size.
  Use expansion screws to secure the base.
  Ensure the base has a bearing capacity of over 3000 kg.
- **Step 3**
  Secure the product to the ground

- **Step 4**
  Install the inverter mounting bracket on the left or right side of the cabinet using M8 screws.



unit:mm

- **Step 5**

  Install the cable trough on the side where the inverter bracket is installed.

unit:mm

- **Step 6**

  After the cable is installed, put the cable trough cover plate on.

- **Step 7**

  Put the other sealing plates on.

As shown in the image, there are screw holes on both sides of the machine. Above is the inverter mounting bracket, currently suitable with Solis and Solinteg inverters. Below is the distribution box, facilitating cable management for easy customer installation.

8 Electrical Connection

8.1 Connection requirements

- **Safety Note**

  Ensure that power supply to the inverter and battery is cut off before making any connections to avoid electric shock.

- **Grounding Instructions**

  This product must be connected to a grounded, metallic, permanent wiring system.

- **Personal Protective Equipment**

  Wear appropriate personal protective equipment, such as safety shoes, safety gloves, and insulating gloves, during electrical connections.

- **Qualified Professionals**

  All electrical connections should be made by qualified professionals.

- **Cable Specifications**

  The cable colors mentioned in this document are for reference only. Cable specifications must comply with local laws and regulations.

- **Warranty Notice**

  Equipment damage caused by incorrect wiring is not covered under the equipment warranty.

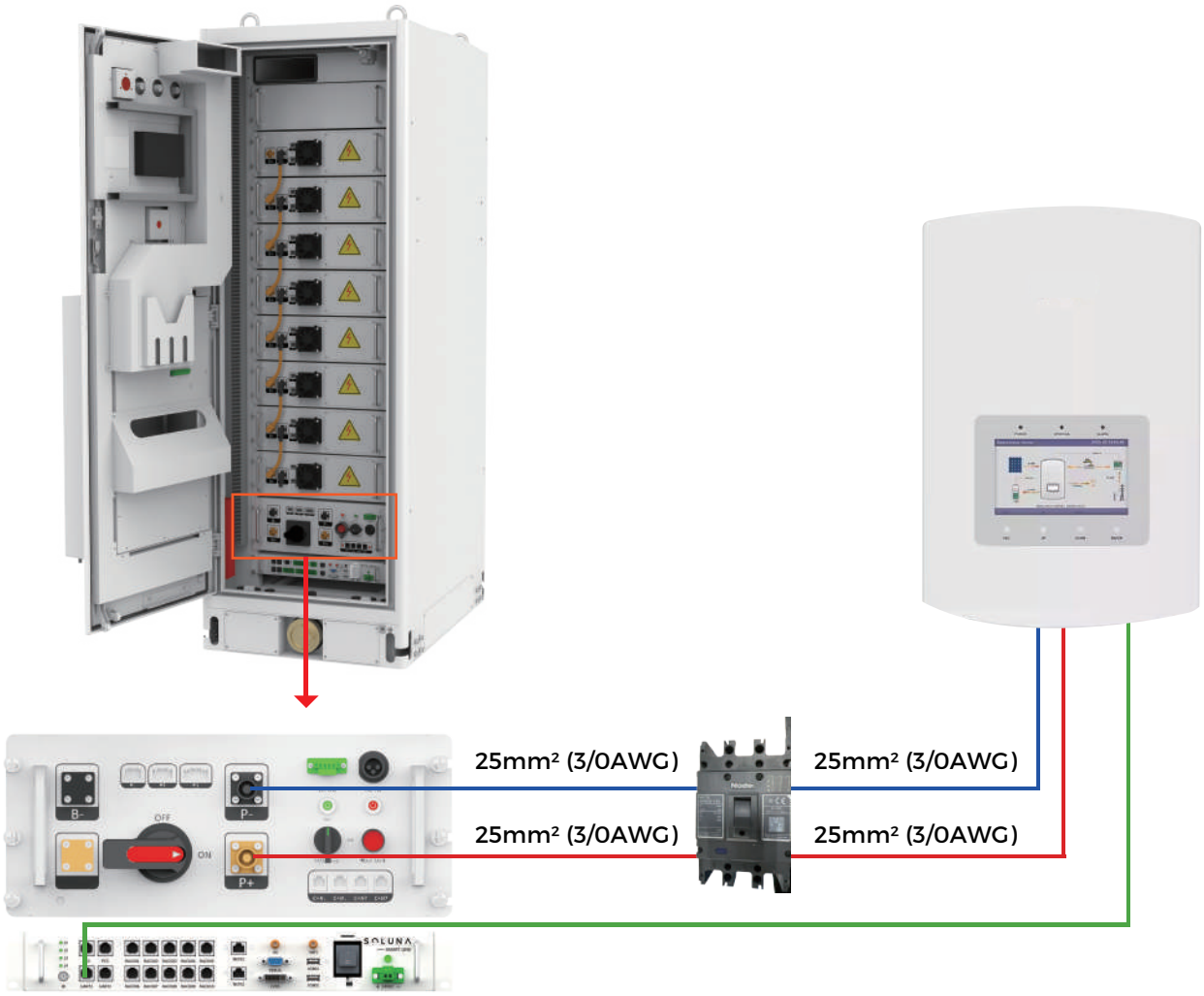
8.2 Electrical system connection diagram

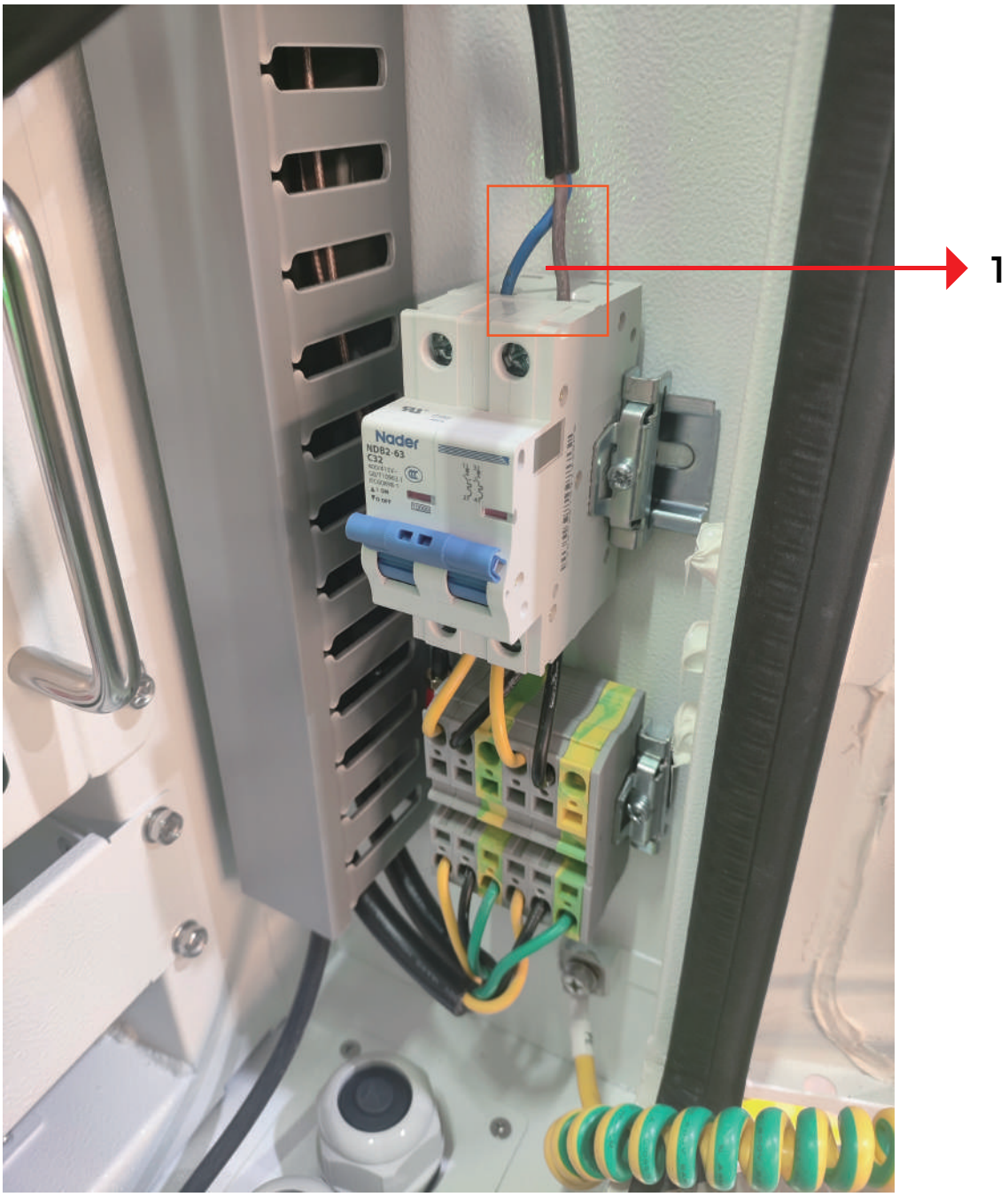
Remark

The circuit breaker is optional.

8.2.1 Standalone

- Communication cable
- Battery positive pole
- Battery negative pole





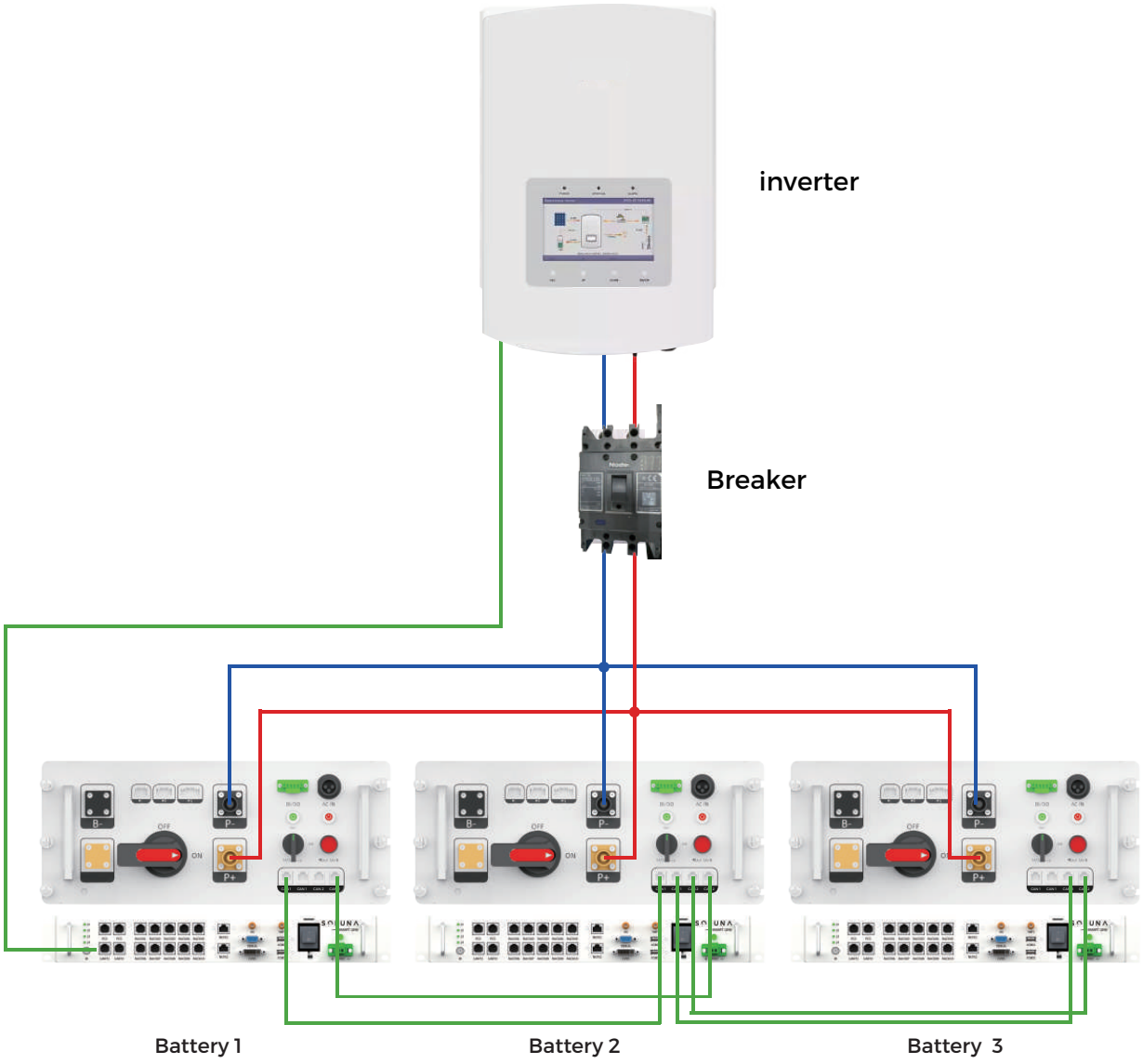
1. Connect the grid's neutral and live wires to the circuit breaker.

- Torque: 3.6–4.5 N·m. Apply silicone sealant at the contact area between the air-conditioner's outer side and the door panel.

  The battery is already grounded, so additional grounding is not required.

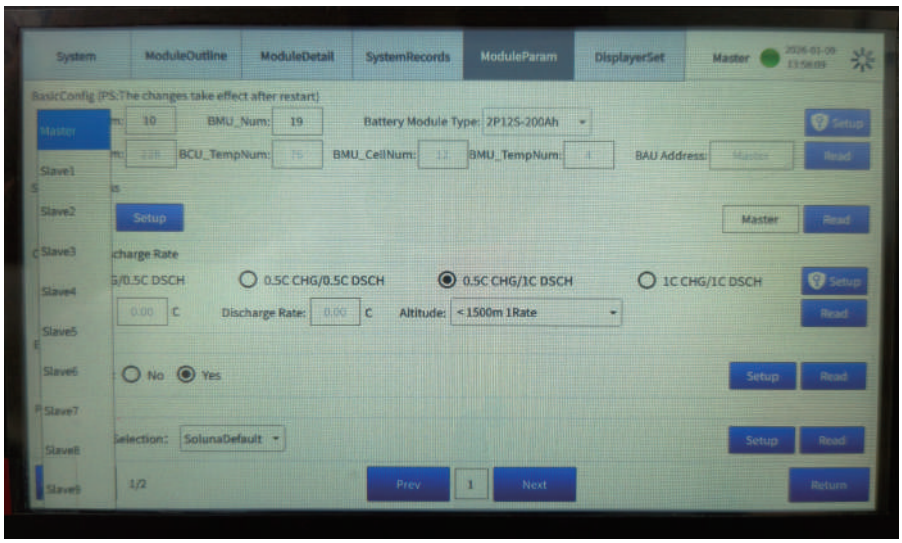
8.2.2 Multiple Clusters

- Communication cable
- Battery positive pole
- Battery negative pole

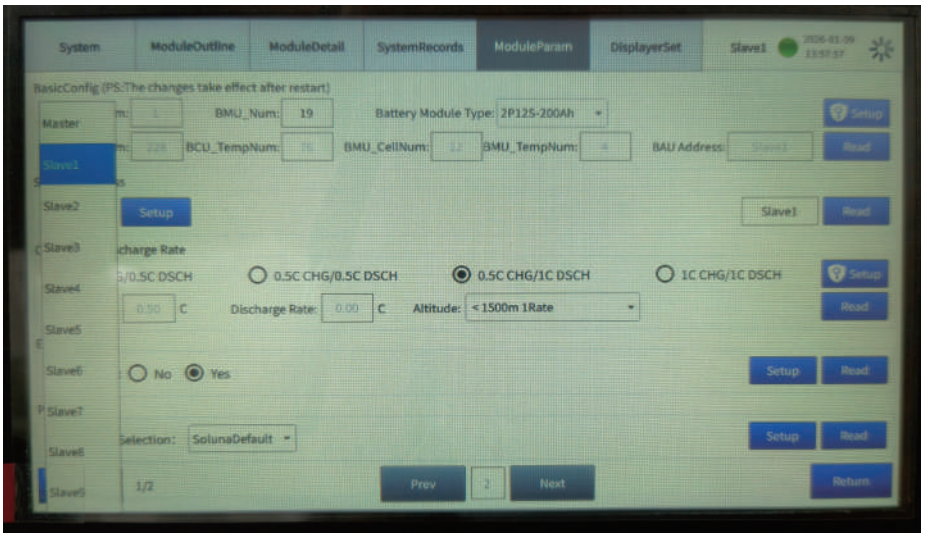


8.2.3. Display and control settings after parallel operation

1. Configure the battery address on the display controller of Battery1, and then set it as the master. Set the number of master BcUs to the number of parallel batteries.



2. Set the display control of Batterv2 to Slave 1, and the display control of Batterv3 to Slave 2. Follow the same logic for battery settings. All slave devices should have 1 BCU.



Notice:
The maximum number of machines that can be paralleled is 10, consisting of 1 master and 9 slaves.

3. All batteries connected in parallel must have the same EMS enabled setting. If an external EMS is used, set it to YES; otherwise, set it to NO.

4. The protocol for parallel batteries also needs to be consistent. If external EMS is enabled, the protocol should be uniformly set to SolunaDefault; otherwise, if external EMS is not enabled.

9 Operation instructions

9.1 Check before starting up

- **Firm Installation**

  Ensure the equipment is installed firmly. The location should be convenient for operation and maintenance, with adequate space for ventilation and heat dissipation. Keep the installation environment clean and tidy.

- **Proper Connections**

  Ensure the protection ground cable, battery power cable, inverter power cable, communication cable, and AC cable are properly and securely connected.

- **Cable Bundling**

  Ensure cable bundling meets requirements and is reasonably distributed without any damage.

- **Switch States**

  Before powering on, make sure all switches are in the off state.

Notice

- **Battery Terminals**

  Do not reverse or short circuit the positive and negative electrodes of the battery, as this will damage the battery pack.

- **BMS Communication Line**

  Do not connect the BMS communication line incorrectly, as this will prevent the battery from working or cause damage.

- **Incorrect Wiring**

  Equipment damage caused by incorrect wiring is not covered by the equipment warranty.

9.2 System start up

- **Step 1** : **Power On the Battery**

  Open the front door of the battery.

  Rotate the BMS Power switch to the ON position.

  Rotate the battery circuit switch to the ON position. The running indicator and the display will light up.

- **Step 2**: **Power On the Inverter**

  Turn on the inverter power PV or power grid. The inverter will start to run.

- **Step 3**: **Select Battery Protocol**
  On the inverter, select the correct battery protocol.
- **Step 4**: **Verify Battery Functionality**
  Check whether the battery can be charged and discharged.

Notice

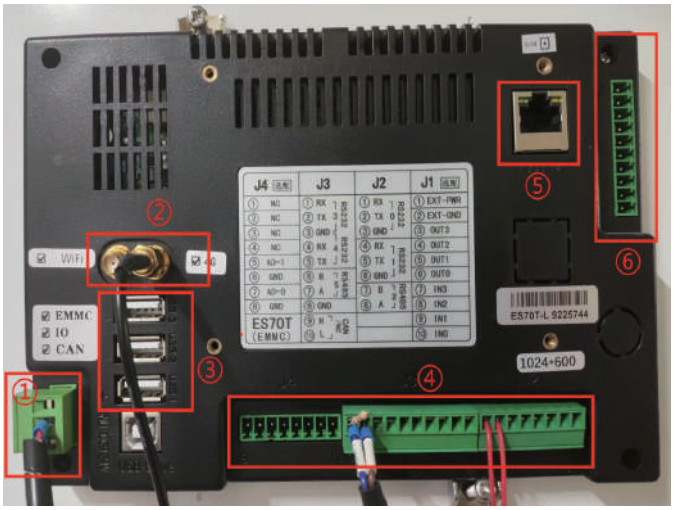
- **Communication Requirement**

The Power Cell-X Series must communicate with the inverter normally to function properly.

- **Off-Grid Mode**

In pure off-grid mode, without PV and power grid, press and hold the black start button for an extended time to start the system.

9.3 Rear Display Interface Functions



1. **Display power interface**
   Connects to the DC24V output of the battery control cabinet. After the battery switch is turned on, the display is powered on simultaneously.

2. **SMA interface**
   These are the antenna interfaces for WiFi and 4G. The purpose of connecting antennas is to ensure stable signal transmission.

3. **USB1/2/3**

   USB1 and USB2 are used for connecting a USB drive to upgrade the display control program. USB3 is currently not in use.

4. **Signal transmission interface**

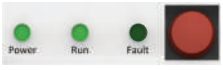
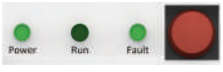
   Primarily receives temperature information uploaded from the air conditioner to monitor its operation.

5. **RJ45 network port**

   Use a network cable to connect to the PCS3 interface of Smart Link, which is used to upgrade the display via Smart Link.

9.4 Front Display Features Overview

9.5 Status indicator light introduction

No	Picture	Power	Run	Fault	Status
1		on	off	off	Power on
2		on	on	off	Charge and discharge operation
3		on	off	on	Fault
4		off	off	off	Power off

9.6 System shutdown

- **Step 1**：**Power Off the Battery**
  Rotate the BMS Power switch to the OFF position.
  Rotate the battery circuit switch to the OFF position.
- **Step 2**：**Disconnect Inverter Power Supplies**
  Disconnect all power supplies of the inverter.
- **Step 3**：**Disconnect Air Conditioner**
  Disconnect the air conditioner

10 Maintenance And Troubleshooting

10.1 Maintenance

- **Recharging**

  It is recommended to recharge the battery system every 6 months from the time it leaves the factory.

- **Long-term Inactivity**

  When the system is not used for a long time, disconnect the battery output to avoid battery exhaustion.

- **Regular Inspections**

  During system operation, professionals should regularly check the system for abnormalities and faults. If any issues are found, they should be addressed promptly to prevent permanent damage to the battery system.

- **Cleaning**

  Professionals should regularly clean the surface and interior of the system, ensuring all power is disconnected before cleaning.

- **Storage Period Checks**

  During storage, professionals should regularly check the battery system for abnormalities. Any issues found should be dealt with promptly.

10.2 Troubleshooting

NO	Faults Phenomenon	Faults Cause	Solution
1	The power indicator is off	1) Battery low voltage 2) No AC input	1) Check the battery voltage and charge it 2) Check the AC input
2	The battery has no output voltage	1) No communication with the inverter 2) The fuse or relay or breaker is damaged	1) Check the communication connection between the battery and the inverter 2) Check the fuses,relay and breaker inside the battery

NO	Faults Phenomenon	Faults Cause	Solution
3	Battery communication exception	1) The communication cable is improperly connected or loose 2) The inverter battery protocol is incorrectly selected	1) Check the communication connection between the battery and the inverter 2) Check the fuses,relay and breaker inside the battery
4	Battery voltage low	No charging for a long time	Connect the photovoltaic or power grid to enable the inverter to charge the battery
5	The sound and light alarm is blinking	The door was not closed tightly	Check the door
6	Fault indicator light on	The battery is seriously faulty	Check the battery fault history
7	Display screen has no communication	Display screen communication circuit abnormality	Check the display communication line
8	Display not working	Display screen power supply circuit abnormality	Check the display power supply circuit
9	Display screen failure	/	Restart the battery
10	EMS not working	EMS power supply circuit abnormality	Check the EMS power supply circuit
11	EMS network abnor-mality	Poor indoor network	Check whether the indoor network is normal
12	EMS communication abnormality	The inverter is not connected and the protocol does not match.	Check whether the inverter is connected, whether the inverter is turned on, and whether the protocol matches

NO	Faults Phenomenon	Faults Cause	Solution
13	Battery parallel abnormality	1) Inconsistent protocols 2) Incorrect dip resistors 3) Incorrect communication connections	Check whether the inverter is connected, whether the inverter is turned on, and whether the protocol matches
14	Air conditioning not working	Air conditioner power supply circuit is abnormal	Check the air conditioner power supply circuit

Notice

Damage to the Battery System Due to Under Voltages

- **Timely Charging**

  Charge the over-discharged system within seven days when the temperature is above 25˚C.

  Charge the over-discharged system within fifteen days when the temperature is below 25˚C.

- **Contact for Assistance**

  If the battery system doesn't start up, please contact Soluna local after-sales service within 48 hours. Otherwise, the battery could be permanently damaged.

- **Long-term Inactivity**

  If the battery system cannot be charged for a long time, please turn it off to prevent damage.

11 Depth Of Discharge (DoD) Setting Of Inverter

To make sure the battery working smoothly, we recommend the DOD setting of inverter as follows.

On-Grid DOD:80%

Off-Grid DOD:70%

Power dispatching mode DOD:70%

In energy storage systems, reducing the depth of discharge (DOD) of lithium batteries is aimed at **improving system economics, extending battery life, enhancing safety, and optimizing performance**. Below are the specific reasons:

1. Extending Battery Life

- The cycle life of lithium batteries is closely related to the depth of discharge. Deep dis charge (e.g., 80%-1 00% DOD) accelerates battery aging, leading to faster capacity d egradation.

- Reducing DOD (e.g., controlling it between 20%-80%) can significantly extend the battery's cycle life, thereby lowering long-term maintenance and replacement costs for the energy storage system.

2. Improving System Economics

- Batteries account for a significant portion of the cost in energy storage systems. Extending battery life means reducing the frequency of battery replacements and lowering the total lifecycle cost.
- Although reducing DOD decreases the available energy per cycle, the overall energy throughput (total charge-discharge capacity) may increase by extending battery life, there by improving economic efficiency.

3. Enhancing Safety

- Deep discharge increases the risk of over-discharge, causing the battery voltage to drop too low, which may lead to irreversible chemical damage (e.g., dissolution of the copper current collector in the anode).
- Reducing DOD can prevent over-discharge, minimize safety risks such as thermal runaway, and ensure stable operation of the energy storage system.

12 Register on the Website after Installation

After completing the installation of the battery system and confirming that it is operating normally, please log in to the Soluna official website to register your product installation and usage details. This registration is required for the product warranty to take effect. Follow the on-screen instructions on the website to complete the registration process.

https://soluna.co → SUPPORT & SERVICE → Warranty registration

13 Contact Us

If you have any questions, feedback, or need assistance, please feel free to reach out to us. We are here to help!

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