Series: AS03-50S

ATLAS Series 03

50 kW Energy Storage System

User Manual

Version: V1.0

Foreword

Dear customer, thank you very much for purchasing and using products developed and manufactured by Shenzhen Ligoo New Energy Technology Co., Ltd (hereinafter referred to as AlpSolarr). We sincerely hope that the products and manuals will fulfill your needs. We welcome your valuable comments and will continue to improve and enhance.

Contents in this document may be updated from time to time due to product version upgrades or other reasons. Unless otherwise agreed, this document is intended as a guide to use only, and all statements, information and recommendations contained in the document do not constitute any express or implied warranties.

All operations of the equipment must be performed by a trained professional electrical technician. The operator should be fully familiar with the composition of the whole system, its working principle and the relevant standards of the country/region where the project is located.

Please read the user manual in detail for product information and safety precautions before installing the equipment. Damage to the equipment resulting from failure to store, handle, install and use the equipment in accordance with this user manual is not covered by the equipment warranty.

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For updates or additional information, please contact AlpSolarr.

Contents

About this manual

★ Target readers

This manual is intended for technicians who install, debug, use and maintain this product. Please read this manual carefully before operation. Readers should have some basic knowledge of electricity, wiring, electrical components, electrical symbols and mechanical principle diagrams.

Installation, operation, maintenance, and replacement of equipment or parts are permitted only by qualified professionals or trained personnel.

★ Main contents

Chapter	Content
I. Safety Precautions	The safety precautions to be observed when operations of transporting, storing, installing, operating, debugging, and maintaining the product are carried out, as well as the meaning of markings on packages, the meaning of warning signs on a machine body and environmental requirements are introduced.
II. Introduction to Product	The functions, principles and configurations of the product as well as electrical data, mechanical data, etc. are described.
III. Installation Instructions	The mobile transportation methods, installation and fixation, wiring methods and precautions of the product are described in details.
IV. Debugging Instructions	The methods and precautions for powering up, debugging and operating the product are introduced.
V. Maintenance Guidance	The routine maintenance methods, maintenance cycles and precautions of the product are introduced.
VI. Troubleshooting	Fault analysis and troubleshooting methods of the product are introduced.

★ Symbolic conventions

The warning symbols shown in the table below may appear in this user manual to indicate different levels of potential hazard. Users must comply with the relevant safety requirements when using the product to avoid accidents.

Grade	Definition
Danger	It indicates a significant potential hazard (especially a high-pressure hazard). Failure to operate as required may result in serious personal injury or property damage.
Warning	It indicates a general potential hazard. Failure to operate as required may result in personal injury or property damage.
Attention	It indicates a general potential risk. Failure to operate as required may result in improper operation of the equipment or property damage.

★ Terms and acronyms

Term/acronym	Description
AlpSolarr	Shenzhen Ligoo New Energy Technologies Co., Ltd

AS03	Shenzhen Ligoo AS03-40、50S Series Energy Storage Integrated Machine

I. Safety Precautions

1.1 Safety statements

Please read and follow these safety precautions before installing, operating or maintaining the equipment.

For personal and equipment safety, please follow marks on the equipment and all safety precautions in the manual when installing, operating and maintaining the equipment.

The “Danger”, “Warming” and “Attention” items in the manual do not represent all the safety precautions to be observed, but are only supplementary to all the safety precautions.

This equipment should be used in an environment that complies with the design specifications, otherwise equipment malfunction may be caused. Abnormal functions or damage to parts, etc., caused by failure to comply with the relevant regulations shall not be covered by the equipment warranty.

AlpSolarr shall not assume any legal liability for personal safety accidents, property damage, etc. caused by unauthorized operation of the equipment.

1.2 Safety matters

1.2.1 Precautions for box marking

The safety precautionary information contained in this document must be observed at all times when operating the equipment.

The markings on the box are as follows:

	High voltage hazard. High voltage is present when the equipment is operating, make sure that the equipment is disconnected from the power supply when operating the equipment.		Delayed Discharge. After the unit is powered down, wait 5 minutes until the unit is fully discharged.
	Before operating the equipment, please read the product manual in detail.		The equipment is potentially hazardous when operated. Please take precautions when operating.
	High temperatures exist on the surface of the equipment, and touching it while the unit is in operation is prohibited and may result in burns.		The equipment is not to be disposed of as household waste, please dispose of the equipment according to local laws and regulations or send it back to the equipment manufacturer.
	CE mark		Protective ground wire connection point.

1.2.2 Precautions for transportation and storage

⚠ Attention

1) Only qualified professionals can install, operate and maintain this product.

2) The product handling or placement process must be carried out slowly, and rapid placement may lead to product damage; great care must be taken during placement; and pay attention to the position of the center of gravity of the product to prevent tipping and prevent knocking the equipment or damaging the cabinet during handling.

3) Liquids, debris or crumbs should be prevented from getting inside the product, as conductive liquid and crumbs may cause short circuits inside the product, which can lead to equipment damage; and do not leave tools inside the equipment.

4) Before installation and maintenance operations are completed, the product must be isolated from external power supply equipment to prevent endangering personal safety.

5) Please make sure to take relevant protective measures to avoid electric shock, fire and other accidents.

6) The product needs to be stored in an environment that meets the requirements. It is not permitted to store it in places exposed to direct sunlight, places exposed to rain, places exposed to heavy sand, dust and salt spray, places where there is impact or vibration, and places where the ground is undulating. Pay attention to dust and moisture prevention.

7) If the product shall be stored for more than three weeks, additional attention should be paid to the following points:

- Place desiccants in the product cabinet.
- Seal and package the product with heat-shrink plastic to minimize the effect of outside air humidity on the product.

8）If the product is not immediately transported or installed for use, the product must be stored indoors in a place that complies with the following conditions:

Parameters	Request
Storage temperature (without battery)	-25℃~+60℃
Battery	20℃～30℃
Storage relative humidity	＜95% (condensationless)
Altitude	＜2000m

1.2.3 Precautions for installation and wiring

⚠ Attention

1) Insulated tools must be used when installing the equipment. For personal safety, please wear personal protective equipment.

2) During installation or operation, the cabinet door must be closed when personnel leave for short periods of time.

3) The product and other connected equipment must be grounded according to the relevant specifications, and the material, size and other processes of the grounding conductor must meet the requirements of the safety regulations to ensure the personnel and product safety.

4) No flammable and explosive items shall be placed inside and near the cabinet of the energy storage product.

5) Make sure that the cable terminals are not charged before wiring; multiple power sources are contained inside the energy storage products, and all AC and DC power sources need to be disconnected before installation and maintenance.

6) During installation, make sure the environment is ventilated and has good heat dissipation. If the ambient temperature is too high, it is necessary to install a forced air cooling unit and ventilation ducts, or an air conditioner cooling unit. The specific implementation program needs to be set according to the environmental conditions.

7) It should be installed on flame retardant materials, such as metal brackets, concrete floors, etc. The installation site must be level and have sufficient load-bearing capacity.

8) When the power cable is connected, make ensure that the power cable is installed with the correct torque. Too small torque may cause the contact resistance to become large, leading to overheating; and too large torque may cause damage to the screw.

9) The connected power cable must comply with the relevant national standards and ensure the quality of construction. The use of substandard cables or the substandard construction quality may result in overheating of cables or cable connections, and fire may occur in severe cases.

10) Do not unscrew the fixing screws of the product at will.

11) According to the regulatory requirements of different regions, the N and PE wire wiring of the inverter ON-GRID and BACK-UP ports are different, depending on the local regulatory requirements.

● When making electrical connections, wear personal protective equipment such as safety shoes, protective gloves, and insulated gloves as required.

● Only specialized personnel are allowed to perform operations related to electrical connections.

● The cable colors shown in this graphic are for reference only, and specific cable specifications are subject to local code requirements.

● Copper wire is recommended for AC connections, so please provide some nickel-plated copper OT terminals of your own.

● If you need to use aluminum wires for AC connection wires, please provide some copper and aluminum transition OT terminals by yourself.

1.2.4 Precautions for debugging and operation

⚠ Attention

1) Before connecting to the input power supply (including AC mains and batteries), be sure to ground reliably.

2) During the operation of the product, make sure that the cabinet door is in a locked state to prevent personal injury. Also try to avoid conductive substances such as dust, salt spray and metal shavings from entering the cabinet.

3) In the power-on period, it is prohibited to touch devices such as internal veneers, cables and terminals.

4) When the product emits an abnormal odor or sound or breaks down, stop the working condition of the product and cut off the power supply immediately, otherwise electric shock or fire accidents may be led.

5) All installation work is completed and it is ensured that the cables are not connected incorrectly before allowing the product to be powered up.

6) It is prohibited to perform any insulation resistance test or voltage withstand test on the product, and incorrect voltage withstand tests will damage the product.

7) When performing insulation withstand voltage tests on other equipment external to the product, the switch between the product and the other external equipment must be disconnected.

8) Insulated shoes must be worn when approaching products in operation and metal jewelry must be avoided.

9) It is prohibited to touch electrically-charged products while your hands are wet or you are sweating profusely.

10) It is prohibited to make contact with fan blades in operation.

11) A certain amount of noise will be generated when the product operates, if necessary, please wear earplugs to protect your ears.

1.2.5 Precautions for operation and maintenance

⚠ Attention

1) Maintenance operations on the product are prohibited during power-on. After the power supply is disconnected, it is necessary to wait for at least 5 minutes and measure whether the voltage of the AC and DC terminals is within the range of safe voltage (36 V), ensuring that maintenance on the product is carried out after the energy storage cabinet is completely powered off.

2) Before maintenance, it is necessary to disconnect all power supplies between the energy storage cabinet and external equipment, and confirm that there is no voltage input into the control circuit and the main circuit.

3) When maintaining, relevant protective measures (including but not limited to wearing insulated shoes, insulated gloves, etc.) should be taken to avoid electric shocks, fire and other accidents.

4) When maintaining overweight components, multiple people must cooperate or use lifting equipment to prevent heavy objects from falling and injuring people.

5) Special attention should be paid to the hot surface of the device to prevent scalding. Some components in the cabinet, such as packs, copper rows, cables, etc., remain at high temperatures for a period of time after the energy storage cabinet is powered off.

6) Routine inspection and maintenance be regularly carried out on the energy storage cabinet, see related contents in “V. Maintenance Guidance” chapter of this manual for specific operations.

7) The pack portion of the product and screws for external wiring should be calibrated for torque periodically to prevent loosening.

8) The device for replacement must be a device with the same model and specifications as the original device.

9) The product needs to be checked to see if the lightning protector is intact after each encounter with thunderstorms, and replacement is needed if it is damaged.

10) Please dispose of discarded components and parts as industrial waste.

1.2.6 Battery Safety Matters

⚠ Warning

1) High voltage exists inside the battery. Before operating the equipment in the system, please make sure that the equipment is disconnected from the power supply to avoid the risk of electric shock.

2) Please do not subject the battery to vibration, impact, pulling or squeezing, otherwise it may cause damage to the battery or risk of fire.

3) Please charge the battery pack regularly when the battery is stored for a long time, otherwise it may cause capacity loss or irreversible damage to the battery pack.

4) Please do not use more than the rated charge/discharge current to charge/discharge the battery.

5) Do not use the battery or the high voltage control box if it has obvious defects, cracks, damage or other conditions, otherwise it may cause personal danger.

6) Battery current may be affected by a number of factors, such as: temperature, humidity, weather conditions, etc., which may result in current limitation and affect the load-carrying capacity.

7) If the battery needs to be replaced, please contact the after-sales service center.

8) If the battery fails to start, please contact the after-sales service center as soon as possible, otherwise, the battery may be permanently damaged.

First aid measures

If the battery leaks electrolyte, avoid contact with the leaking liquid or gas. The electrolyte is corrosive and contact may cause skin irritation and chemical burns. In case of inadvertent contact with the leaked substance, perform the following actions:

1) Inhalation of leaked substance: Evacuate from the contaminated area and seek immediate medical help.

2) Eye contact: Flush with water for at least 15 minutes and seek immediate medical help.

3) Skin contact: Wash contact area thoroughly with soap and water and seek medical help immediately.

4) Ingestion: Induce vomiting and seek medical help immediately.

Fire

1) The battery may release toxic and harmful gases when it catches fire.

2) In case of fire, please call the fire alarm immediately, notify firefighters and provide product-related information.

3) In case of fire, it is recommended to disconnect the upper and lower switches of the equipment in time to ensure the safety of personnel.

4) When extinguishing the fire, please do not use ABC dry powder fire extinguishers to extinguish the fire, and firefighters must wear protective clothing and self-contained breathing apparatus.

1.3 EU Declaration of Conformity

Devices with wireless communication capabilities that can be marketed in Europe meet the requirements of the following directives:

- Radio Equipment Directive 2014/53/EU (RED)
- Restrictions of Hazardous Substances Directive 2011/65/EU and (EU) 2015/863 (RoHS)
- Waste Electrical and Electronic Equipment 2012/19/EU
- Registration, Evaluation, Authorization and Restriction of Chemicals (EC) No 1907/2006 (REACH)

You can download the EU Declaration of Conformity on the official website: www.alpsolarr.com

II. Introduction to Product

2.1 Basic introduction

The ATLAS 03 industrial and commercial series energy storage product is a high-safety, high-reliability and standardized series product developed by AlpSolarr for industrial and commercial application scenario field, which adopts modular system configuration to flexibly match all kinds of industrial and commercial scenarios, supports for grid-connection and off-grid automatic switching with the switching time of milliseconds, supports for parallel expansion, facilitates the expansion of the system, can achieve peak and valley time shifting and off-peak power consumption, and alleviates the pressure on the grid. This industrial and commercial energy storage product is suitable for application scenarios with high requirements for grid continuity, can be used for peak shaving and valley filling, backup power and optical storage integrated use, and can also be suitable for application in microgrid scenarios.

The industrial and commercial energy storage integrated machine internally includes a battery insertion box, a control box, a power conversion system (PCS), an air conditioner system, a battery management system (BMS), an energy management system (EMS), a fire protection system, etc.

2.2 Application scenarios

It is mainly used in industrial parks, financial institutions, educational institutions, buildings, gas stations, communication base stations and other small and medium-sized industrial and commercial scenarios.

2.3 Product features

AS03 adopts an energy storage cabinet type integrated solution with modular design, which integrates a long-life battery cell, the battery management system BMS, the high-performance power conversion system PCS, an active safety system and a thermal management system into a single standardized cabinet, forming an integrated plug-and-play distributed energy storage box. It has the following functional features:

Long-life battery cell: the high-quality and high-reliability cells certified by UL 1973, IEC 62619 and other international standards are used, and the service life can be more than 10 years.

High-performance BMS: a multi-level distributed architecture design, high-accuracy acquisition and detection, with a voltage error <5 mV and a current error <1%. The intelligent SOX algorithm of the neural network is used. Therefore, the charging and discharging efficiency is optimized.

Optical storage integration: it supports the connection to the photovoltaic device through the DC coupling to integrate the photovoltaic device and the energy storage device. It can also automatically switch between connection to the grid and disconnection from the grid in milliseconds. It can provide the backup power without connection to the grid.

Multi-protection design: immersive protection at the pack level + active safety isolation function at the cluster level + surrounding fire fighting at the system level + partitioned safety isolation

Flexible installation: with an integrated modular design, it is highly integrated and covers a small area. The wiring is done at the front. Its installation is simple and it is a plug-and-play device.

It supports the expansion of capacity through parallel connection to facilitate the expansion of the system.

Intelligent EMS: the human-machine interaction design is used. It monitors the status and records the failures in real time. It can give early warnings against failures and position the failures. It has the function of monitoring and recording the battery performance. The remote maintenance and monitoring is available through the cloud technology. The complete set of solutions to the local background monitoring, the web display and the mobile APP is supported. It contains an EMS. Multiple operation modes can be selected to increase the yield.

2.4 Electrical principle

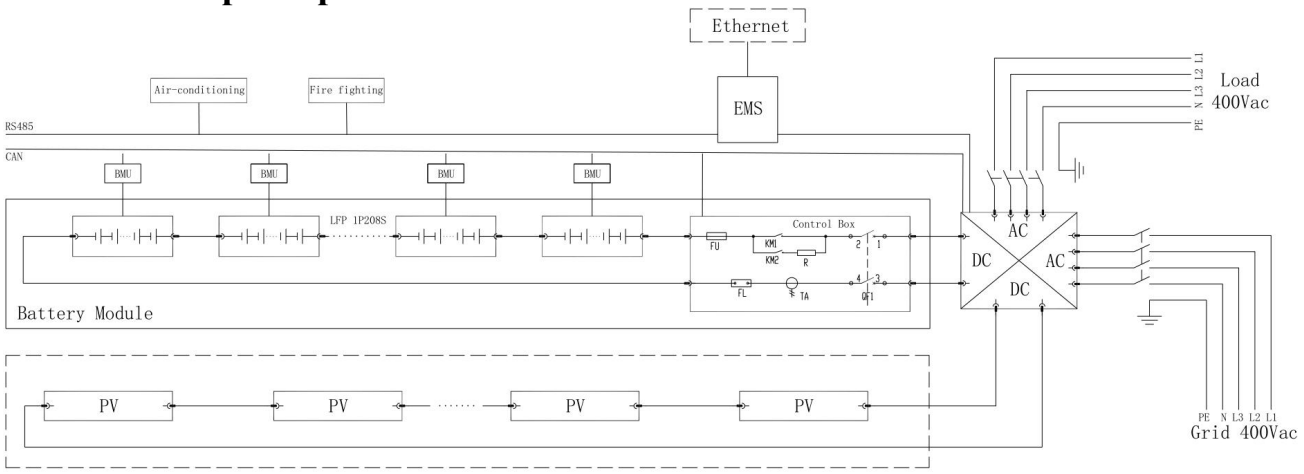


Figure 2.4.1 AS03 Electrical topology schematic diagram

2.5 Product display

The energy storage system is an AS03-50S series energy storage product, which adopts the outdoor cabinet type, and the internal layout of the outdoor cabinet is shown in the following figure.

Figure 2.5.1 Product effect dchematic diagram

The nominal capacity of this energy storage cabinet is 40、50 kW/80~100 kWh, the manner of cell connection in single PACKs adopts 1P16S, it can support 11-13 PACKs connected in series, 150Ah Li-FePO4 cells are adopted, the capacity of one PACK is 7.68 kWh, the rated power of PCS is 40、50 kW, and the whole machine can support parallel capacity expansion.

2.6 Technical parameters

Product Series	AS03-40S-080	AS03-40S-090	AS03-40S-100	AS03-50S-100
Product Model	AS03-40S080A、AS03-40S080E	AS03-40S090A、AS03-40S090E	AS03-40S100A、AS03-40S100E	AS03-50S100A、AS03-50S100E
Battery Side Parameters				
Cell Type	LFP			
Cell Specification	3.2 V 150 Ah			
Capacity of PACK	7.68 kWh			
Rated Capacity	84.48kWh	92.16kWh	99.84kWh	99.84kWh
Rated Voltage	563.2V	614.4V	665.6V	665.6V
Max. Charging/Discharging Current	85A			
PV Side Parameters				
DC Input Voltage Range	150 V-1000 V			
MPPT Voltage Range	150 V-850 V			
Number of MPPT Tracker / Strings	4/8			
Max. DC Input Current	55 A*4			
Max. DC Input Power	52 kW			65 kW
AC Side Grid Connection Parameters				
Rated AC Input/Output Power	40 kW			50 kW
Max. AC Input/Output Power	40kW (Australian version) / 44kVA (European version)			50kW (Australian version) / 55kVA (European version)
Rated AC Input/Output Current	58A			72.5A
Max. AC Input/Output Current	58A (Australian version) / 63.8A (European version)			72.5A (Australian version) / 79.8A (European version)

THDi	＜3%（of nominal power）			
Rated Input/Output Voltage	230/400 V			
Rated Input/Output Frequency	50/60 Hz			
Power Factor	-0.8（leading）～+0.8（lagging）			
AC Side Off-grid Parameters				
Rated Output Power	40 kW			50 kW
Wiring Method	3L+N+PE			
Rated Output Voltage	230/400 V			
Rated Output Frequency	50/60 Hz			
THDu	＜3%（of nominal power）			
System Parameters				
Communication Interface	RS485, CAN, etc.			
Communication Protocol	Modbus			
Display	Touch screen, background terminal, APP.			
Protection Grade	IP55			
Cooling Mode	Industrial Air-conditioning			
Installation Mode	Outdoor			
Corrosion-proofing Grade	C3			
Ambient Temperature	-30℃-55℃（＞45℃ derating）			
Ambient Humidity	0-95% (No Condensation)			
Noise	<70 dB			
Protective Class	Class I			
Type of Isolation	Non-isolated			
Altitude	2000 m			
Size (W*D*H)	1100*1350*2100 mm			
Weight	1322 kg	1386 kg	1450 kg	1450 kg

2.7 Overall structure

The AS03-50S series energy storage product internally comprises a battery insertion box, a control box, a power conversion system (PCS), an air conditioner system, a battery management system (BMS), an energy management system (EMS), a fire protection system, etc.

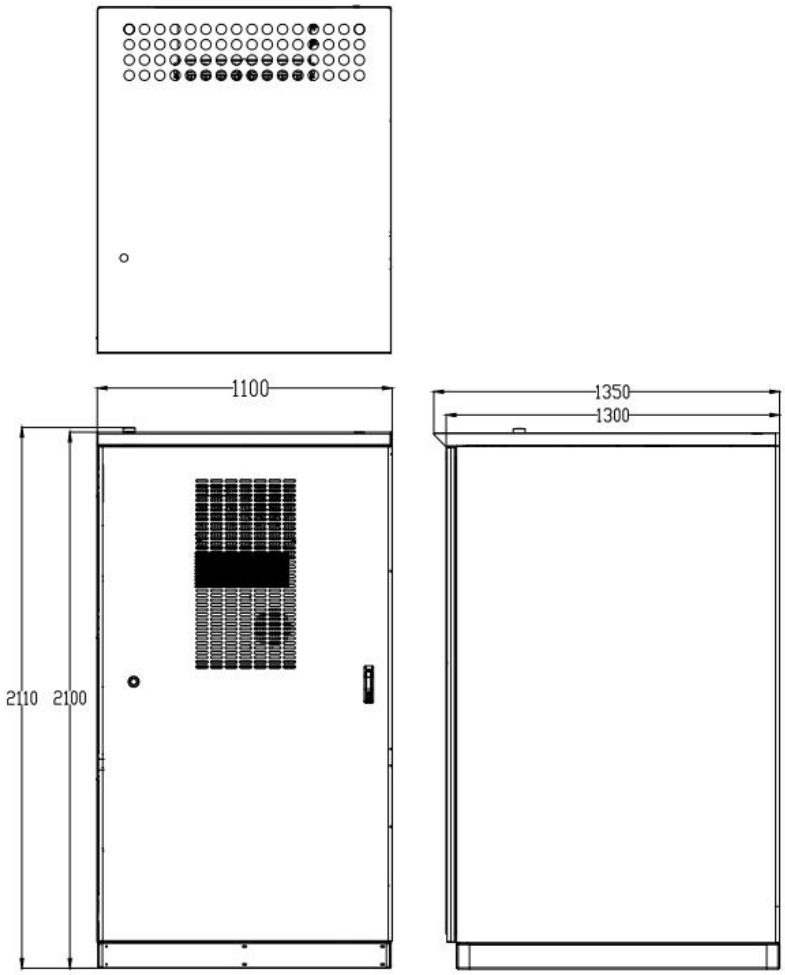


Figure 2.7.1 Cabinet dimension schematic

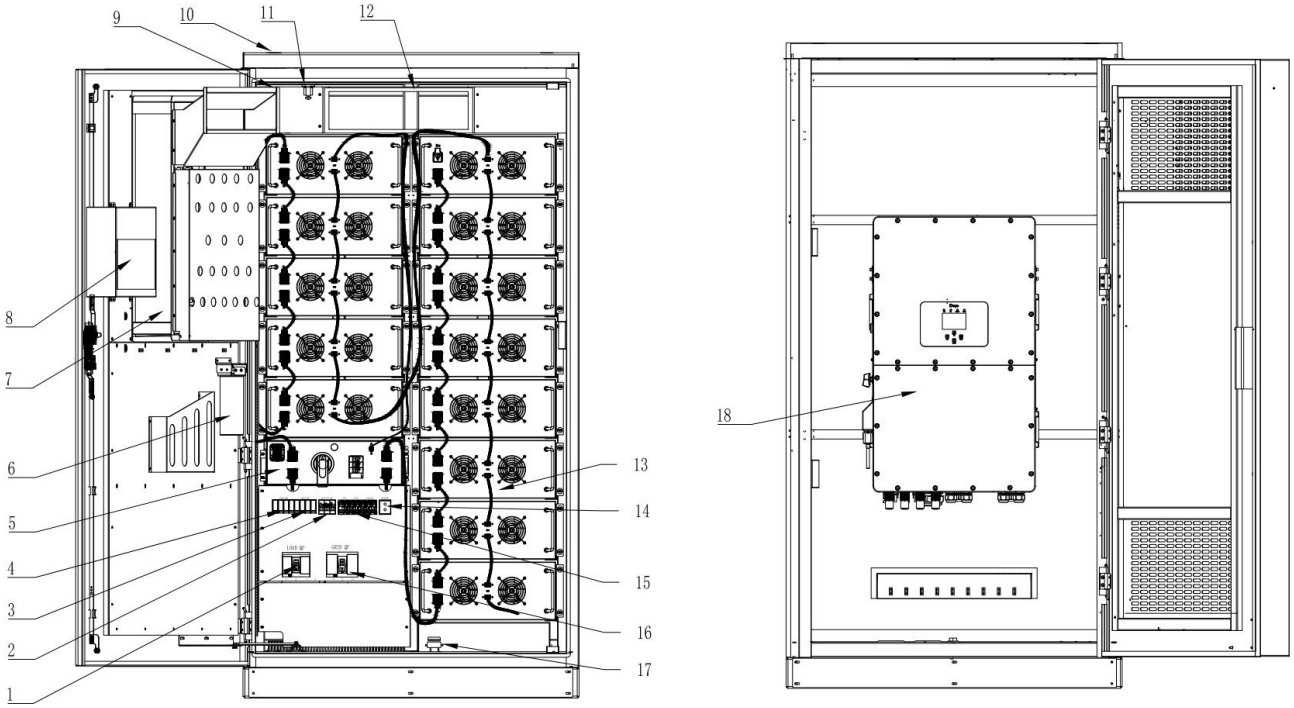


Figure 2.7.2 Schematic diagram of interior of cabinet

NO.	Name	NO.	Name
1	Load control protection switch	10	Antennae
2	Utility side surge protector protection switch	11	Travel switch
3	Utility surge protector	12	Explosion-proof lighting
4	Load-side surge protectors	13	PACK
5	High voltage control box	14	Flood controller
6	Fire extinguishers	15	Power and air conditioning start switch
7	Industrial air conditioning	16	Utility control protection switch
8	Industrial tablet computer	17	Flood sensors
9	Thermal runaway sensors	18	Hybrid inverter

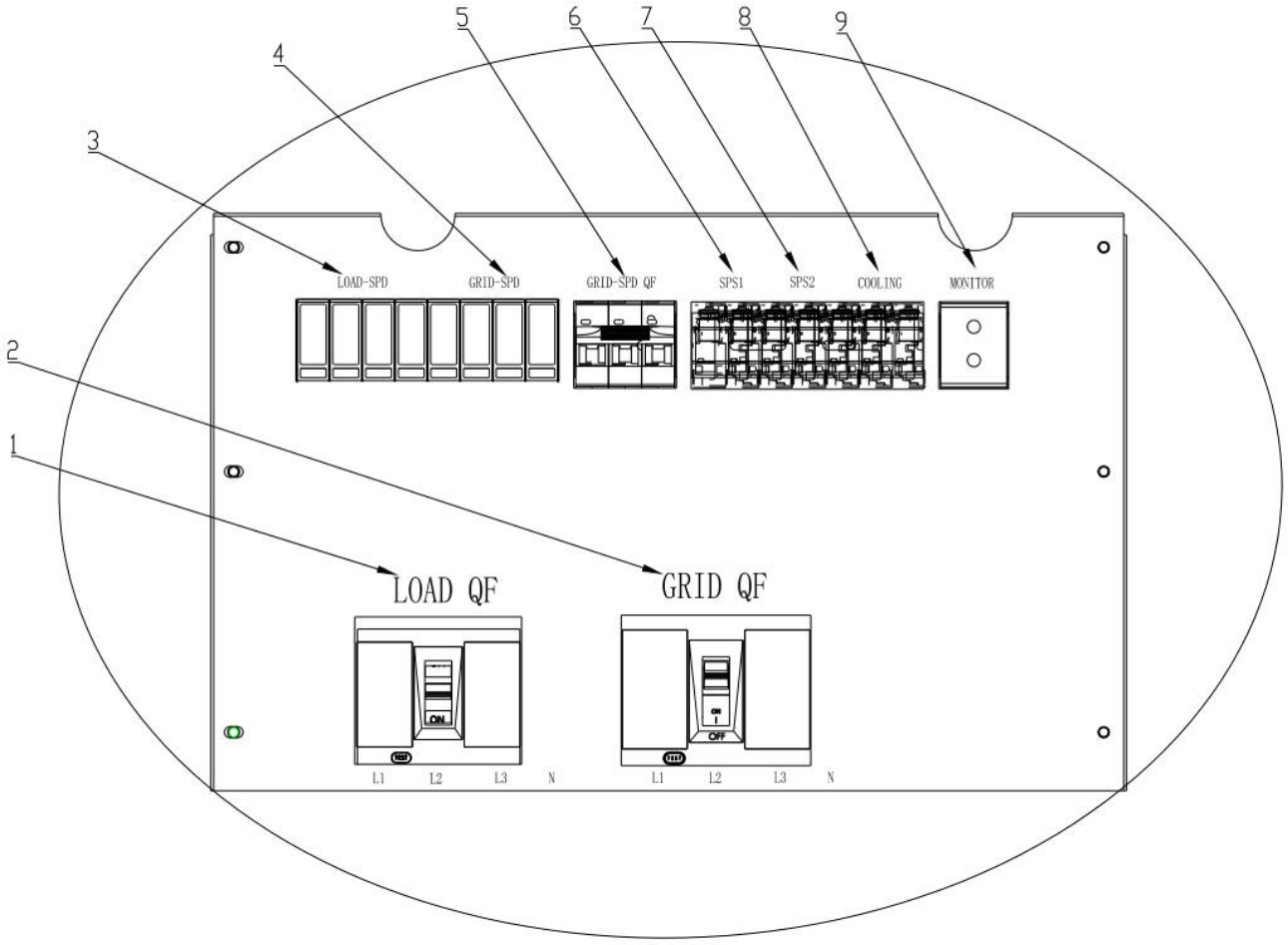


Figure 2.7.3 Schematic diagram of switch panel in cabinet

NO.	Silkscreen	Functional Description	NO.	Silkscreen	Functional Description
1	LOAD QF	Load protection switch	6	SPS1	DC internal power switch
2	GRID QF	Grid protection switch	7	SPS2	AC internal power switch

3	LOAD-SPD	Load side surge protector	8	COOLING	Air conditioner protection switch
4	GRID-SPD	Grid side surge protector	9	MONITOR	Flood sensing controller
5	GRID-SPD QF	Grid side surge protector protection switch			

2.8 System control principle

The operating modes of the system of the AS03-50S series energy storage product are divided into a standby mode, a grid-connected charging mode, a grid-connected discharging mode, and an off-grid discharging mode. The details are described below:

1. Standby mode

When connection of the energy storage system into the utility power and battery is normal,the grid, battery, PV, and load in the system are in a no-power conversion state. The power modules in the system are in standby mode, and the energy storage system can quickly restore output according to the customer's demand.

2. Grid-connected charging mode

When connection of the energy storage system into the utility power and battery is normal, the energy storage system can operate in the grid-connected charging mode according to the user's settings, at this time, the PCS in the energy storage system will convert the AC utility power into DC power to charge the energy storage battery. If there is access to the photovoltaic system, the electricity generated by the photovoltaic is prioritized for use by the load, and when the electricity generated by the photovoltaic is not enough for use by the load, the load can also take electricity from the grid; when the electricity generated by the photovoltaic is enough for use by the load, the user of the excess electricity can choose to feed to the grid to achieve the purpose of selling electricity.

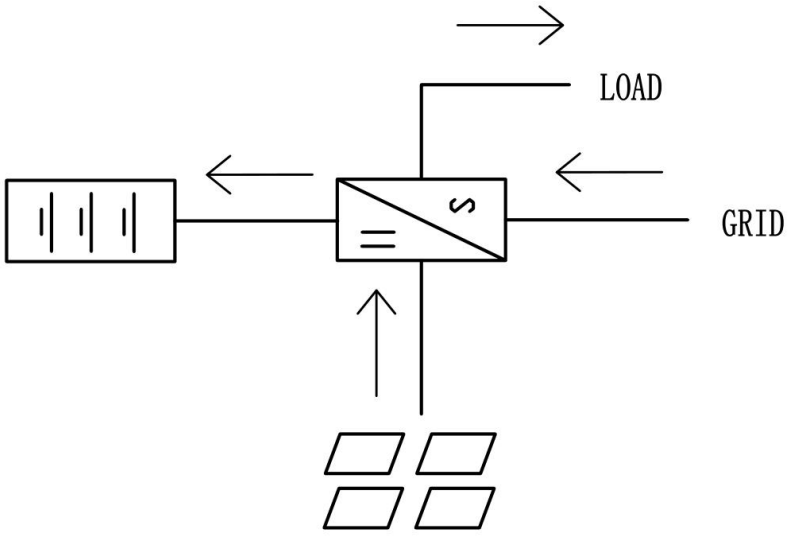


Figure 2.8.1 Schematic diagram of energy flowing during grid-connected charging mode

3. Grid-connected discharging mode

When connection of the energy storage system into the utility power and battery is normal, the

energy storage system can operate in the grid-connected discharging mode according to the user's settings, at this time, the system will convert the DC power of the energy storage battery into AC power to supply power to the load or feed back to the grid. If there is access to the photovoltaic system, the electricity generated by the photovoltaic is prioritized for use by the load, and when the electricity generated by the photovoltaic and the electricity discharged by the battery are not enough for use by the load, the load can also take electricity from the grid; when the electricity generated by the photovoltaic is enough for use by the load, the user of the excess electricity can choose to feed to the grid to achieve the purpose of selling electricity.

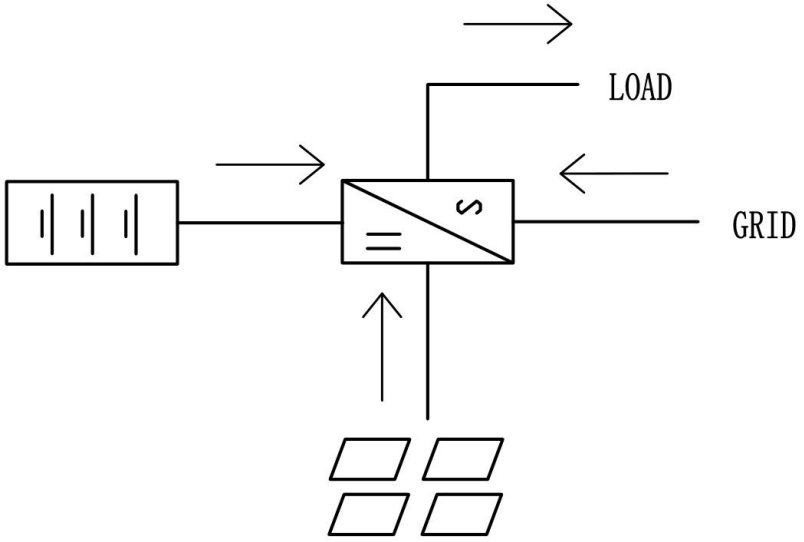


Figure 2.8.2 Schematic diagram of energy flowing during grid-connected discharging mode

4. Off-grid discharging mode

When connection of the energy storage system into the utility power is abnormal and connection into the battery is normal, the energy storage system can operate in the off-grid discharging mode according to the user's settings, at this time, the system will convert the DC power of the energy storage battery into AC power to supply power to the load. If there is an access to the PV system, the electricity generated by the PV is prioritized for use by the load.

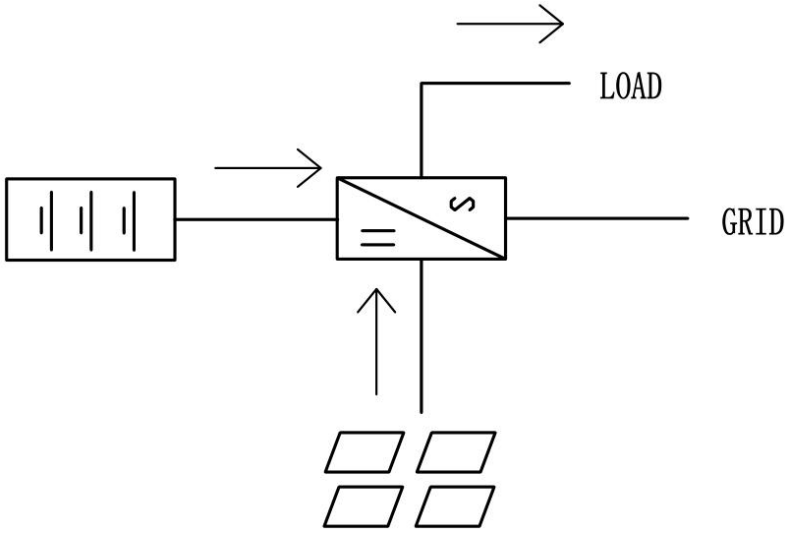


Figure 2.8.3 at this time, the system will convert during off-grid discharging mode

III. Installation Instructions

3.1 Check before receiving

Please perform an unpacking inspection after confirming that the outer package is intact. Check for damage to the goods, with steps as follows:

1. Unpack the packaging box and check if AS03 apperance is good. When the packaging box is unpacked, use tools carefully to avoid scratching the cabinet.

2. Check whether there is any obvious device detachment or loosening inside AS03.

Check the completeness of the goods received in accordance with the table below:

NO.	Item name	Quantity	Unit	Remarks
1	AS03	1	Set	Cabinet (Includes PACK, PCS, high voltage box, air conditioner, etc.)
2	User manual	1	pcs	
3	Factory inspection report	1	pcs	
4	certificate of conformity	1	pcs	
5	Warranty card	1	pcs	
6	Base mounting screw	4	pcs	Expansion screw M12*150L
7	Photovoltaic terminal block	16	pcs	8 each end of terminal block
8	M8 OT Crimp Terminal	10	pcs	For grid-side and load-side wiring
9	M5 OT Crimp Terminal	2	pcs	For grounding
10	Fireproofing mud	2	pcs	1kg/pcs
11	Ribbon	30	pcs	

Note: if the number of packs is different, the whole machine capacity will be different; and AS03-50S-100、AS03-40S-100 has 13 packs, AS03-40S-090 has 12 packs, and AS03-40S-080 has 11 packs.

Customers are responsible for providing their own traffic cards needed for wireless 4G communication.Simply install it while the unit is powered off.

The AS03 unit has been rigorously tested and inspected when leaving the factory, but accidental damage may occur during transportation, so the user is urged to inspect the AS03 upon receipt of the shipment. Please contact AlpSolarr as soon as possible if you notice any damage or if you have any question for better service. After unpacking and inspecting the goods, you can only carry out the subsequent work such as installation and wiring.

3.2 Preparation for installation tools

NO.	Tools or equipment	Specification	Use	Remarks
1	Forklift or pallet truck	3t class and above, fork width <150 mm	Mobile AS03	Lifting equipment needs to be able to carry the weight of AS03
2	Wrench	General	Power cable wiring and screw force correction, base fixing and screw force correction	12N • m
3	Claw hammer	General	Unpacking the cabinet packing wooden box	
4	Screwdriver	Cross-shaped, flat-head	Control cable wiring	
5	Stripping pliers	General	Strip crimp terminals	
6	Multimeter	Range >1000 ∇ DC	Voltage measurement	Power verification
7	Other general construction tools	Mated	For miscellaneous purposes	Scissors, shims, etc.
8	Safety protection tools	Mated	Construction safety protection	

Note: Installation requires the proper wearing of protective tools, not limited to the following protection tools: insulating rubber mats, insulating ladders and stools, insulating gloves, insulating shoes, safety fences, helmets, safety belts, protective glasses, protective clothing, warning signs, warning tape, etc.

3.3 Equipment installation

3.3.1 Installation environmental requirements

1. The installation environment of AS03 needs to meet certain requirements, the installation location can not be in the low-lying areas, and the installation point level is higher than the highest historical water level of the region.

2. The soil condition of the installation point is good, the ground is solid, there shall be no rubber soil, weak soil layers and other adverse geological conditions, do not choose the ground that is easy to accumulate water and easy to sink.

3. The heat dissipation problem needs to be considered, and air circulation and good heat dissipation of the site where AS03 is located should be ensured.

4. Be away from strong vibration, strong noise sources and strong electromagnetic field interference areas.

5. Keep away from places where dust, fumes, harmful gases and corrosive, flammable and explosive materials are produced or stored.

6. An open location should be chosen to ensure that there are no obstacles within 10 m of the equipment’s distance from the surrounding area.

7. The distance from airports, buried waste disposal sites, riverbanks, coasts or dams shall be not less than 1000 m.

8. AS03 may generate some noise during operation. Therefore, it should be installed in an industrial environment far away from residents' lives and at least 50 m away from residential areas to avoid noise pollution.

9. Temperature requirement: -30℃-+55℃. When the ambient temperature exceeds 45°C, please choose an installation site with shade or build an awning to ensure reliable shade.

10. The mounting surface must be made of flame retardant materials, and the strength and hardness are sufficient to withstand the weight of AS03; and it must be installed vertically, the mounting surface must be smooth enough, and the levelness is not more than 10mm/m.

3.3.2 Installation space requirements

Sufficient space should be reserved at the periphery of the device for routine maintenance, heat dissipation of the device, escape from hazards, etc. When AS03 is in operation, the equipment in the cabinet will produce a large amount of heat, too high equipment temperature may directly affect the electrical performance of the equipment, or even damage the equipment, so it is recommended that when the cabinet is installed, a proper and sufficient distance (not less than 1m) should be kept between the air vent of the cabinet and obstacles such as the wall to meet the requirements for the narrowest maintenance passage, escape routes, ventilation. etc.

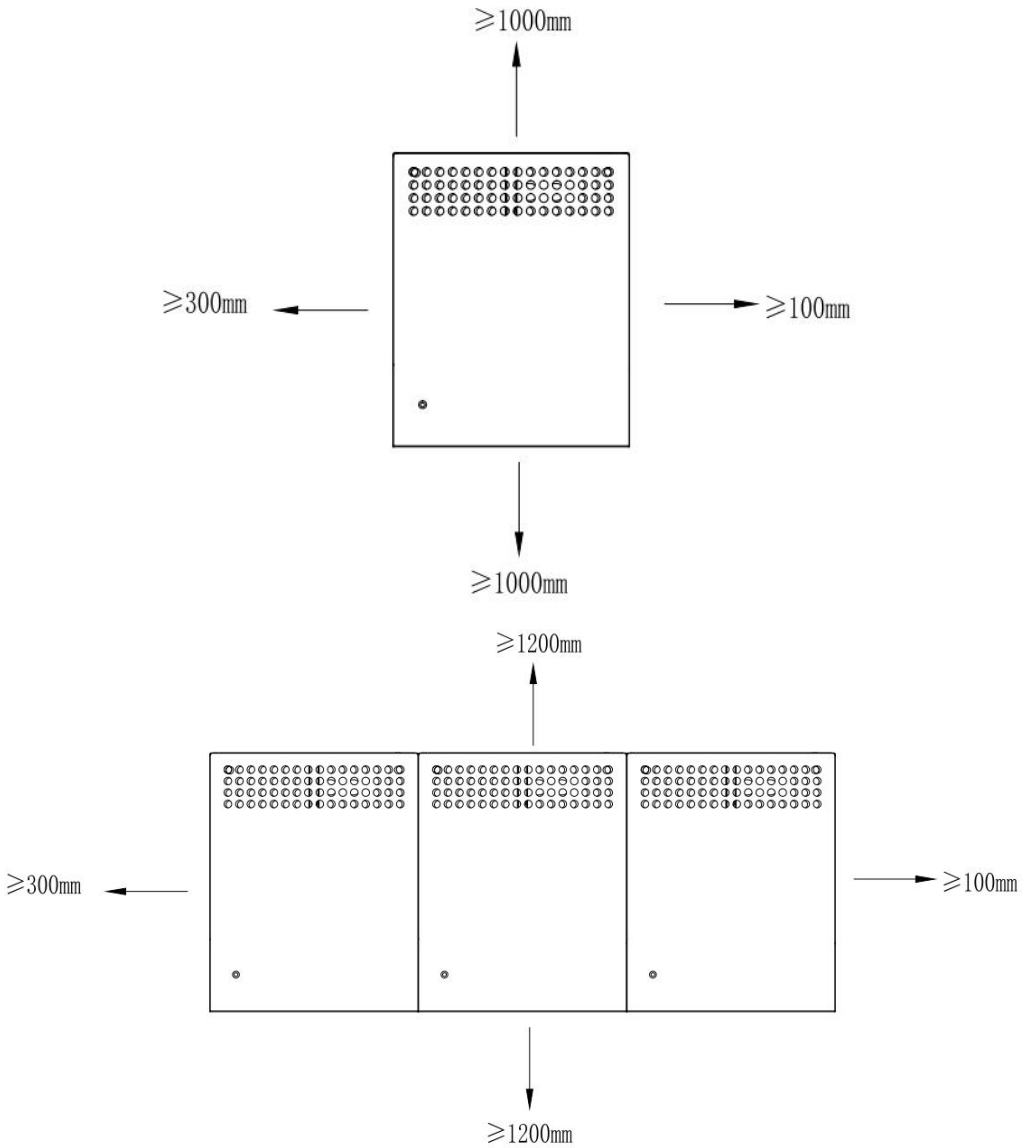


Figure 3.3.2.1 Schematic diagram of cabinet installation space requirements

AS03 should be installed in a place with good ventilation conditions and high air flow. Engineering measures such as adding air supply grilles or fans can be used to obtain greater ventilation. There should be plenty of fresh air supply in the air inlet. Good air quality needs to be ensured. If the air has a high content of suspended particles such as sand and dust, engineering measures can be taken to bring the air quality in line with the requirements (e.g. installing filters at the air supply grilles of the building, etc.).

3.3.3 Foundation requirements

Before installing the equipment, concrete platforms and trenches are built on the ground already selected. Foundation construction requirements are as follows:

1. Foundation dimensions meet cabinet installation and load-bearing requirements.
2. AS03 needs to be installed on a solid concrete floor or a solid base, and it is ensured that the installation inclination is less than 5%.
3. The strength of the supporting foundation is more than 100 kg/cm^2.
4. The horizontal error of the contact surface between the foundation and the cabinet is less than 3 mm.
5. The ground network is buried and a ground copper bar is reserved at the ground position of the cabinet, with one end being connected to the cabinet and the other end connected to the ground point of the cabinet. When the ground network is embedded, enough length is reserved for the ground lug to ensure connection to the cabinet ground point.
6. AS03 adopts underfloor wiring, and the cables must be pre-buried below the cabinet.
7. The base should be higher than 50 mm above the horizontal ground level to avoid the backflow of water accumulated around it.

3.3.4 Equipment installation

All components of AS03 need to be installed in a cabinet. During shipment, the PCS, the air conditioner, the control box and other supporting components have been installed in the cabinet. When installing, the cabinet needs to be fixed in a suitable outdoor site, then the packs are placed into the cabinet one by one and fixed, and then wires are connected. The specific installation steps are as follows:

1. Installation of cabinet

Reserve bolt fixing holes (suitable for M12*150 bolts) and determine the cabinet installation positions based on the foundation design diagram (refer to the AlpSolarr foundation diagram for onsite foundation design. Contact AlpSolarr to obtain the required foundation diagram.)

Measure the foundation cabinet support points to ensure that the support points are in one plane, with an error of no more than 3 mm (for an error of more than 3 mm, please prepare 2 mm or 3 mm steel shims).

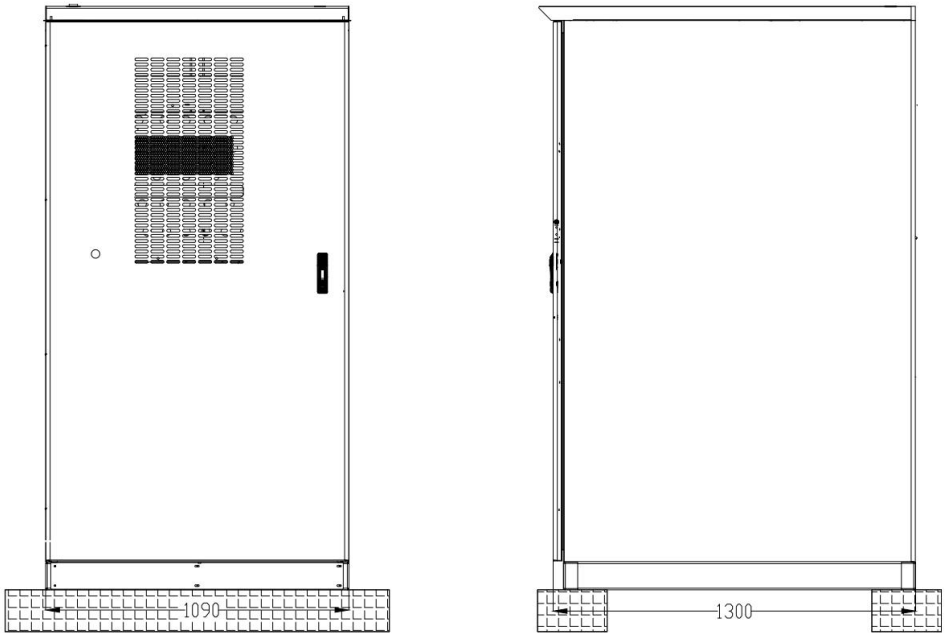


Figure 3.3.4.1 Schematic diagram of cabinet installation

Remove the front and rear baffles at the bottom of the cabinet first, keep the removed baffles and screws, then use a forklift to load and unload the cabinet, then adjust the cabinet, level the cabinet with shims, make sure that the bottom support points are evenly supported without suspension, and finally remove the forklift.

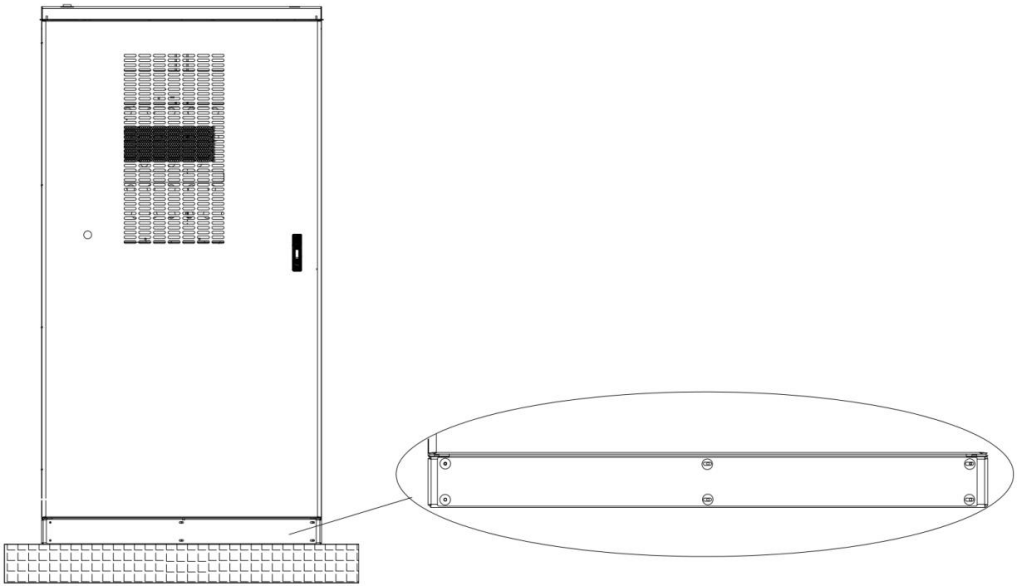


Figure 3.3.4.2 Schematic diagram of removable baffles for cabinet base

After the cabinet is placed smoothly, secure the cabinet, and connect the cabinet base to the reserved screw holes in the foundation using fixing bolts. There are a total of 4 fixing bolts, with 2 in the front and 2 in the back, and the bolt specification is M12*150. After fixing, install the baffle disassembled, and complete the cabinet fixing and installing steps.

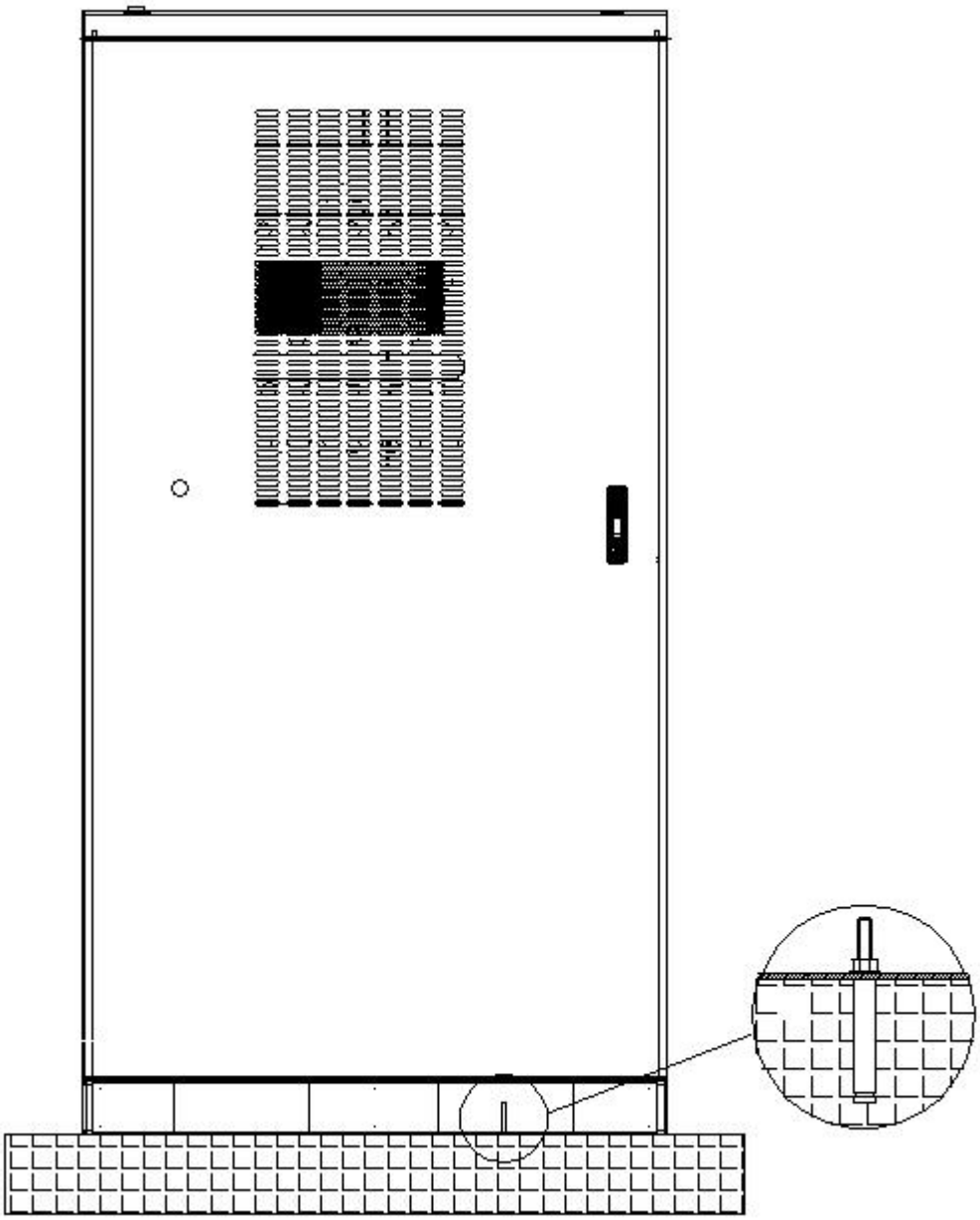


Figure 3.3.4.3 Schematic diagram of cabinet fixing bolt installation

3.3.5 Installation wiring

The wiring harness between the PCS and the control box is pre-connected in the cabinet of AS03. When wiring, external load wiring required (if required, load power not greater than 50kW), external grid wiring, photovoltaic access wiring (if required), external wired communication wiring (if required), etc.Prepare the cables as shown in the table below:

No.	Name	Wiring Type	Quantities	Specification	Access method	Remark
1	AS03	Grid-side AC output wiring	4	1\0AWG, 53.49mm^2 , AC600V	M8 OT Terminal Crimp	Wiring harnesses are user-provided

2	AS03	Load-side AC output wiring	4	2AWG, 33.62mm^2, AC600V	M8 OT Terminal Crimp	Wiring harnesses are user-provided
3	AS03	grounding wire	1	4AWG, 21.15mm^2, yellow-green line	M5 OT Terminal Crimp	Wiring harnesses are user-provided
4	AS03	PV side input wiring	16	10AWG, 5.26mm^2, 1000V	Photovoltaic Connector Mating	8 positive and 8 negative, Connector interface is a random accessory, wiring harness user-provided
5	AS03	External network port wiring	1	Ethernet cable	Shielded RJ45 Crystal Head Plug	Wiring harnesses and terminals are user-provided(if required)

Note: The selection of cable wire diameter should be in accordance with local cable standards. Factors affecting the selection of cables include: rated current, cable type, laying method, maximum expected line loss, rated temperature, ambient temperature, temperature resistance, acidity, settlement, environmental protection requirements.

Access to the utility and load line crimp M8 OT terminal, M8 screw tightening torque recommended value: 12 ± 10% N • m; access to the PE line crimp M5 OT terminal, M5 screw tightening torque recommended value: 2.5 ± 10% N • m.

Explanation of the wiring of the cabinet externally to the mains and loads:

Remove the lower left baffle of the cabinet first, and after removing it, you can see the wiring location of the externally connected utility terminal, load terminal and ground terminal.

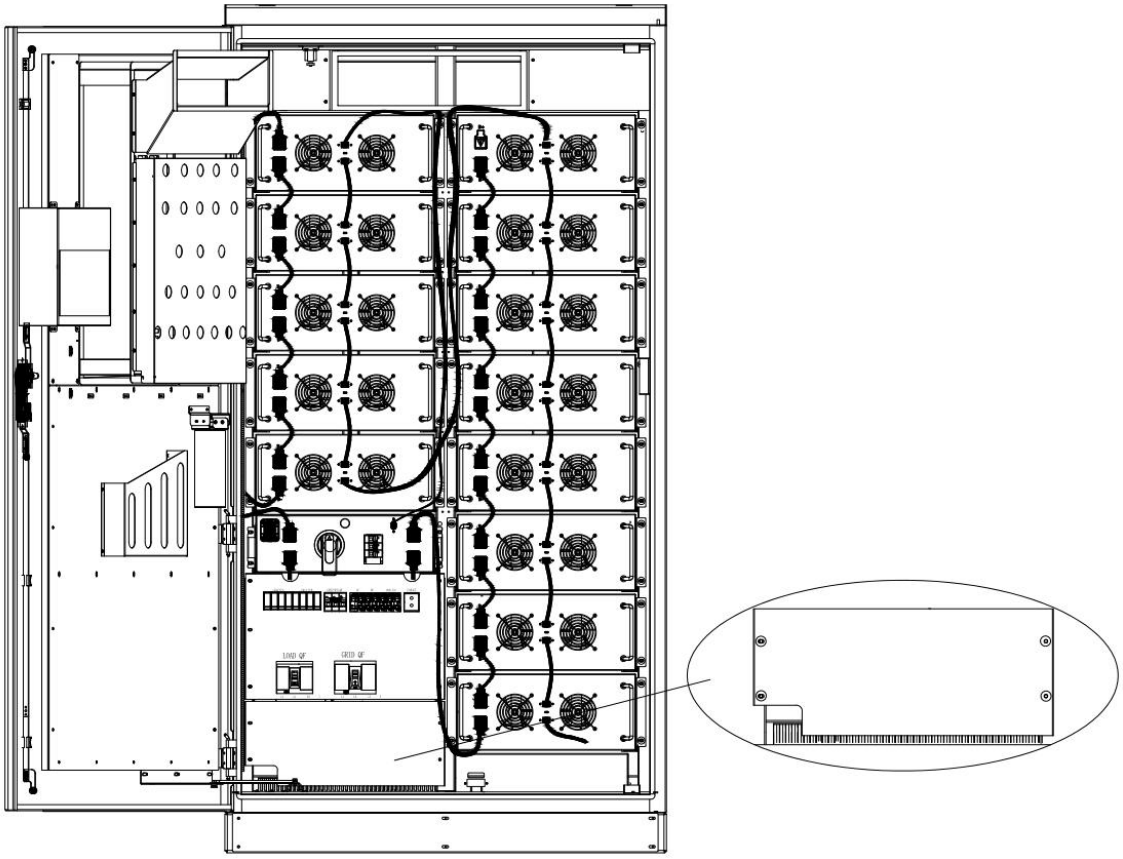
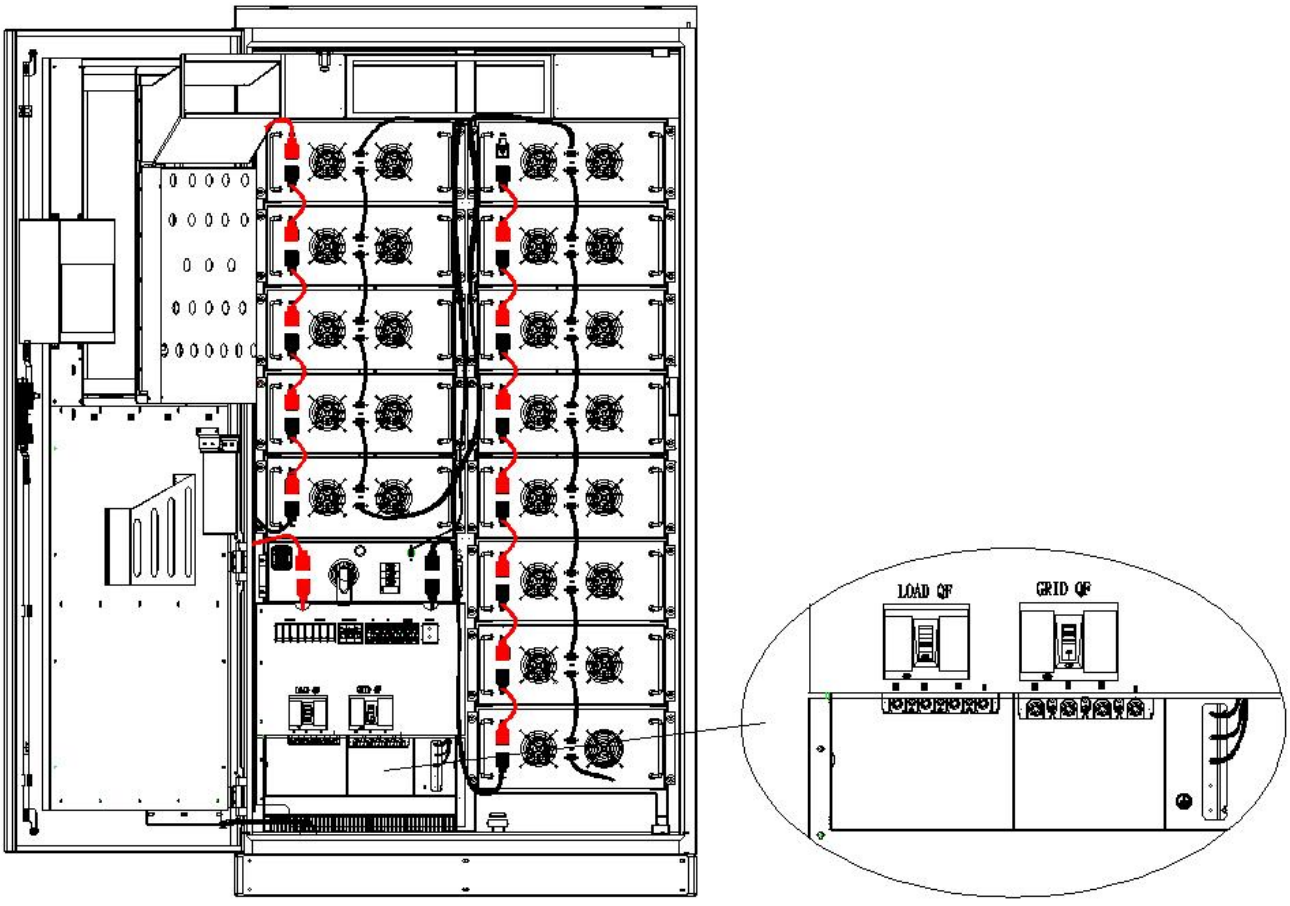


Figure 3.3.5.1 Cabinet removal baffle schematic



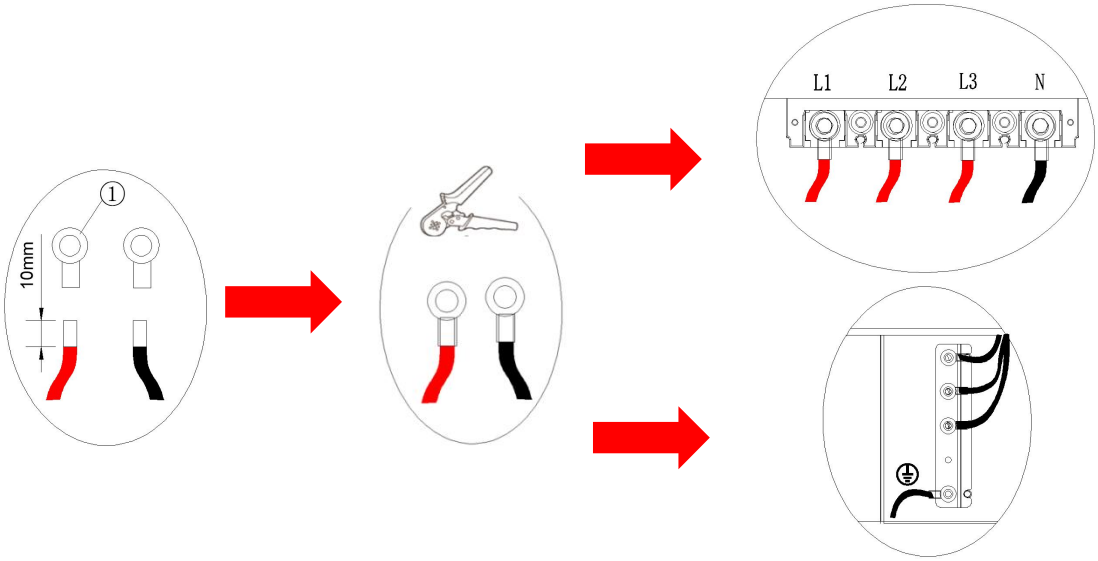


Figure 3.3.5.2 Schematic diagram of the wiring between the cabinet and the utility, load and ground externally

Labeling	Function description	Labeling	Function description
GRID QF		LOAD QF	
L1	Grid A phase	L1	Load A phase
L2	Grid B phase	L2	Load B phase
L3	Grid C phase	L3	Load C phase
N	Grid N phase	N	Load N phase
⏚	Mains and load mains grounding		

Note: Access to the utility and load line crimp M8 OT terminal, M8 screw tightening torque recommended value: 12 ± 10% N • m; access to the PE line crimp M5 OT terminal, M5 screw tightening torque recommended value: 2.5 ± 10% N • m.

The energy storage system has 4 MPPT channels and can be connected to 8 strings of PV panels. Please make sure that the following requirements are met before connecting the PV cables to the energy storage system.

1) The open-circuit voltage and short-circuit current of the PV string should not exceed the specifications, see “2.6 Technical parameters”;

2) The isolation resistance of the PV string from the ground should be more than 300 kΩ;

3) The same number of PV panel strings per road is recommended to be consistent;

4) PV panels are connected to the front end of the energy storage system, please make sure to increase the insurance and anti-reverse function.

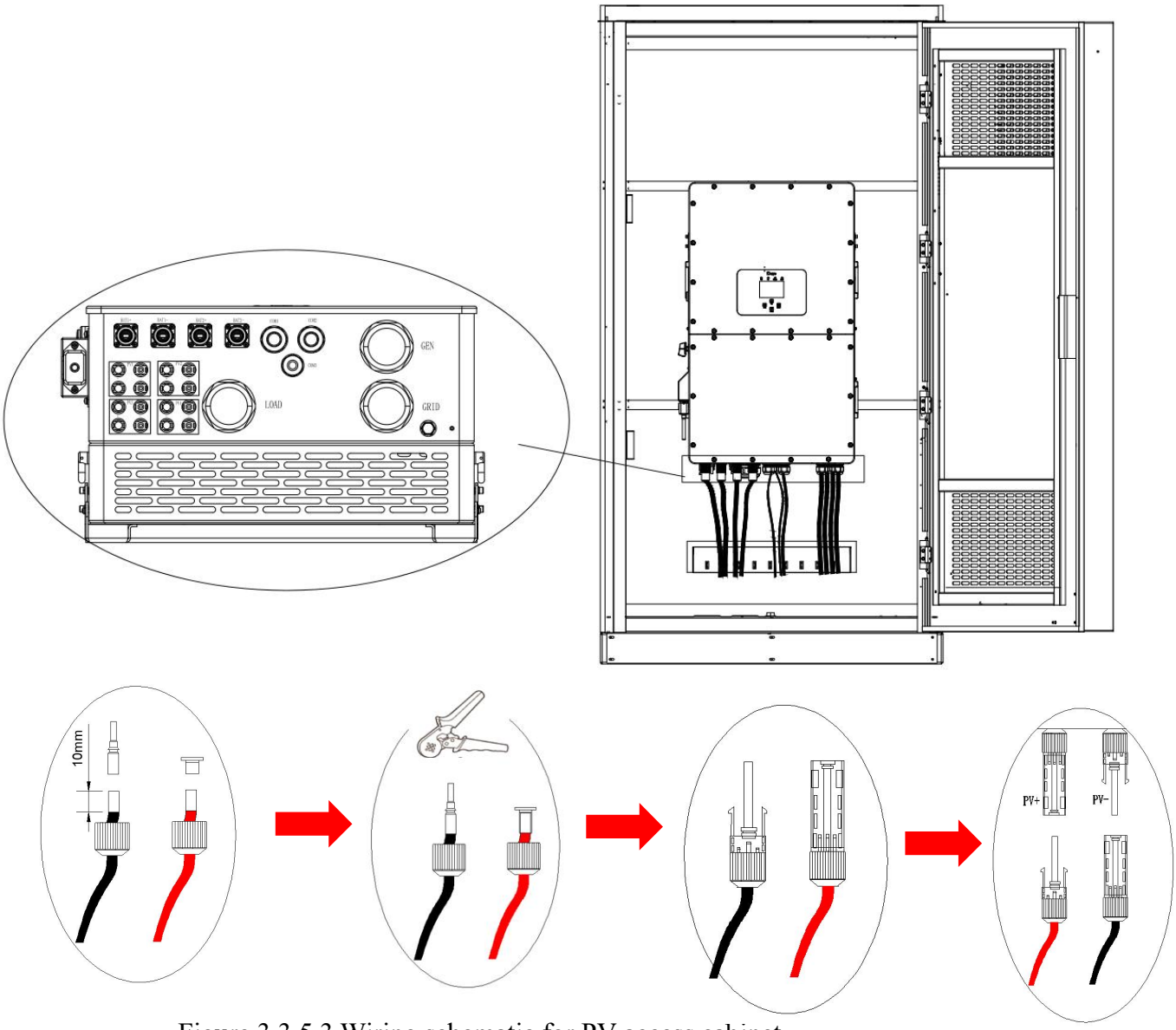


Figure 3.3.5.3 Wiring schematic for PV access cabinet

PV Docking Instructions:

1. Open the rear door of the cabinet.
2. Remove the accessory box PV docking terminals and crimp the PV docking connector.
3. Dock with the PV terminals on the inverter to ensure secure docking.

The energy storage system is reserved for 1~4 way PV inlet interfaces, the corresponding markings are as follows:

Labeling	Functional description	Labeling	Functional description
PV1+	2-way photovoltaic positive	PV1-	2-way photovoltaic negative
PV2+	2-way photovoltaic positive	PV2-	2-way photovoltaic negative
PV3+	2-way photovoltaic positive	PV3-	2-way photovoltaic negative
PV4+	2-way photovoltaic positive	PV4-	2-way photovoltaic negative

Note: Positive and negative PV terminals in different channels cannot be mixed.

IV. Debugging instructions

4.1 Check before debugging

Danger

1) Before proceeding to the next step of powering up, please read “I. Safety Precautions” in this manual carefully, and make detailed checks according to the following table.

2) When operating or maintaining metal parts inside AS03, the voltage to the chassis (protective earth) must be checked with a high-voltage tester or other instruments to prevent electric shocks.

Once AS03 is installed, the following contents need to be carefully checked item and item before powering up:

1. Please read “ I. Safety Precautions” carefully.
2. Confirm that AS03 is free of signs such as damage or scratches.
3. Confirm that there are no foreign objects left inside or on top of the cabinet of AS03.
4. Confirm that there is enough space around AS03 for maintenance and operation.
5. Confirm that there are no explosive or flammable materials around AS03.
6. Confirm that the system input switch in the field is in the disconnected state, all power wiring is correct, and all communication line cables are connected correctly.
7. Confirm that AS03 has been well grounded.
8. Confirm that the isolation zone and warning signs have been set up around AS03 to prevent others from misusing or approaching.

4.2 Debugging steps

1. Close the high voltage control box circuit breaker, close the high voltage control box contactor, and press the high voltage control box switch button. The cabinet indicator shows green for indicating normal operation.

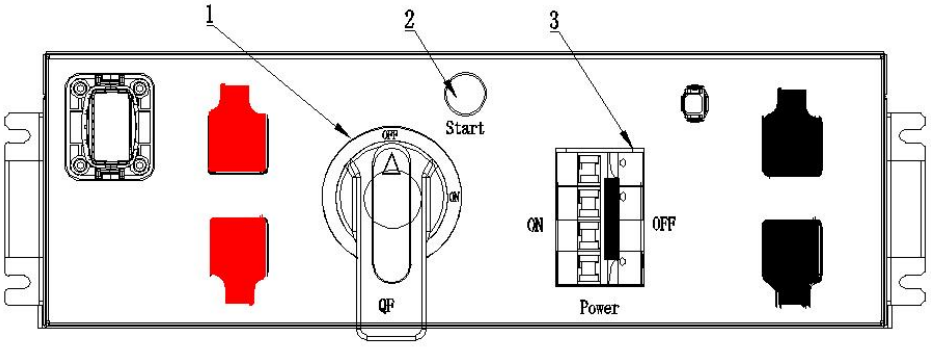


Figure 4.2.1 Schematic diagram of high voltage control box panel

No.	Silkscreen	Description
1	QF	High voltage control box circuit breaker
2	Start	High voltage control box switch button
3	Power	High voltage control box contactor

2.Closing the grid protection switch (GRID QF) / load protection switch (LOAD QF) / grid-side surge protector protection switch (GRID-SPD QF) / DC internal power supply switch (SPS1) / AC internal power supply switch (SPS2) / air-conditioning protection switch (COOLING), the system carries out on-grid or off-grid operation mode.

3.With the system connected to the PV panels, open the rear door and close the 2 PV circuit breakers on the left side face of the inverter.

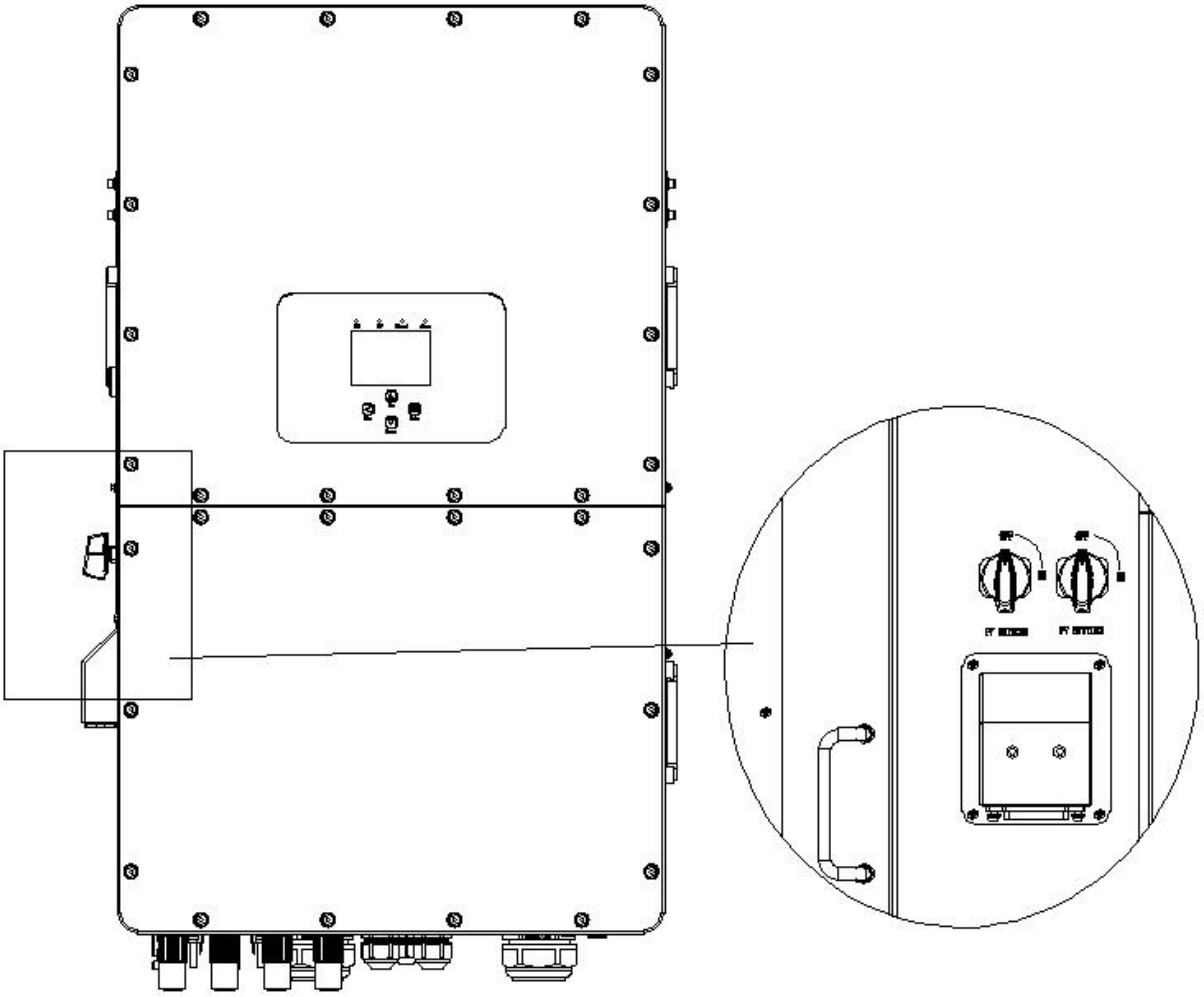


Figure 4.2.2 Schematic diagram of PV circuit breaker

4. Insert SIM card, customers need to buy their own local standard SIM card for network transmission. Simply insert the SIM card slot of the touch screen while the device is powered off.

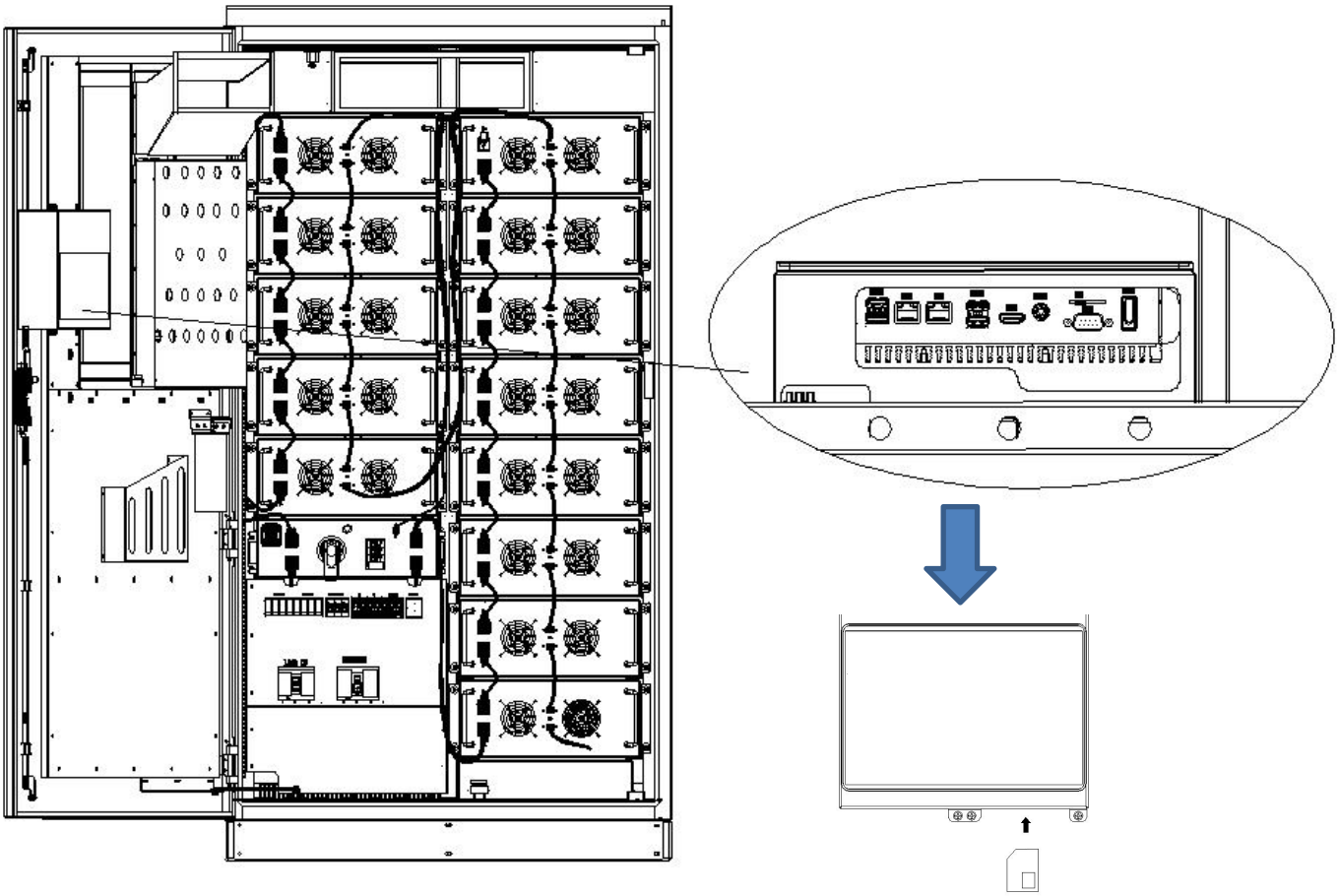


Figure 4.2.3 Schematic diagram of SIM card installation

5. Open the URL (https://lta.alpsolarr.com/#/wel/index), login to the account password and enter the cloud platform operation interface and set the operation mode(Account number and initial login password are pasted on the top of the touch screen).

V. Maintenance Guidance

5.1 Maintenance precautions

Danger

1) Before maintenance, metal parts that need to be touched or may be touched must be tested with instruments such as high-voltage testers to avoid electric shocks.

2) When maintaining, please pay attention to internal warning labels of AS03 to prevent personal injury caused by high temperature, overweight and other devices.

3) Maintenance must be performed under the condition that the system is shut down and unpowered in accordance with the following steps:

① Shut down AS03.

② Disconnect all external power supplies.

③ Verify that the preceding-stage switch has been disconnected and the grounding knife gate has been properly connected.

④ After maintenance, all screws need to be tightened according to the required torque.

4) The model number of the new device for replacement must be the same as the original device. Please contact AlpSolarr if there is any doubt.

5) The daily inspection of AS03 can be performed by personnel who have received relevant training, and the inspection and replacement of its devices should be operated by authorized professionals.

6) Parts behind protective cover plates that require tools to open are not user operable, and only qualified maintenance personnel are permitted to open such protective cover plates.

5.2 Maintenance content

Serial number	Inspection item	Inspection content	Maintenance cycle	Remarks
1	Electrical connection part	Check the cable connections for detachment and looseness; and check the cables for damage, flesh cut, aging, etc.	3-6 months	
2	Cooling system	Whether there is any abnormality in fan noise; and whether the air conditioner is normal or not	3-6 months	
3	Device inspection	Whether the device at each part has obvious damage, looseness, odor, discoloration and other phenomena	3-6 months	
4	Grounding reliability	Check whether all grounding cables are reliably grounded.	6 months	
5	System dusting	Pay attention to cleaning the air inlet mesh, the air outlet mesh and floor drains, especially for sandy and dusty application scenarios; and use a vacuum cleaner if necessary to ensure that air can circulate freely inside the cabinet. The power supply must be cut off before dusting; and rinsing with water is strictly prohibited.	3-6 months	In extremely harsh environments, clean the air inlet mesh of the cabinet at least once a week or replace the dustproof net

5.3 Maintenance of spare parts

Battery maintenance

Perform routing inspection of the energy storage system every three months, and keep a routing inspection record. Perform battery maintenance on the system every three months to prevent causing battery damage.

Before the first use of the system which is stored for a long time, perform at least one time of full charging to activate the battery system in order to restore the performance of the battery to its optimal state.

Batteries should be stored in a clean, dry, ventilated room at 40%~50% charge state, at a temperature of 0℃~40℃ and a relative humidity of no more than 75%, and should be protected from fire and heat, and avoid contact with corrosive elements. Batteries should be recharged every 3~6 months during storage.

Table 5.3.1 Storage and periodic maintenance modalities

Storage temperature	Charging interval	Rechargeability
20℃~30℃	Every 6 months	1) Charge to 100% SOC at 0.2C 2) Discharge at 0.2C to 0% SOC 3) Charge at 0.2C to 40%~50% SOC
0℃~20℃ or 30℃~40℃	Every 3 months	

VI. Troubleshooting

When an abnormality or malfunction occurs to AS03, inspection and troubleshooting are first performed according to the table below. If the problem is not resolved, please contact AlpSolarr for technical support.

NO.	Fault name	Fault cause	Troubleshooting	Remarks
1	Water logging fault	Water logging of energy storage cabinet	1. Check whether this is water buildup inside the cabinet. 2. Verify whether the outdoor cabinet leaks water and whether the equipment inside the cabinet is intact.	
2	Fire fighting fault	Battery overheating or fire	Continuous observation at a safe distance for 30 minutes. If there is smoke or fire, call the fire reporting telephone; and if there is no abnormality, manually clear this active alarm and contact the manufacturer.	
3	Grid overvoltage/under voltage fault	Grid-connected side voltage abnormality	Check whether the grid-connected side voltage is abnormal.	
4	Grid overfrequency/underfrequency fault	Grid-connected side frequency abnormality	Check whether the grid-connected side frequency is abnormal.	
5	Island protection fault	Grid-connected side voltage abnormality	Check whether the grid-connected side voltage is abnormal.	
6	Grid voltage unbalance fault	Grid-connected side voltage abnormality	Check whether the grid-connected side voltage is abnormal.	
7	Grid incorrect phase Fault	Grid-connected side incorrect phase sequence	Exchange any two of ABC cables.	
8	DC voltage high/low Fault	Battery voltage abnormality	Check whether the DC input voltage is abnormal.	
9	Grid-connected three-phase current imbalance	Load imbalance	1. Check whether the load is abnormal. 2. Contact the manufacturer.	
10	DC overcurrent	DC current	1. Check whether there is short	

	Fault	excess	circuit or line breaking on the DC side. 2. Contact the manufacturer.	
11	Output overload/overcurrent Fault	AC side power/current excess	1. Check whether the grid voltage is normal. 2. Check whether there is short circuit or line breaking on the DC side. 3. Check whether the off-network load is excessive. 4. Replace the energy storage converter module or contact the manufacturer.	
12	Communication fault	Communication outage	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.	
13	Low DC voltage alarm	Battery not turned on	Check whether the battery is turned on.	
14	PV reverse connection	PV(+) and PV(-) wiring reversal	Check whether the PV(+) and PV(-) are reversed and correct them.	

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