TBB POWER

Version: V1.0

USER MANUAL

All-In-One Standalone Solar Power System

Raython M Pro series



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1.About this manual

This manual applies to storage cabinet models: Raython M10 Pro and Raython M15 Pro.

1.1 Brief introduction

This Manual contains the following:

- Safety instructions

Introduce the safety matters that shall be observed when installing and operating the energy storage system.

- Product introduction

Introduce the system composition, structure, electrical wiring of the energy storage system.

- Unpacking and installation

Introduce the related precautions for unpacking of the energy storage system.

- Installation guidance

Introduce the mechanical installation, electrical installation, communication connection, and inspection methods after installation of the energy storage system, provide and the suggestions for the design of installation and electrical wiring of this product.

- Others

Introduce the technical parameters of the energy storage system and our contact information.

1.2 Applicable personnel

This Manual is applicable to the staff responsible for installation, operation, and maintenance of this product. Readers shall have a certain knowledge of electricity, electrical wiring and machinery, and be familiar with electrical, mechanical principle diagrams and electrical safety.

1.3 Use of this Manual

To ensure the safety of users and to give full play to the excellent performance of this product, please carefully read this Manual before using this product. Please keep this Manual with other relevant documents for easy reference.

1.4 Use of symbols

To enable the users to use this product efficiently, appropriate symbols are used to highlight relevant information.

Danger

"Danger" indicates highly potential danger. If it is not avoided, it will result in death or serious injury.

Warning

"Warning" indicates moderately potential danger. If it is not avoided, it may result in death or serious injury.

Attention
"Attention" indicates a potential risk. If it is not avoided, it may result in abnormal operation of the equipment or property loss.

"Notes" are additional information in this Manual to emphasize and supplement the content. They may provide the tips for optimizing the use of this product to help you solve a problem or save your time.

Signs	Interpretation of Signs
	This sign indicates that there is high voltage inside this product, and touch may cause shock hazard.
	This sign indicates that the temperature here is above the acceptable range of the human body. Do not touch at will to avoid injuries.
	This sign indicates the PE terminal, and it shall be grounded firmly to ensure the safety of the operator.

2.Safety instructions

The energy storage system is designed and tested strictly in accordance with international safety standards. This section describes the general safety rules that shall be observed when installing, operating, and maintaining the energy storage system. Please read the safety instructions carefully before installing. Please refer to the warning instructions in the corresponding chapter for the safety instructions in use and maintenance.

Danger

- **Non-professional technicians or unauthorized personnel are prohibited from entering the internal storage system.**
- **Non-professional or unauthorized personnel are prohibited from operating any equipment in the energy storage system.**
- **Non-professional technicians are prohibited from disassembling, repairing, or renovating the energy storage system by themselves.**
- **Operations other than installation, operation, maintenance, etc. indicated in this Manual are prohibited.**

Danger

- **There is a fatal high voltage inside this product!**
- **When this product is not powered off, do not move or touch the inside of the live electrical equipment.**
- **Note and follow the warning signs on this product.**
- **Follow the safety precautions listed in this Manual or other relevant documents of this product.**

Danger

- **Do not touch the power terminals and contacts in this product.**
- **Note all instructions or safety instructions for grid connection.**
- **Damaged equipment or system failure may cause electric shock or fire!**
- **Before operation, please visually check if the equipment is damaged or dangerous.**
- **Check the safety of other external equipment or electrical connections.**

Danger

- **Battery modules for energy storage, positive and negative poles of the battery cluster are strictly prohibited from short circuit!**
- **When the power is off, fatal high voltage still exists in battery packs inside this product!**

2.1 Manual keeping

- This Manual contains important information on the operation of the energy storage system. Read this Manual carefully before operating the energy storage system.
- Please operate the energy storage system in strict accordance with this Manual, otherwise it may result in equipment damage, casualties, or property loss.
- Keep this Manual properly for easy use by the maintenance, overhaul or other operators.
- After installation, any manual or paper shall not be placed in any part of the storage system cabinet. Relevant data shall be placed in the special file pocket in the cabinet.

2.2 Personnel requirements

- Only professional electricians or personnel with professional qualification can operate this product.
- Operators shall be fully familiar with the composition and working principle of the energy storage system.
- Operators shall be fully familiar with the Manual of this product.
- Operators shall be fully familiar with the relevant standards in the country/region where the project is located.

2.3 Cabinet protection signs

- Warning signs on the energy storage system cabinet contain important information on safe operation of the energy storage system, which shall not be torn or damaged.
- A product nameplate is installed inside the energy storage system cabinet, which contains important parameters related to this product, and shall not be torn or damaged.

Attention

- **Make sure the cabinet signs are always clear and readable.**
- **If the cabinet signs are damaged or blurred, replace them immediately.**

2.4 Setting of warning signs

When carrying out installation, routine maintenance, overhaul, etc. for the energy storage system, to prevent misoperation by irrelevant personnel or accidents, please observe the following:

- Place clear signs on the preceding- and backward-stage switches of the energy storage system to prevent accidents caused by false switching.
- Set up warning signs or safety warning tapes near the operating area.
- After maintenance or overhaul, etc., be sure to pull out the key of the cabinet door and keep it properly.

2.5 Requirements of escape way

To ensure that the staff can leave the scene quickly in case of an accident, please observe the following:

- In the process of the maintenance, overhaul, etc. of the energy storage system, the escape way shall be completely unimpeded.
- It is strictly forbidden to pile up sundries or occupy the escape way in any form.

2.6 Lithium battery protection

For the energy storage system, the direct voltage of the positive and negative poles of the battery pack is very high. If it is accidentally touched, there will be electric shock and even life danger.

Danger

There is fatal high voltage between the positive and negative poles of the storage battery pack!

Do not short-circuit the positive and negative terminals of the battery, otherwise it will cause a short circuit of the battery.

- **When maintaining this product, ensure that the energy storage inverter is completely disconnected from the energy storage battery pack.**
- **Set a warning sign at the disconnection to ensure no accidental reconnection.**
- **Do not expose the battery to mechanical shock, drop, collision, hard object puncture, or pressure impact; otherwise, the battery may be damaged or fire may occur.**
- **It is strictly prohibited to disassemble, modify or destroy the battery (such as inserting foreign bodies, external extrusion, immersion in water or other liquids) to avoid battery leakage, smoke, release of flammable gas, thermal runaway, fire or explosion.**

2.7 Installation of this product

The energy storage system must be installed in strict accordance with this Manual. To avoid the impact of the operation of the energy storage system on the living area, the energy storage system shall be installed according to the following requirements:

- The energy storage systems shall be as far away as possible from the living area.
- Any combustibles or flammables shall not be stacked around the energy storage system.
- Personnel escape requirements shall be met around the energy storage system.

2.8 Electrical connection

Electrical connection must be carried out in strict accordance with this Manual and the electrical schematic diagram.

Warning

- **The AC current, voltage, frequency and other parameters of the power grid side must meet the technical parameter requirements of the energy storage inverter.**
- **All electrical installations must meet the electrical installation standard of the country/region where the project is located.**
- **Please perform wiring operation strictly according to the wiring signs inside this product.**

2.9 Use of measuring equipment

To ensure that the electrical parameters meet the requirements, when conducting electrical connection, trial operation, etc. for the energy storage system, related electrical measuring

equipment shall be used.

Warning

- **Select high-quality measuring equipment that meets the requirements of the site in the range and usability conditions.**
- **Make sure that the measuring equipment is connected and used correctly to avoid dangers such as arcing.**
- **For live line measurement, take protection measures (e.g., wearing insulating gloves).**

2.10 Parameter setting of touch panel

Some parameters in the touch panel can be set, which are closely related to the operation of the energy storage system. These parameters can only be modified after a reliable analysis and evaluation of the operating condition of the energy storage system is carried out.

Warning

- **Inappropriate parameter setting may affect the normal functions of the energy storage system!**
- **Only authorized professionals can set parameters of the energy storage system.**

2.11 Electrostatic protection

There are many circuit boards or some electrostatic sensitive elements in the energy storage system, which may cause failure or damage in the process of electrostatic discharge. For the energy storage system, static protection must be done.

Attention

Contact with or improper operation of printed circuit boards or other electrostatic sensitive elements can lead to device damage.

- **Avoid unnecessary contact with the circuit boards.**
- **Observe electrostatic protection specifications, such as wearing antistatic wrist strap.**

2.12 Moisture protection

The humid environment is very harmful to the components in the energy storage system, which usually results in high-voltage ignition, mold on the surface of parts, performance reduction of insulation materials, corrosion of metal parts, poor contact of plugs, oxidation of printed circuit boards, etc. Therefore, proper moisture protection and correct maintenance can effectively reduce faults of this product.

2.13 Product scrap

When the energy storage system and equipment are discarded, they shall not be disposed as regular waste because of the built-in batteries and electrical components. Please contact a local authorized professional recycling agency for disposal.

2.14 Others

In addition to the notes above, the following protective or emergency measures shall be taken according to the needs of the site:

- When carrying out maintenance, overhaul and other operations for this product, the relevant personnel shall take appropriate protective measures as needed, such as wearing sound-proof earplugs, insulating shoes, insulating gloves.
- The energy storage system is usually installed away from the population concentration area or living area. Therefore, relevant emergency facilities shall be prepared for use when needed.
- All necessary supplementary measures shall be taken to ensure the safety of personnel and this product.

Warning

- **All operations of the energy storage system must conform to the relevant standards of the country/region where the project is located.**
- **It is strictly forbidden to maintain or repair this product when it is live!**
- **When maintaining or repairing this product, at least two personnel must be present. Maintenance cannot be performed until this product has been disconnected and discharged.**
- **The power supply voltage of the system is dangerous, and direct or indirect contact through wet objects may be dangerous.**
- **Irregular and incorrect operation may cause accidents such as fire or electric shock.**
- **Before the electrical connection of this product, its preceding-stage protection switch must be turned off.**
- **Before switching on AC power, the electrical connection of this product must be completed.**
- **Before connecting the output cable or battery cable, the polarity of the cable and terminal must be confirmed to prevent reverse connection.**

3.System description

3.1 Product overview

TBB Raython M Pro series is an all-in-one standalone solar power system designed to address energy challenges faced by homes and businesses without access to the grid. This versatile system is also well-suited for energy storage solutions in areas with stable arid but high electricity costs, empowering home and business owners to make the most of solar energy for self-consumption, reduce electricity expenses and achieve greater energy independence.Raython M Pro series features a highly integrated design, allowing for quick installation and commissioning.

Features:

- All-in-one design for easy and quicker installation (<3 hours)
- Provided with IP55 protection index for outdoor use
- Factory assembled and tested system enable you get free from complicated groundwork
- ECO-Friendly: lower pollution, less noise and lower fuel consumption
- AGS Function: automatically start and stop the generator according to the load level, battery level or time period to ensure continuous power supply in the case of insufficient PV power or system overload
- Power assist function enables the Raython power system to discharge its batteries to power heavy loads in conjunction with small generator, to prevent the overload on the AC Supply
- Strong ability to handle the spikes of the load initial current
- High performance system with strong overload capability, designed to power heavy loads like air-conditioner, water pump, fridge, washing machine, etc.
- NOVA Web & App system monitoring, to display real-time data of all system components and history record, to control the power generation and power consumption. According to historical data, users can actively adjust and optimize power consumption habits

3.2 System configuration

The only difference between the Raython M10 Pro and Raython M15 Pro is the Power Conversion System.

Table 3-1: List of system configuration

Category	No.	Item	Unit	Specifications	Quantity	Remarks
Energy storage system	1	Indoor cabinet structure	Set	W*D*H: 820*1210*2040 mm	1	
	2	Li-ion battery pack	Set	ES100 II	4-8	Number of battery packs to be configured according to capacity
	3	Power Conversion System	Set	Matrix II	1	
	4	LCD monitor	Set	TBB-E4 LCD Monitor	1	
	5	Installation accessories	Batch	Wires and fasteners	1	See the packing list for details

Table 3-2: Basic parameters of the system

Model	Raython M10 Pro	Raython M15 Pro
AC input		
Generator compatible	Yes	
AC input voltage range (VAC)	175~265	
AC input Frequency range (Hz)	45~65	
AC input Current (transfer switch) (A)	2*100	
Inverter		
Product Topology	Transformer based	
Nominal battery voltage (V)	48	
Input voltage range (V)	42~68	
AC output voltage (V)	220/230/240 ± 2%	
AC output frequency (Hz)	50/60 ± 0.1%	
Harmonic distortion	<2%	
Cont. output power at 25°C (VA)	10000	15000
Cont. output power at 25°C (W)	8000	13000

Peak power (30 min) (W)	10000	15000
Maximum efficiency	96%	
Zero load power (W)	40	60
Max AC charge current (A)	140	200
Main Output (AC Out1) Current (A)	100	
Transfer time	0ms (<15ms in Weak AC source Mode)	
Solar Charge Controller		
Max output current(A)	300	400
Maximum PV open circuit Voltage(V)	600	900
Maximum PV short circuit Current per tracker(A)	25+25+25+25	25+25+25+25
MPPT operating voltage range(V)	120~600	160~900
MPPT efficiency	>99.9%	

3.3 Raython cabinet dimension

Dimensions of the storage cabinet: width 820mm,height 2040mm,depth1210mm（Includes air conditioning）.

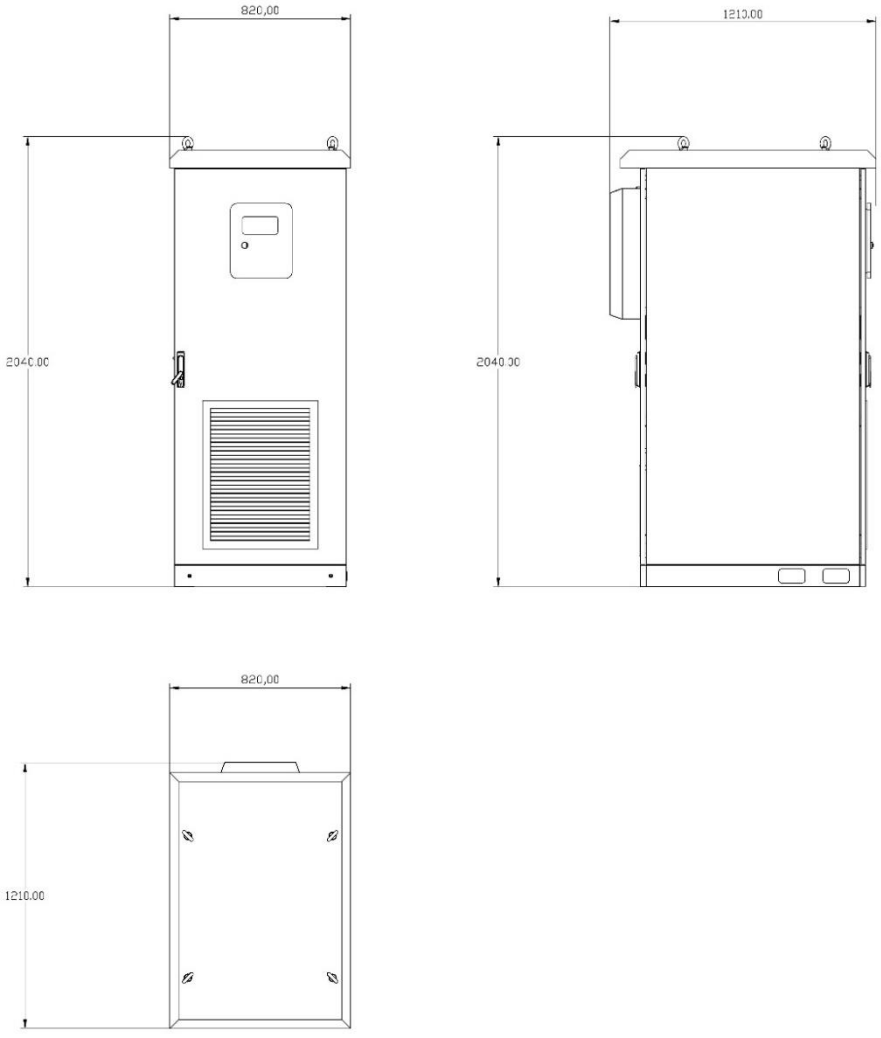


Figure 3-1: Three views of the cabinet

3.4 Structure layout

3.4.1 External structure layout

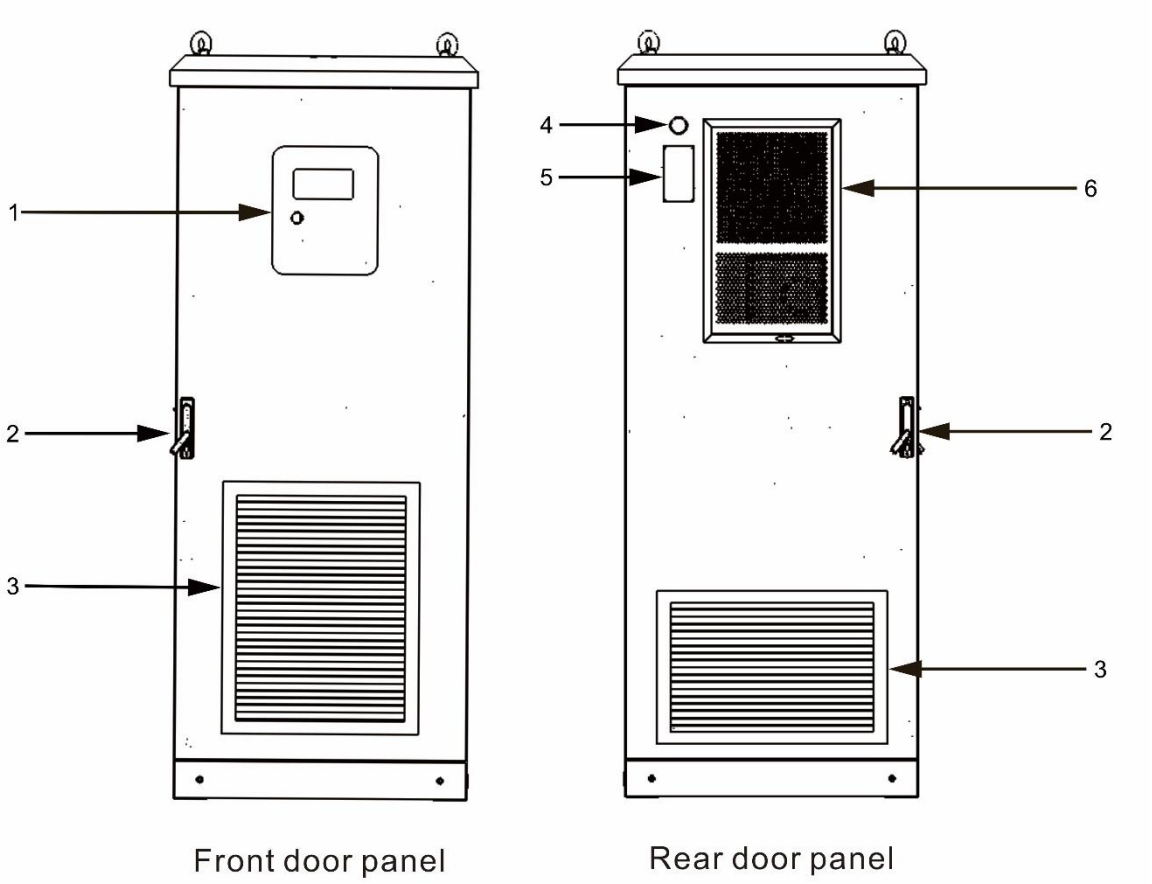


Figure 3-2：Structural appearance of door panel

Table 3-3: Component description of the door panel

No.	Functional unit
1	Indicator Lights
2	Cabinet door lock
3	Ventilation Filter Cover
4	External Antenna
5	Cabinet nameplate
6	Air-conditioner

3.4.2 Internal structure layout

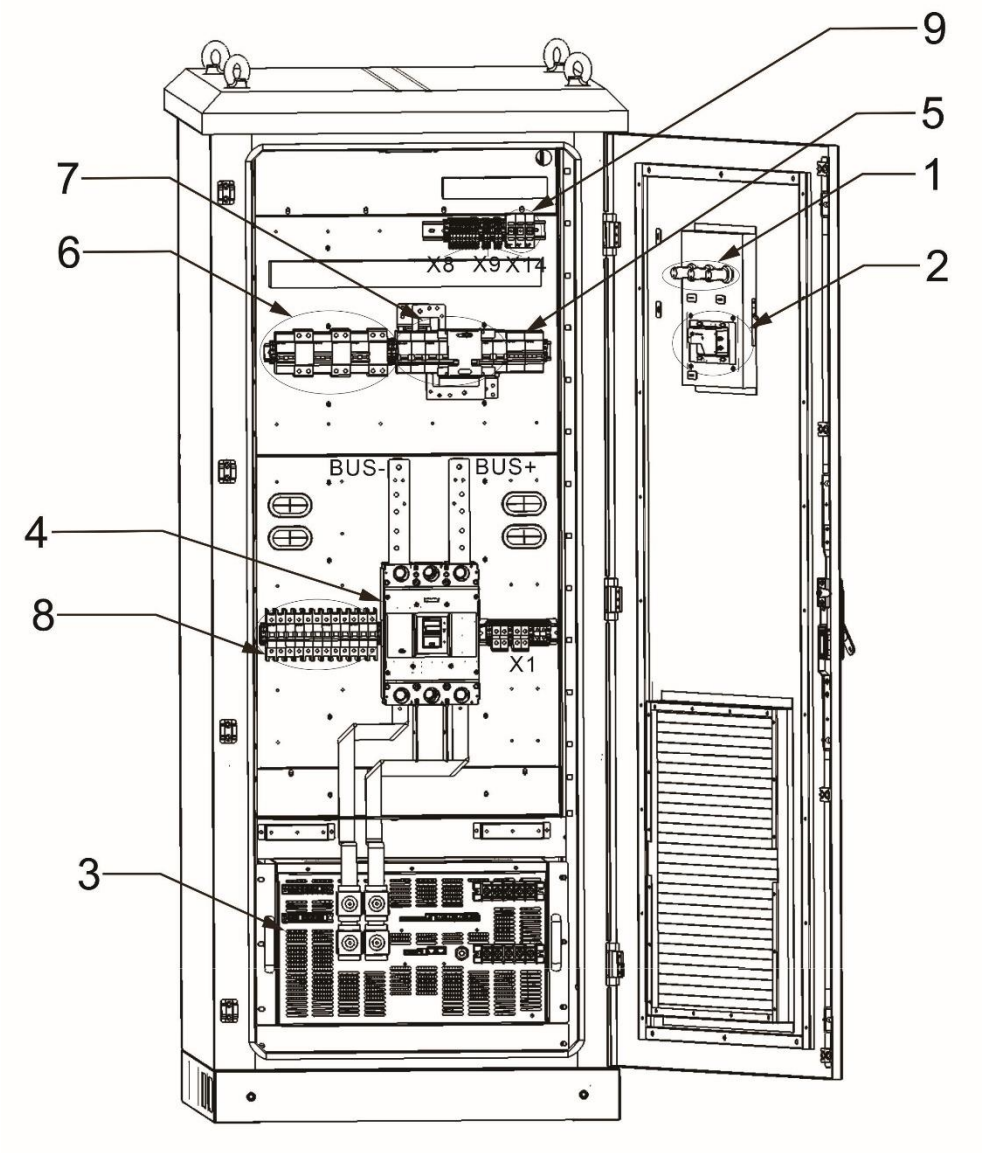


Figure 3-3：Structural layout of the front cabinet

Table 3-4: Structural component introduction

No.	Functional unit		No.	Functional unit	
1	Indicator Lights		7	1QF	AC input circuit breaker
2	E4 LCD Monitor			2QF	Maintenance bypass switch
3	Matrix Ⅱ Pro			3QF	AC output1 circuit breaker
4	Battery Control Circuit Breaker			4QF	AC output2 circuit breaker
5	Circuit breaker for air conditioner and fan		8	PV Disconnector QF2~QF5	
6	1QFS,2QFS 3QFS	Circuit breaker for SPD	9	FU1~FU3	
	1SPD,2SPD 3SPD	Surge protective device			

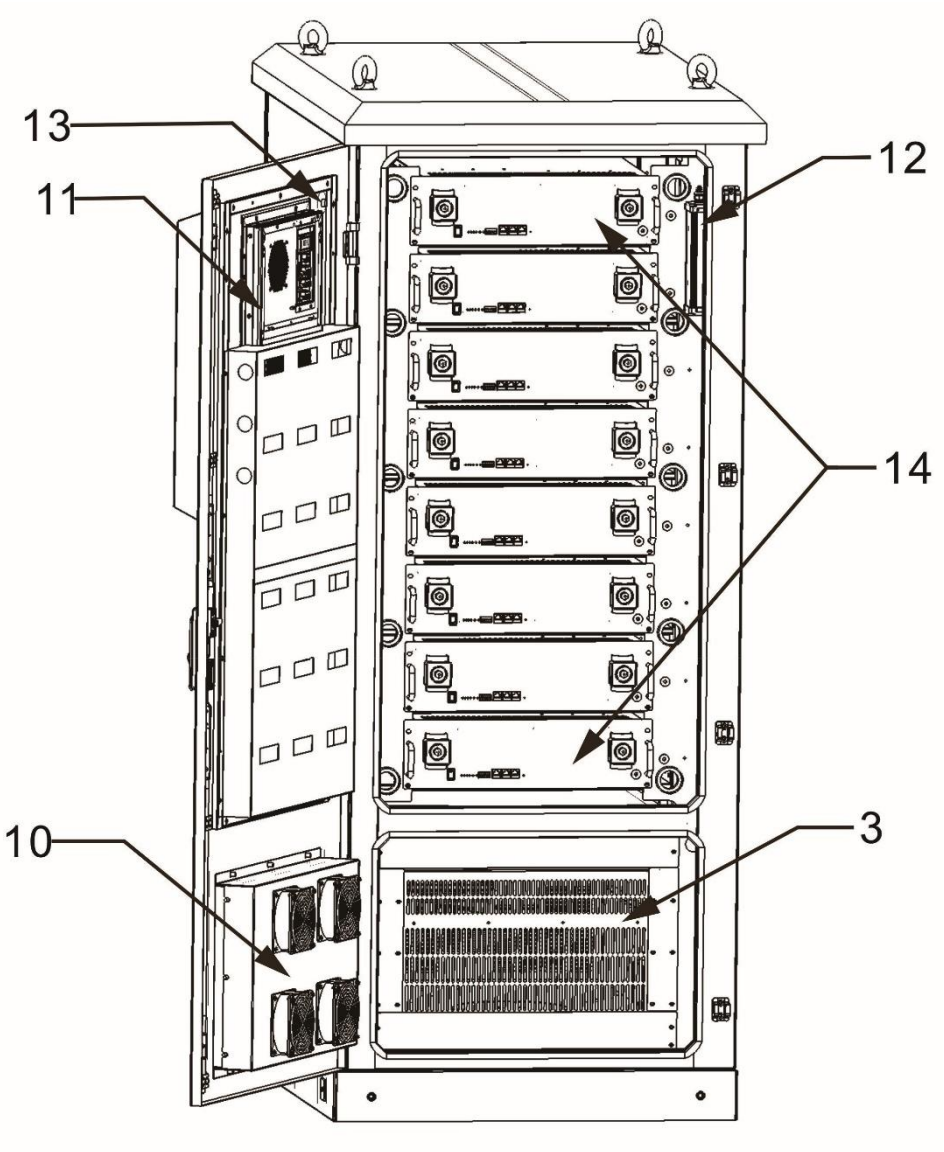


Figure 3-4：Structural layout of the rear cabinet

Table 3-5: Structural component introduction

No.	Functional unit	No.	Functional unit
3	Matrix Ⅱ Pro	12	Fire extinguishing apparatus
10	FAN1~FAN4	13	External Antenna
11	Cabinet air conditioner	14	Lithium battery ES100 II

3.5 Solar hybrid inverter

Matrix II Pro series solar hybrid inverter (hereinafter referred to as Matrix II) is a low-frequency transformer-based inverter integrated with multiple functions like battery inverter, AC charger suitable for backup power and off-grid applications. Matrix II10.0S Pro-R, Matrix II 15.0S Pro-R: Two AC inputs for grid and generator (or for two generators). For more information about Matrix II, please refer to its manual.

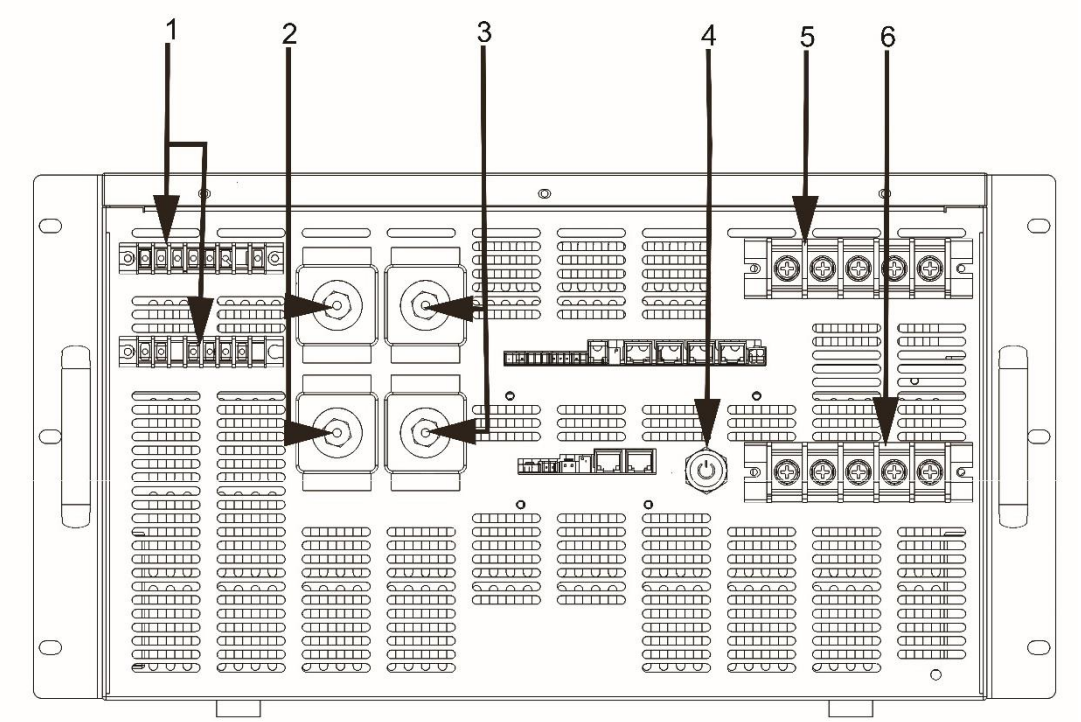


Figure 3-5: Structure layout of Matrix II

Table 3-6: Interface description of Matrix II

No.	Name		Description
1	PV Input		PV Input 1/2/3/4
2	BAT-		Battery Negative Input
3	BAT+		Battery Positive Input
4	ON/OFF Button		Power switch of the inverter
5	AC Output	AC OUT1	AC Output 1
		AC OUT2	AC Output 2
6	AC Input	AC IN1	AC Input 1 Can be connected to the grid or generator
		AC IN2	AC Input 2 Can only be connected to the generator

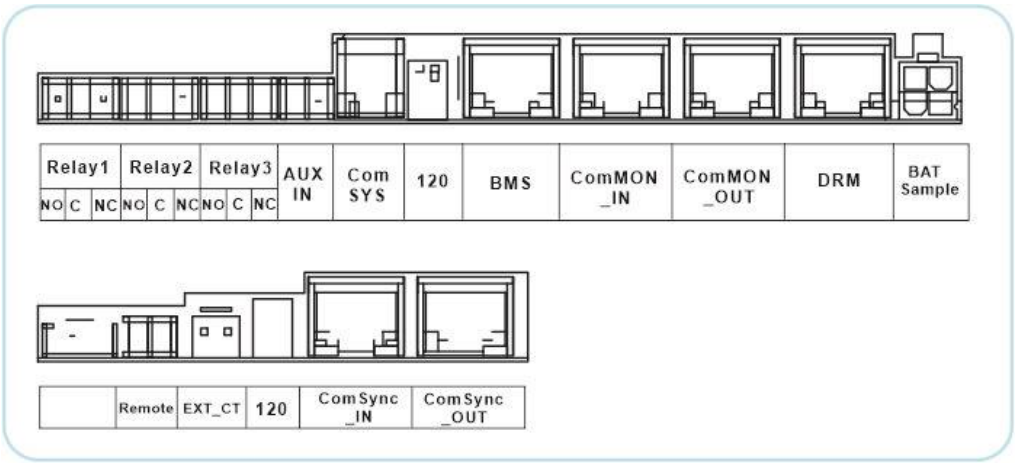


Figure 3-6: Communication terminals of Matrix II

Table 3-7: Introduction of Matrix II communication terminals

No.	Name	Description
1	ComSync In	For multiple inverters running in parallel system or three-phase system.
2	ComSync Out	
3	ComMON In	Monitoring to communication port for connecting to the upper computer (Via TBB interface), Kinergy I I, E4, Ether-Link, etc.
4	ComMON Out	
5	ComSYS	System communication port for connecting to the Solar Mate, Meter, etc.
6	BMS	For connecting lithium battery BMS communication.
7	DRM	Can be configured as DRMO-DRM8 for AS 4777.2 (Australia/New Zealand).
8	BAT Sample	Battery temperature sampling.
9	Relay 1	Dry output contact. its control logic can be selected through the upper computer.
10	Relay 2	
11	Relay 3	
12	EXT CT	External current sensor interface for external grid curr ent sampling.
13	AUX IN	Programmable input dry contact.
14	Remote	Remote ON/OFF control.

3.6 E4 LCD Monitor

TBB E4 is all intelligent central LCD touch monitor, providing intuitive, local and real-time control and monitoring for TBB systems, but it is applicable to different systems. For TBB off-grid systems and residential energy storage systems. Meanwhile, it is connect the system to the TBB NOVA online portal for remote system monitoring. For more information about E4, please refer to its manual.

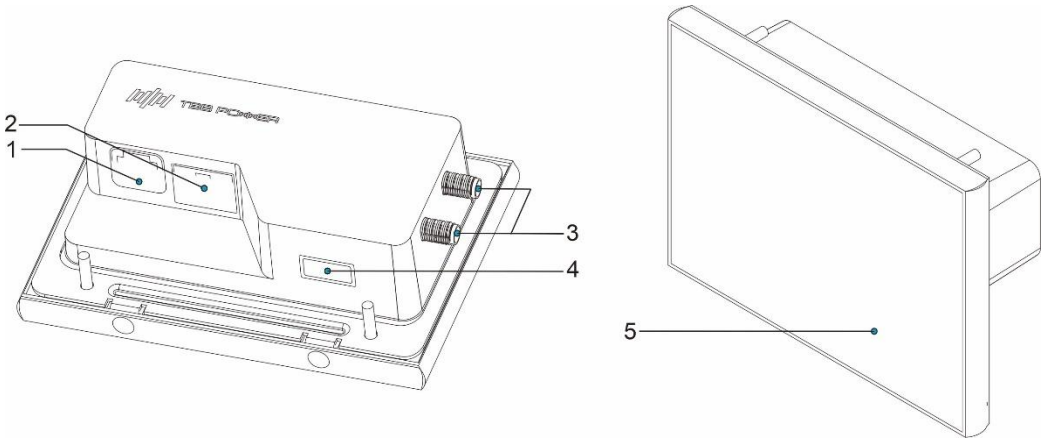


Figure 3-7: The structural appearance of the E4 LCD

Table 3-8: Function description of E4 port

No.	Description
1	For communication with the battery, grid meter and PV inverter.
2	Integrated interface for power supply and communication with the inverter.
3	An interface for connecting the Wi-Fi signal antenna.
4	USB interface for real-time data storage and firmware upgrade.
5	E4 Display screen.

3.7 ES100II Lithium battery

ES100 II is the latest 48V 105Ah lithium battery module provided by TBB POWER, designed for backup power system, solar grid system, and residential, industrial & commercial energy storage systems, with good compatibility, high energy density , fashionable design and safe long cycling life.

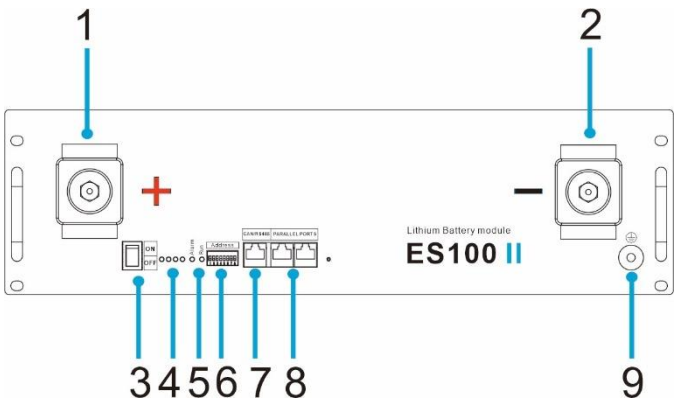


Figure 3-8: Structure layout of ES100 II

Table 3-9: Interface description of ES100 II

No.	Name		Description
1	Positive Socket		Connect to battery positive output cable or positive parallel cable.
2	Negative Socket		Connect to battery negative output cable or parallel negative cable.
3	Power switch		OFF/ON button, must be on the "ON" state when in use.
4	Soc		The number of green lights on shows the remaining battery power.
5	Light	Alarm	Red light flashes when an alarm occurs. Red light is always on during protection status. When the battery is no longer under protection, it will be automatically off.
		Run	Green light flashes during standby and charging mode. Green light is always on when the battery is under discharging.
6	Address		DIP Switch
7	CAN/RS485		Communication port, support CAN and RS485 communication
8	Parallel Ports	IN	Parallel communication port, the OUT port should be connected to the IN port of the next slave module.
		OUT	
9	Ground connection point		Shell ground position

3.8 The Air-conditioner

The battery compartment of the Raython M Pro All-in-one energy storage system is equipped with an IP65 cabinet air conditioner, with a rated current of 1.4A, cooling capacity of 600W, and heating capacity of 500W. The EMS controls the operation modes of the cabinet air conditioner via RS485 communication: cooling, heating, air supply, and dehumidification.

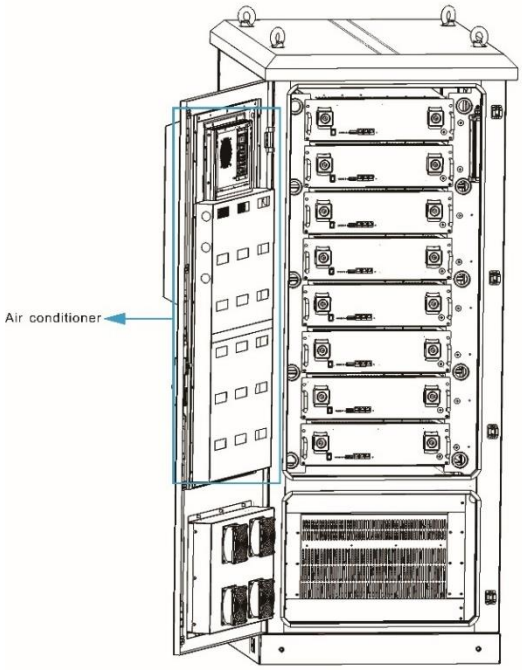


Figure 3-9: Location of the Air-conditioner

3.9 The fire suppression system

The battery compartment of the Raython M Pro All-in-one energy storage system is equipped with a thermal aerosol fire suppression device. When the configured thermal-sensitive wire exceeds 170°C, the fire suppression device will be activated, and its status will be sent to the PCS. The hybrid inverter in the system will shut down. That need to be manually reset. Additionally, the display screen and NOVA will indicate fire alarm messages. Wiring diagrams for the fire suppression device in Figure 3-10.

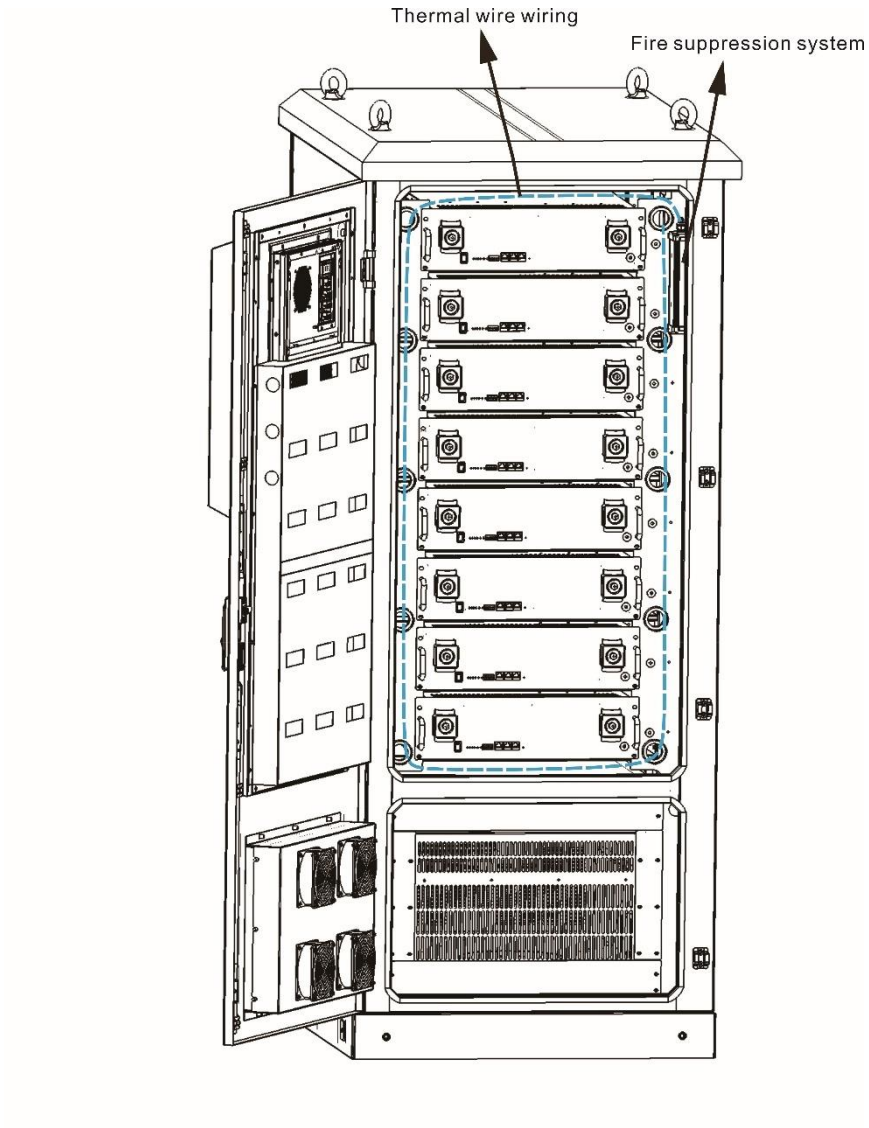


Figure 3-10: Location of the fire suppression system

3.10 The indicator light

The Raython M Pro All-in-one energy storage system is externally equipped with three indicator lights of yellow, green, and red colors. Please refer to Figure 3-13 for the light display positions. These lights correspond to the power, operation, and fault status of the system cabinet.

- Yellow Light (POWER): When the AC input is connected to the system, the yellow light (POWER) illuminates, indicating that the system is energized.
- Green Light (RUN): When the hybrid inverter in the system is operating inverter mode, the green light (running) will come on. When the hybrid inverter is not operating, the green light will go out.
- Red Light (FAULT): When the system encounters an alarm condition, the red light (FAULT) illuminates. The red light remains off when no alarms are triggered.

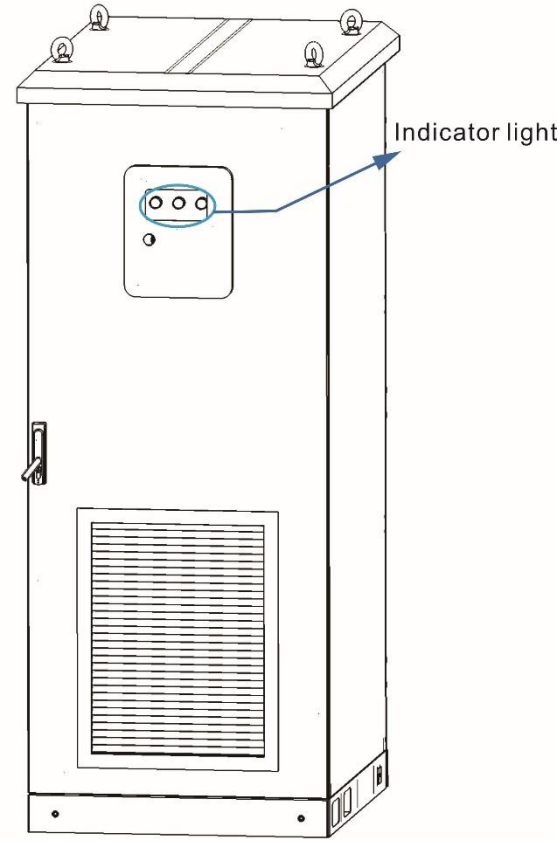


Figure 3-11: Location of the indicator lights

4.System topology

Raython M Pro is composed of Solar Hybrid Inverter, E4, and Li-ion battery modules. As following diagram shows, through monitoring the real-time output power, energy consumption of the connected appliances and the battery SOC, Raython will automatically change the work mode to keep your loads being powered.

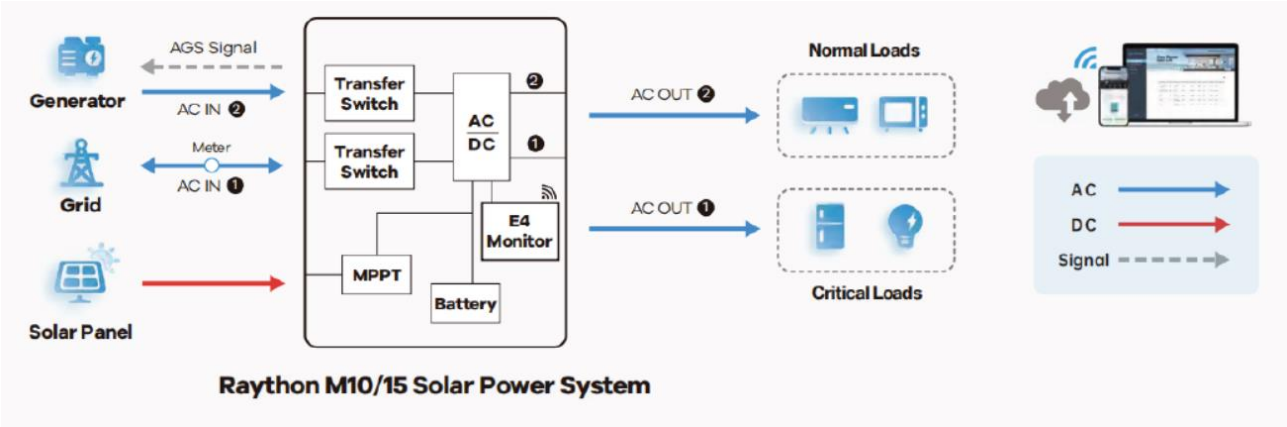


Figure 4-1: Function Topology of the system

5.Transportation and Installation

5.1 Product transportation

- Cabinet transportation

The ex-factory energy storage cabinet is not equipped with battery modules, and it is packed in a wooden case. The cabinet interior contains spare parts and screws required for installation. The cabinet can be transported according to the requirements of ordinary freight. Pay attention to water and moisture resistance when shipping.

- Module transportation

The ex-factory energy storage module is packed separately in a carton with a moisture-proof bag to avoid moisture during shipping. The battery module shall be packed and transported as the Class 9 Dangerous Goods.

- Electrical equipment transportation

The electrical equipment transported independently shall be packed in a wooden case, and can be transported according to the requirements of ordinary freight. Pay attention to water and moisture resistance when shipping.

5.2 Site requirement

Please install the equipment in a location of Dry, Clean, Cool with good ventilation.

- Working temperature：-15℃~40℃
- Storage temperature：-40℃~60℃
- Relative Humidity：0%~95%，non-condensing
- Cooling：Forced air

5.3 Material list

The unit is packed with following materials. Please confirm the series number on the inverter is the same to that on the outer carton.

- Raython M Pro cabinet
- Raython M Pro User manual
- E4 User manual
- Matrix II User manual
- Cable and screw accessory package

5.4 Cabinet placement requirements

Warning

- **The energy storage cabinet should be installed on a flat surface.**
- **The energy storage cabinet should be placed vertically on the ground. Do not place the energy storage cabinet tilted, horizontal, or upside down.**

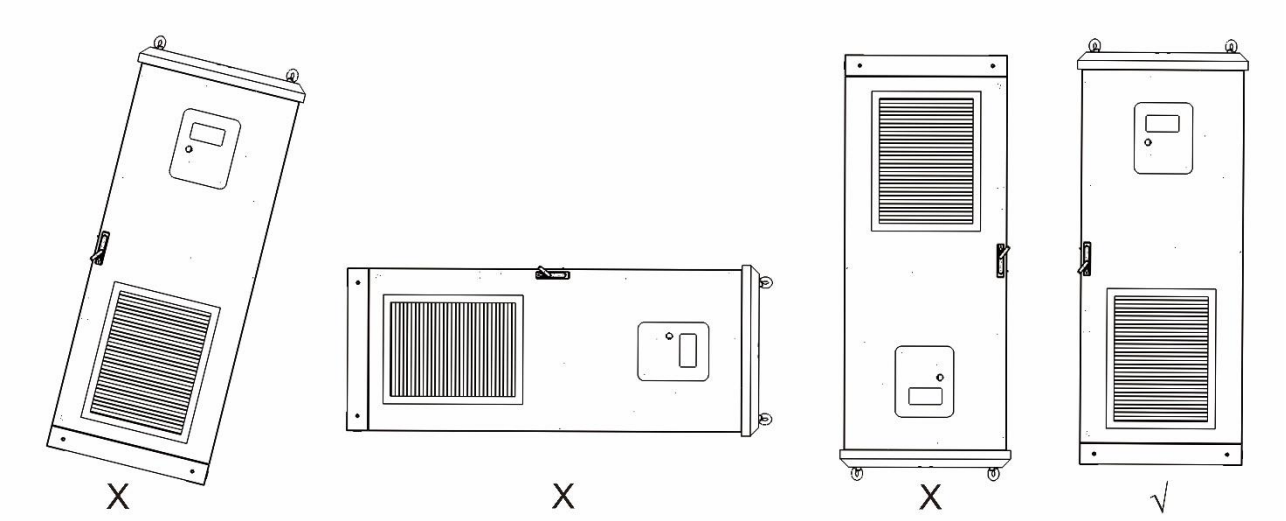


Figure 5-1: Placement of the cabinet

5.5 Requirements of installation spacing

To have sufficient space for operation and maintenance, the installation space must meet the requirements shown in figure 5-2.

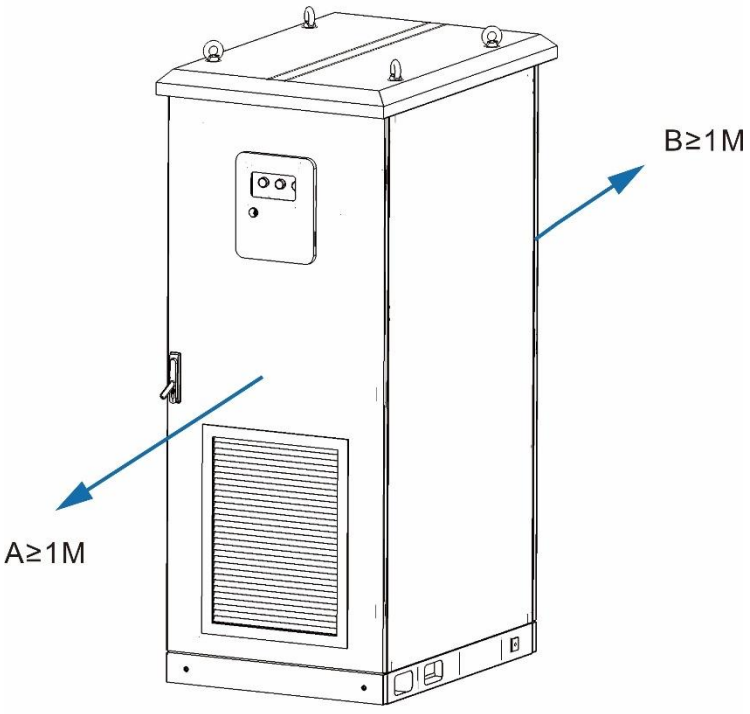


Figure 5-2: Installation space requirement

5.6 On-site transportation

Warning

- **In the process of forklift or crane transportation, the energy storage cabinet shall be balanced!**
- **Due to the large size and dead weight of the energy storage cabinet, the movement distance in the air shall be reduced when formulating the handling route to ensure the smooth driving route!**
- **It is forbidden to carry out hoisting operation in abnormal weather, such as rainstorm, fog, typhoon!**

The on-site transportation of the cabinet supports forklift or crane handling, and adjustments can be made according to the actual situation on-site. If the cabinet is transported together with the wooden pallet, the forklift can be inserted directly under the wooden pallet for lifting and transportation. If the cabinet needs to be separated from the wooden pallet for transportation, please refer to the following steps.

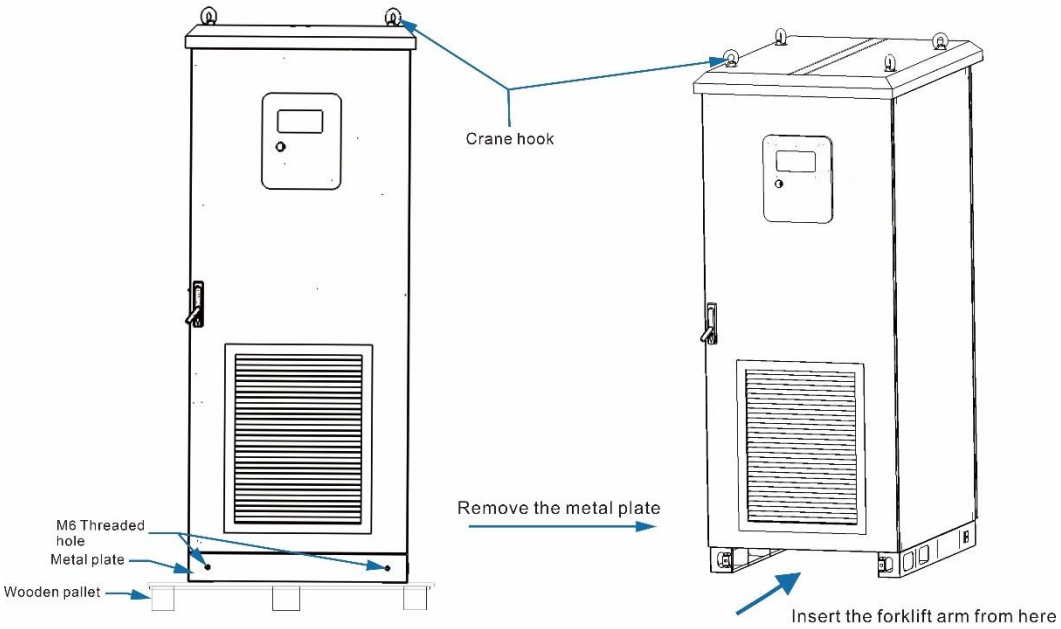


Figure 5-3: Remove the metal plate

Step 1: Sheet metal plates for the front and rear bases is secured by two M6 screws. After removing the fixing screws with a cross screwdriver or suitable socket, the metal plate can be directly removed. The cabinet and the wooden pallet are secured by 4 M10*70mm bolts (Installed in the cabinet base mounting holes). After removing the 4 bolts, the cabinet and the wooden pallet can be separated for transportation. These 4 screws can be kept and used to secure the storage cabinet to the foundation. Forklift hole baffles are as shown figure 5-3.

Step 2: The forklift driver operates the forklift, adjusts the direction, and drives close to the cabinet. When approaching within 2 meters of the cabinet, slow down and adjust the direction and height of the forklift arms to align with the forklift holes on the cabinet. Drive slowly and insert the forklift arms into the forklift holes of the cabinet.

Step 3: The driver raises the forklift arms to a height of about 100mm above the ground and drives the forklift slowly to the target location, ensuring the balance of the cabinet during movement.

Step 4: The driver adjusts the height and direction of the forklift arms, and slowly places the cabinet at the target location. Ensure alignment with the fixed bolts at the target installation point.
Step 5: The driver operates the forklift arms to slowly withdraw them from the cabinet.
Step 6: After securing the storage cabinet, install the metal plate removed in step 1 back into the base. For details about how to secure the energy storage cabinet, refer to Section 5.7.

5.7 Secure the storage cabinet

The foundation for installing the energy storage cabinet should be a level concrete surface that meets the load-bearing requirements. The bottoms of the Raython M Pro Cabinet have 4 mounting holes for securing the energy storage cabinet. The foundation where the energy storage cabinets will be placed should have the corresponding holes pre-drilled in advance. The model of expansion screw recommended by the manufacturer for fixing the energy storage cabinet is M10*70. Figure 5-4 shows the distances and dimensions of the mounting holes (units: mm).

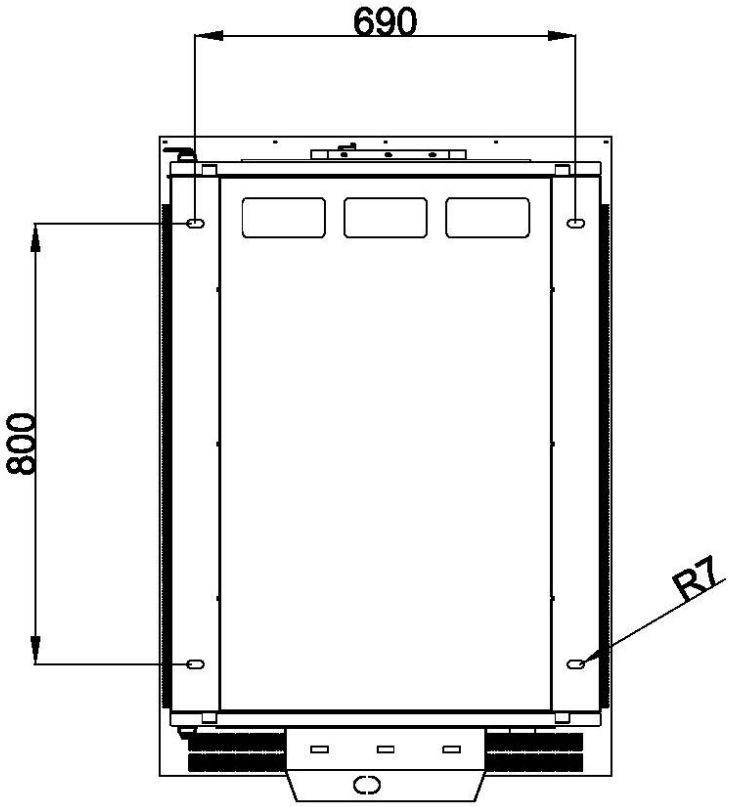


Figure 5-4: Position of the bottom mounting holes

5.8 Battery module installation

5.8.1 Unboxing

As the battery modules are transported separately from the cabinet, it is necessary to unbox the batteries during installation. Unpack the cardboard packaging, remove the shock-absorbing foam, and discard the moisture-proof plastic bags.

5.8.2 Placing the battery modules into cabinet

Due to the weight of the battery modules, it's recommended to have two people lift them. Hold the handles of the battery modules with one hand and support the bottom with the other hand. Align the battery modules with the installation slots and gently push them into the bottom of the rack. Before placing the batteries in the cabinet, remove the screws locking the battery modules in place. Refer to section 5.8.3 for specific locking steps.

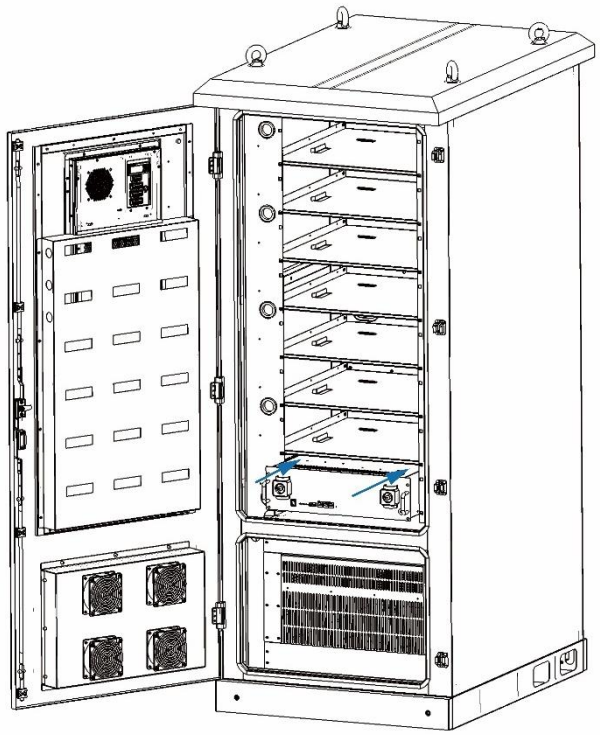


Figure 5-5: Battery installation

5.8.3 Installing the battery modules

After placing the battery modules in the cabinet, each module should be secured with four M6*19 screws (already fixed in the cabinet's locking position). Refer to figure 5-6 for installing the locking screws.



Figure 5-6: Battery module fixing

5.8.4 Battery installation completion

Raython M Pro can house up to 8 modules of ES100 II. The Figure 5-7 shows the system after completing battery installation.

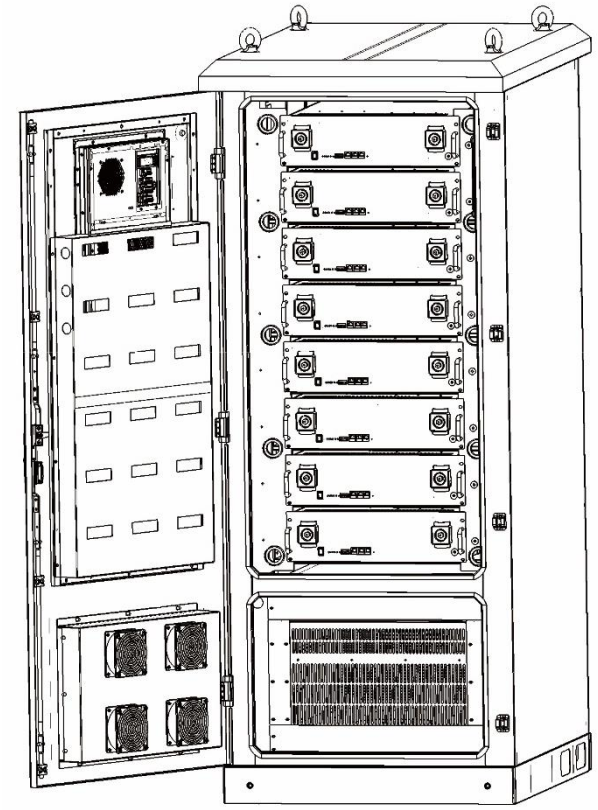


Figure 5-7: Battery installation completion

5.9 Introduction to installation tools

Installation tools include but are not limited to the following recommended parts. If necessary, other auxiliary tools can be used on site.



Goggles



Earplugs



Protective mask



Insulating gloves



Insulating shoes



Utility knife



Straight screwdriver



Cross screwdriver



Electric drilling machine



Pliers


Marking pen


Spirit level


Hammer



Socket spanner set



Spanner


Antistatic wrist strap


Wire cutters


Wire stripper



Crimping pliers


Heat blower



Crimping pliers


Single open-end spanner



Universal meter


Cable clamp


Dust collector

Table 5-1: Recommended Installation Tools

No.	Appellation	Description
a	Straight screwdriver	M6/M8/M12
b	Cross screwdriver	M3/M4/M8
c	Electric drilling machine	Drilling sizes: Φ12, Φ14
d	Socket spanner set	Socket spanner full-size set
e	Spanner	Openings: 13 mm, 16 mm
f	Crimping pliers	Tube terminal crimping pliers, crimping range: 10 mm²–25 mm²
g	Universal meter	DC voltage measuring range ≥1,000 V
j	Crimping pliers	Copper nose crimping pliers, crimping range: 16-50 mm

6.Wiring

Warning

- **Incorrect wiring sequence may cause fire and combustion. Please pay attention to the connection sequence of wiring parts.**
- **Before wiring, ensure that the cabinet is securely placed without tilting or turning over, and check whether each module is installed correctly and securely. If the connection is not sufficient or the contact surface is oxidized, or the heat is too large, it may cause fire and combustion.**
- **The ground wire must be connected before other cables in the system.**

Attention

- **After the wiring is completed, the incoming line hole at the bottom of the cabinet shall be blocked with fireproof mud to prevent small animals from entering.**
- **Ensure the wiring environment is protected against water and sunlight; avoid use in chemically corrosive environments.**

Please connect the cables in strict accordance with the description in this section.

Cables shall be selected according to the following requirements:

1. The selected cables must have sufficient current-carrying capacity. The current-carrying capacity of a conductor is at least related to environmental conditions, type of conductor insulation material, laying method, conductor material, cross-sectional area, etc.
2. The cross-sectional area of all cables must be selected according to the maximum power of the energy storage system, with reserved margin.
3. The cables on the same side shall be of the same specification and type.
4. Please select flame-retardant cables.

6.1 Battery wiring

The battery modules and the cabinet are shipped separately, during on-site installation, the main module, Matrix II Pro, has been installed and related connections completed. On-site personnel do not need to perform internal wiring on the battery module.

Once the battery is installed and secured, the professional needs to connect the ground wire, the power cable, the communication cable between the batteries, and the communication line between the battery and the E4 in turn.

6.1.1 Battery ground wire connection

Warning

- **To ensure safety, the grounding wires must be connected before connecting other system cables such as AC cables, DC cables, communication cables, and control cables.**

Step 1: Confirm the grounding point position of each module inside the cabinet. The M6*14mm external hexagonal flange screws are already configured in the screw holes, as shown in the figure below:
Step 2: Take out the ground wires from the accessory pack and connect them to the grounding point of each module.
Step 3: Use a suitable screwdriver to remove the fixing screws from the system grounding points. Secure the grounding wire with the copper lug to the grounding point using screws (torque: 4Nm ± 0.5Nm).
Step 4: Measure the ground resistance, which should be less than 4 Ω.
Raython M Pro with battery ground wire connection completed is shown in the figure 6-2.



Figure 6-1: The ground position of the battery

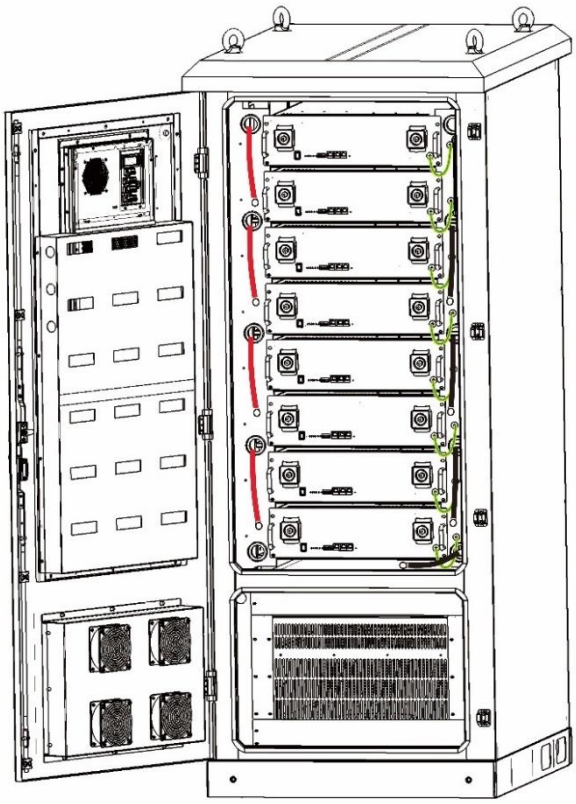


Figure 6-2: Ground cable connection

6.1.2 Battery power cable connection

Danger

There is fatal high voltage between the positive and negative poles of the storage battery pack!

- **Do not short-circuit the positive and negative terminals of the battery, otherwise it will cause a short circuit of the battery.**
- **During installation and maintenance, keep the battery loop disconnected.**
- **If the 8 batteries are not fully used, please remove the unused power cable connected to the battery. Do not allow the power cable not connected to the battery to be left in the cabinet.**

Step 1: Raython M Pro can house up to 8 ES100 II modules. The installation method is to divide them into 4 groups, each with 2 battery modules connected in parallel.
Step 2: The combiner cables have been pre-installed and fixed at the inlet holes before delivery, as shown in the figure 6-3. Connect the power cable to the battery respectively (The positive power cable is connected to BAT1, 3, 5, 7, and the negative power cable is connected to the battery 2, 4, 6, 8). If the eight batteries are not fully used, remove unconnected power cables from the cabinet.
Step 3: The battery's positive and negative terminals are protected with plastic insulation. When installing the cables, remove the plastic shells.
Step 4: Take out the parallel copper busbars from the battery accessory pack. Connect the positive electrodes of the battery in parallel, and the negative electrodes are grouped in parallel.

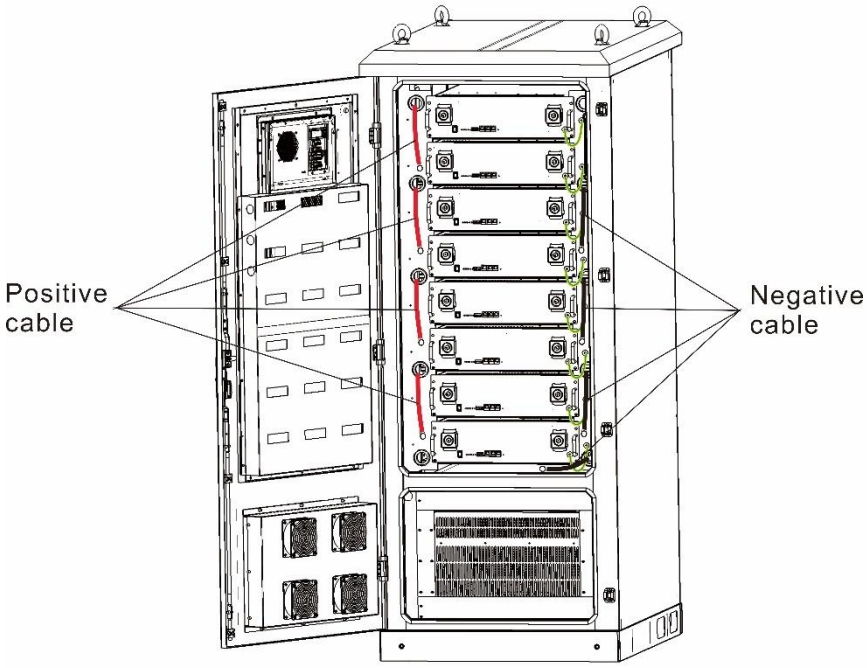


Figure 6-3: Position of power cables

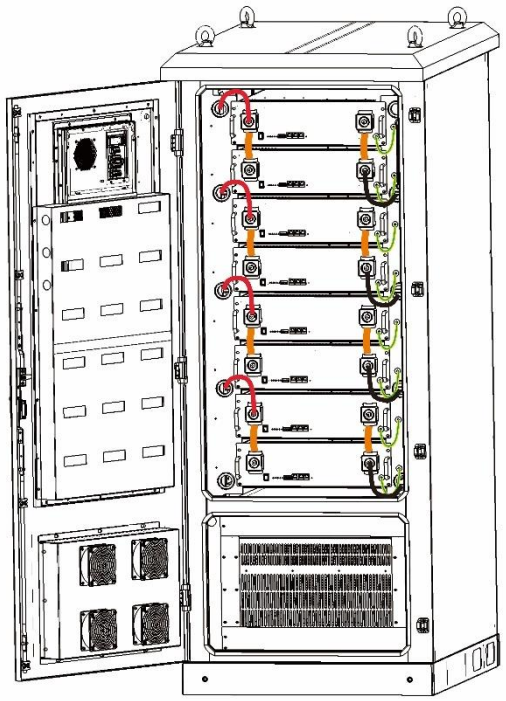


Figure 6-4: Power cable connection

6.1.3 Battery communication cable connection

Take out the communication cables from the battery accessory pack. Firstly, connect the "Inverter" port of BAT1 to E4, and then, connect the “Out” port of BAT1 to the “In” port of BAT2, and continue this until the last battery is connected. The battery communication cable connection should be completed as shown in the figure 6-5.

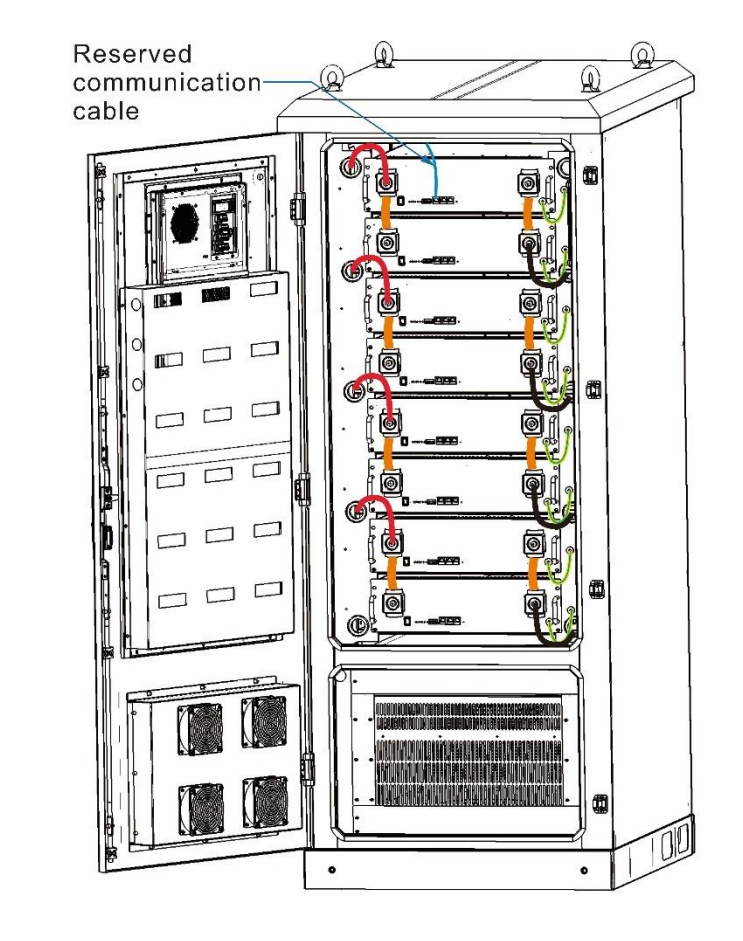


Figure 6-5: Communication cable connection

6.2 External wiring

6.2.1 Wiring recommendation

Please find the following minimum cable size. In case of DC cable longer than 5m, please increase the cross-sectional area of the cable to reduce the loss.

Table 6-1: Recommended cable sizes

Item	Cable Size	Circuit Breaker
AC input	25mm²	100A
AC output	25mm²	100A
PV input（1~4）	4mm²	25A
AGS cable	1 mm²	-

6.2.2 Connection terminal description

Step 1: To ensure safety, the Raython M Pro is shipped with a cover plate sealing the distribution panel. When wiring on-site, it is necessary to remove the six screws on the cover plate and then take off the cover plate, as shown in the figure 6-6.

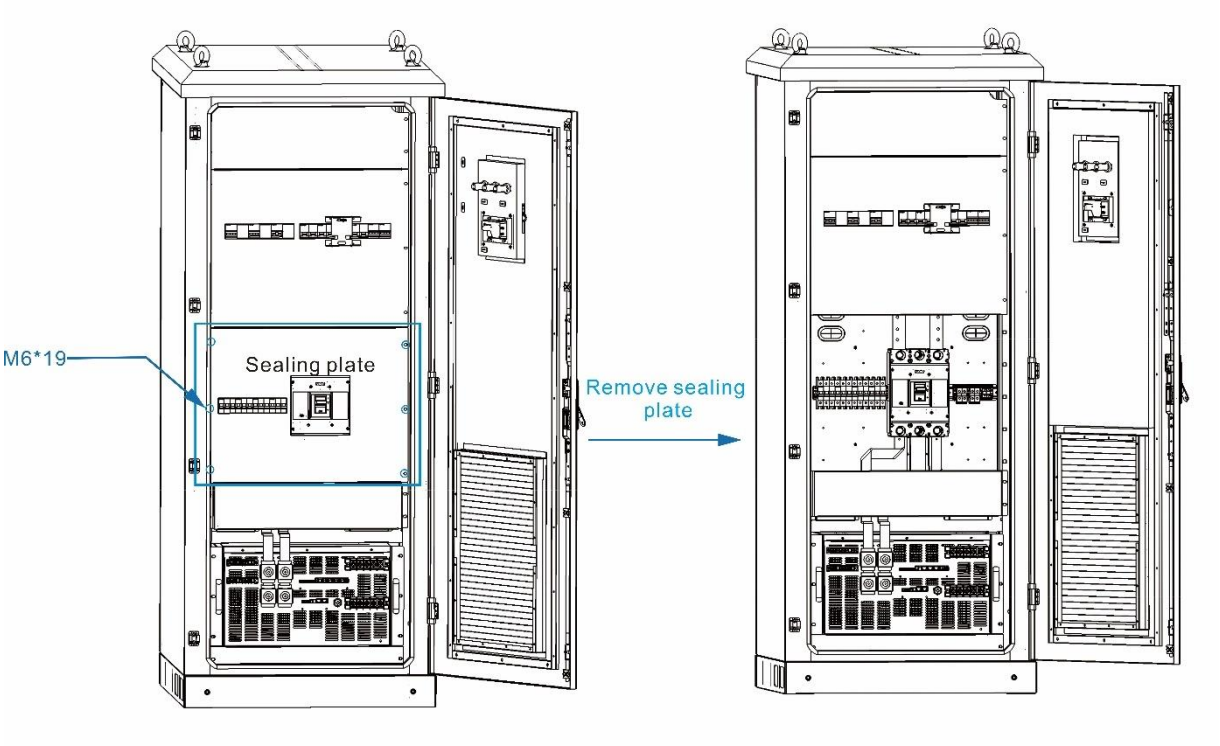


Figure 6-6: Remove the sealing plate

Step 2: After removing the cover plate, the technician can connect the PV input, AC input, AC output, and upper computer communication cables through the terminal block. Refer to section 6.2.1 for recommended cable sizes. Once all cable connections are completed, reinstall the cover plate. The terminal block position is shown figure 6-7.

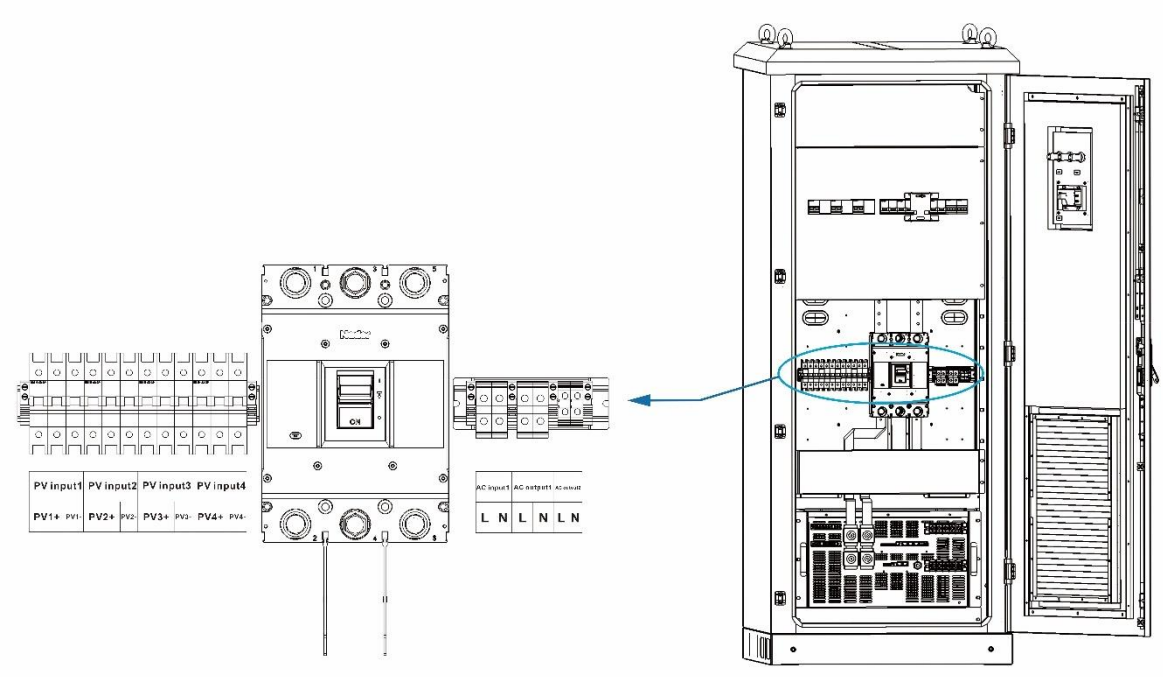


Figure 6-7: Wiring terminal block layout

Table 6-2: Description of the terminal block

Item	Name	Description	Label	Torque
1	PV IN1	Connected to PV input	+	2N • m~2.5N • m
			-	
2	PV IN2	Connected to PV input	+	
			-	
3	PV IN3	Connected to PV input	+	
			-	
4	PV IN4	Connected to PV input	+	
			-	
5	AC IN1	Connected to the grid	L	3.2N • m~3.7N • m
			N	
6	AC OUT1	Connected to the load	L	
			N	
7	AC OUT2	Connected to the load	L	1.2N • m
			N	

Step 3: Inside the cabinet, there is a ground bus bar. When connecting external wiring, please use 10~16 mm^2 wires. The ground bus bar position is shown in the figure 6-8.

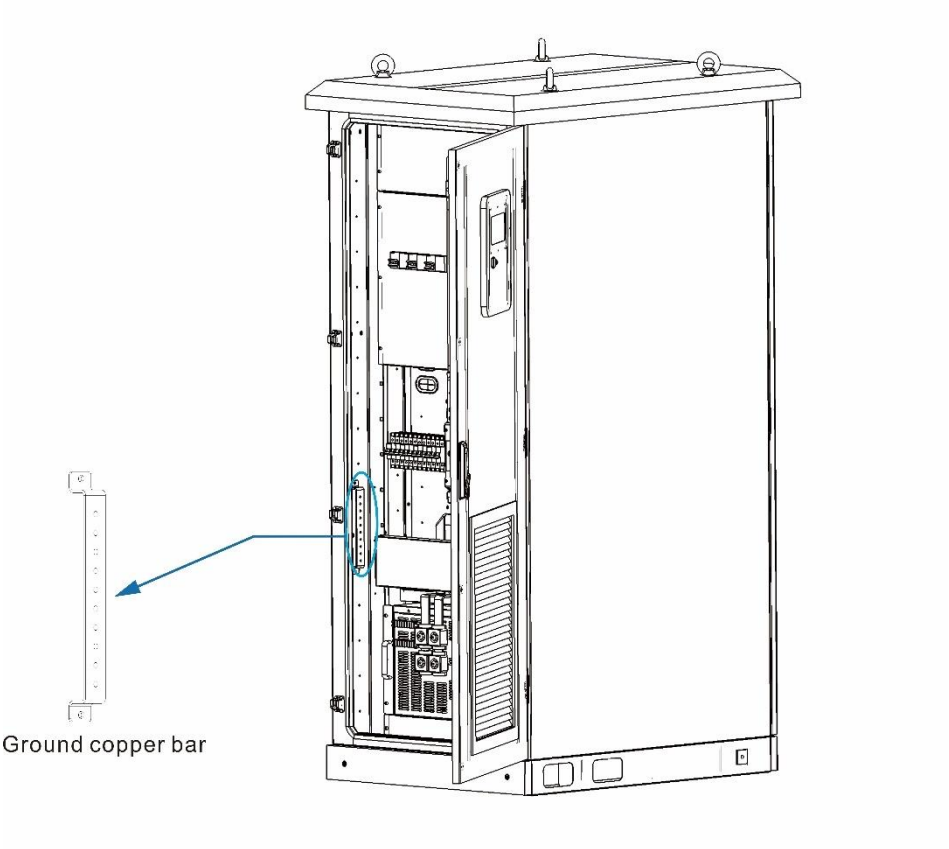


Figure 6-8: Position of the Ground Bus Bar

6.2.3 Position of the external wiring entry holes

Cables that connect to the energy storage cabinet from outside must enter the energy storage cabinet through the external wiring entry holes.

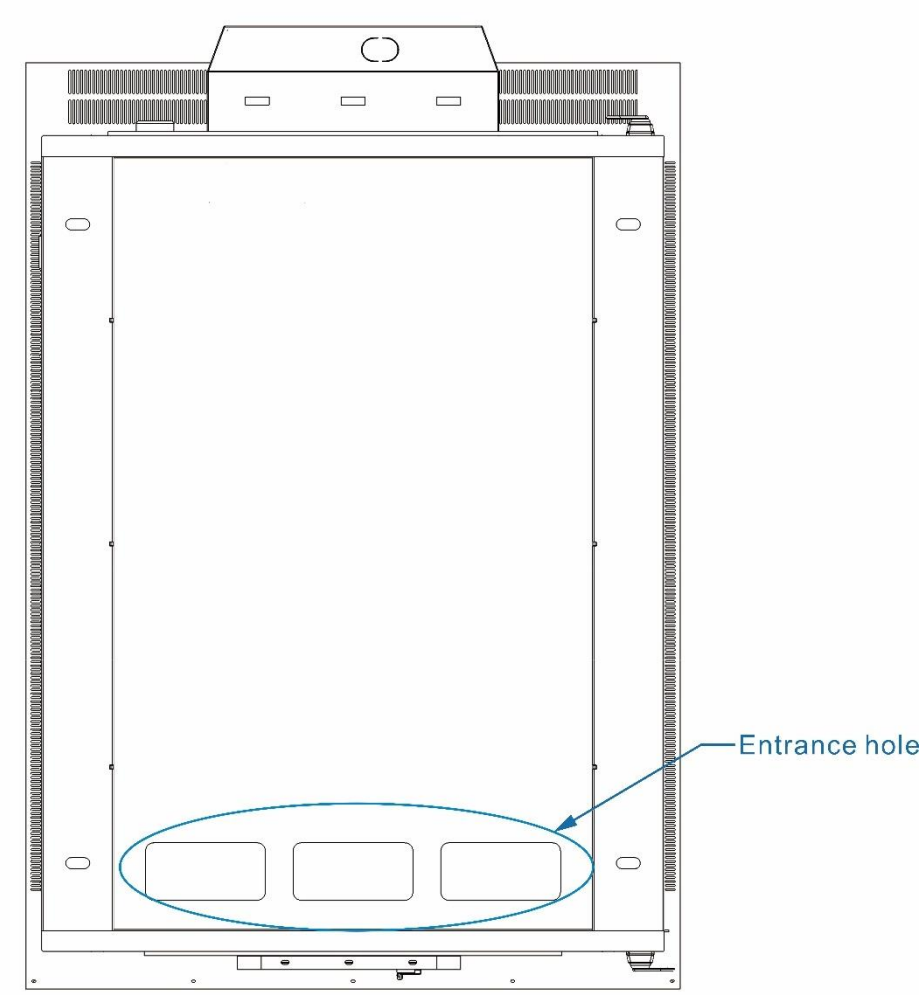


Figure 6-9: Position of external wiring entry holes

6.3 Wiring inspection of the energy storage cabinet

After the wiring of the energy storage cabinet is completed, comprehensive inspection shall be carried out. At least two workers are required to check the items listed in the following table.

In the inspection process, records shall be made. Changes shall be made immediately once the installation does not meet the requirements.

Table 6-3 : Checklist

Mechanical installation Inspection items	The external body and internal components of the energy storage cabinet shall be free of deformation and damage.
	The bottom of the energy storage cabinet shall be fixed for stable and reliable support.
	There shall be enough space around the energy storage cabinet.
	The ambient temperature, humidity, and ventilation of the energy storage system shall meet the requirements.
Electrical installation inspection	The cabinet shall be sealed and protected reliably.
	The energy storage cabinet shall be grounded firmly.
	The grid-side voltage shall match the rated output voltage of the energy storage inverter.
	The phase sequence at the grid side shall be consistent with that at the inverter side.
	The tightening torque of the power connection part shall meet the requirements.
	The communication cables shall be connected correctly.
	The cable markers shall be correct and clear.
Other inspections	All useless conductive parts shall be fastened with insulating ties.
	There shall be no tools, parts, conductive dust or other foreign matters left inside the cabinet.
	There shall be no condensed moisture or ice inside the cabinet.

6.4 Block the wiring entry holes

After the trial run of the energy storage system is completed, the system operates normally, and the hardware is not changed, the incoming cable hole of the cabinet shall be blocked with fireproof mud to prevent small animals from entering the cabinet.

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