TBB POWER

Version: V1.0

USER MANUAL

All-In-One Standalone Solar Power System

Raython R-II series



www.tbbpower.com

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About this Manual

This manual describes our product features and provides procedure of installations. This manual is for anyone intending to install our equipment.

General Instruction

Thanks for choosing our products and this manual is suitable for Raython R-II series Solar Intelligent Energy Storage System.

This chapter contains important safety and operation instructions. Read and keep this User Guide well for later reference.

The Raython R-II series needs to be installed by professionals and please pay attention to the following points prior to installation:

1> Please check the DC input voltage or battery voltage is the same to the nominal input voltage of this inverter.
2> Please connect positive terminal “+” of the battery to “+” input of the inverter.
3> Please connect negative terminal “-” of the battery to “-” input of the inverter.
4> Please use the shortest cable to connect and ensure the secure connection.
5> While connecting, please secure the connection and avoid short cut between positive terminal and negative terminal of the battery, to avoid damage to the battery.
6> The system will have high voltage inside. Only authorized electrician can open the case.
7> The system WAS NOT designed to use in any life retaining equipment.

⚠Warning

- The system voltage is much higher than the safety value. Direct contact or indirect contact with wet objects could be dangerous.
- Substandard or incorrect operations might lead to accidents like fire or electric shock.
- The upstream protective switch must be disconnected before conducting electrical connection.
- Electrical connection must be finished before letting AC in.
- Make sure the cables have been connected to the right poles of battery pack before connecting the output cable or battery cable.
- This product should be kept away from liquid and must not be installed below positions prone to water leakage such as air conditioning ducts, ventilation outlets, or wiring windows, etc.
- Make sure there is not condensation inside the cabinets. When there is liquid inside, the power should be turned off immediately. Then, please turn to relevant staff for troubleshooting.
- When the temperature is too low, huge impact or vibration might result in brittle cracking of the plastic cable sheath. To ensure safety, cable installation should be proceeded in above 0℃.
- If the cables are stored under 0℃, they are supposed to be placed in indoor temperature for more than 24 hours before being installed.

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1. General Safety Instruction

1.1 Safety Instruction

As dangerous voltages and high temperature exist within the Raython, only qualified and authorized maintenance personnel are permitted to open and repair it.
This manual contains information concerning the installation and operation of the Raython. All relevant parts of the manual should be read prior to commencing the installation. Please follow the local stipulation meantime.
Any operation against safety requirement or against design, manufacture, safety standard, and are out of the manufacturer warranty.

1.2 Symbols Used in the Documentation



This symbol indicates a hazardous situation which, if not avoided, could result in death or serious injury.



This symbol indicates a situation which, if the instructions are not followed, could result in injury and damage to the equipment.



This symbol indicates a situation which, if the instructions are not followed, could result in damage to the equipment.

1.3 General Precaution



To avoid fire and electric shock， make sure all cables selected with right gauge and being connected well. Smaller diameter and broken cable are not allowed to use. Please do not put any inflammable goods near to Raython.



Do not expose to dust, rain, snow or liquids of any type，it is designed for indoor use. DO NOT block off ventilation, otherwise the Raython would be overheating.

1.4 Precaution Regarding Battery Operation

Only authorized and trained person who should be familiar to battery installation, preparation, charging, and maintenance is permitted to the operation for battery
SHOCK HAZARD- DO NOT touch the uninsulated battery connectors or terminals. Be sure to discharge static electricity of tools and technicians by touching a grounded surface, but away from the cells and flame arresters.

All tools should be adequately insulated to avoid the possibility of shorting connections.

DO NOT lay tools on the top of the battery.

Although the batteries are sealed and no gas emitted during normal operation, they contain potentially explosive gases, which may be released under abnormal operating conditions, such as a charger malfunction. It is the responsibility of the customer to provide adequate ventilation so that hydrogen gas accumulation in battery area does not exceed 2% by volume. However, normal air circulation in a ventilated facility will preclude any hydrogen build-up even during cyclic charging. Never install batteries in a sealed cabinet or enclosure.

Remove all personal metal items such as rings, bracelets, necklaces, and watches while working with batteries. Batteries can cause short-circuit current high enough to make metal melt, and could cause severe burns.



The battery contains sulfuric acid, which may lead to the burning of the severe. In case of skin touched the electrolyte, please remove contaminated clothing and flush affected areas thoroughly with water. If eye contact has occurred, flush for a minimum of 15 minutes with large amounts of running water and seek for immediate medical attention.

2. System Description

The Rayhton R-II system is an all-in-one standalone solar power system. It is an ideal solution designed for holiday houses or single-family houses that have no access to the grid power and the users often use generators as their power supply. Featuring low pollution and low fuel consumption, it is also a perfect solution for people who pursue a more sustainable lifestyle.

The Raython system is expertly assembled, tested and shipped as a complete system, integrating a solar hybrid inverter, lithium battery modules, wireless data logger, and AC and DC power distribution into one system. On arrival, Raython R-II system is ready to install and the all-in-one design makes it easy to install and saves your precious time.

Our Raython R-II System is designed for applications with a daily power use from 10kWh-20kWh, to meet your different power need.

Features:

- All-in-one design for easy and quicker installation (<3 hours)
- Provided with IP54 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

2.1 Equipment layout

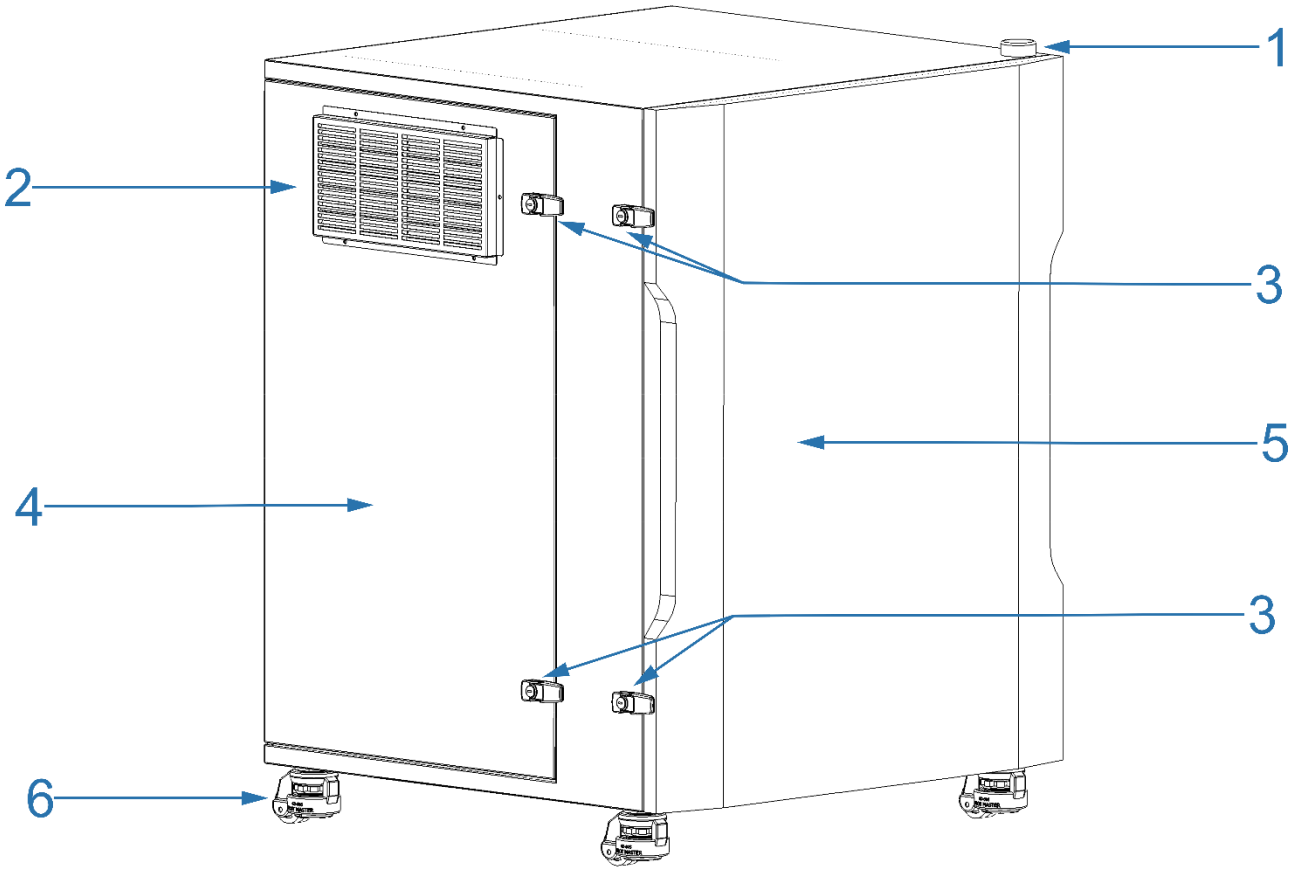


Figure 2-1 Raython R-II External Layout

Table 2-1 Description of Raython R-II External Layout

No.	Functional unit	No.	Functional unit
1	External antenna	2	Anti-dust mesh cover
3	Cabinet front door lock	4	Battery compartment door
5	Cabinet front door	6	Caster

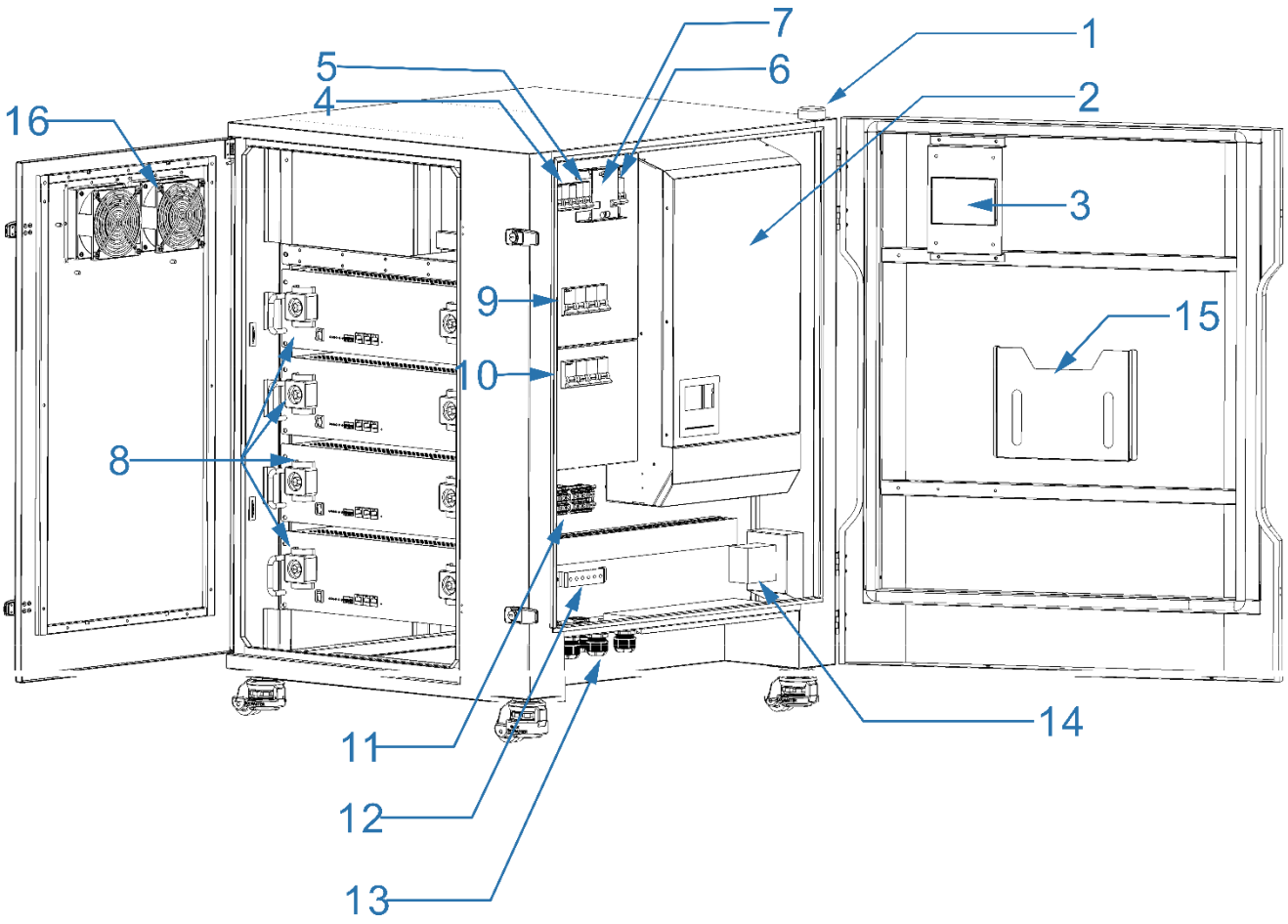


Figure 2-2 Raython R-II Internal Layout

Table 2-2 Description of Raython R-II Internal Layout

No.	Functional unit	No.	Functional unit
1	External antenna	2	Solar hybrid inverter
3	E4 LCD Monitor	4	AC Input circuit breaker
5	Bypass circuit breaker	6	AC Output circuit breaker
7	Manual maintenance switch padlock	8	Lithium battery
9	Internal battery circuit breaker	10	External battery circuit breaker (optional)
11	External wiring terminal	12	Ground copper bar
13	Inlet and outlet holes for cables	14	PV input isolate switch
15	file pocket	16	cooling fan

2.2 Cabinet Dimensions

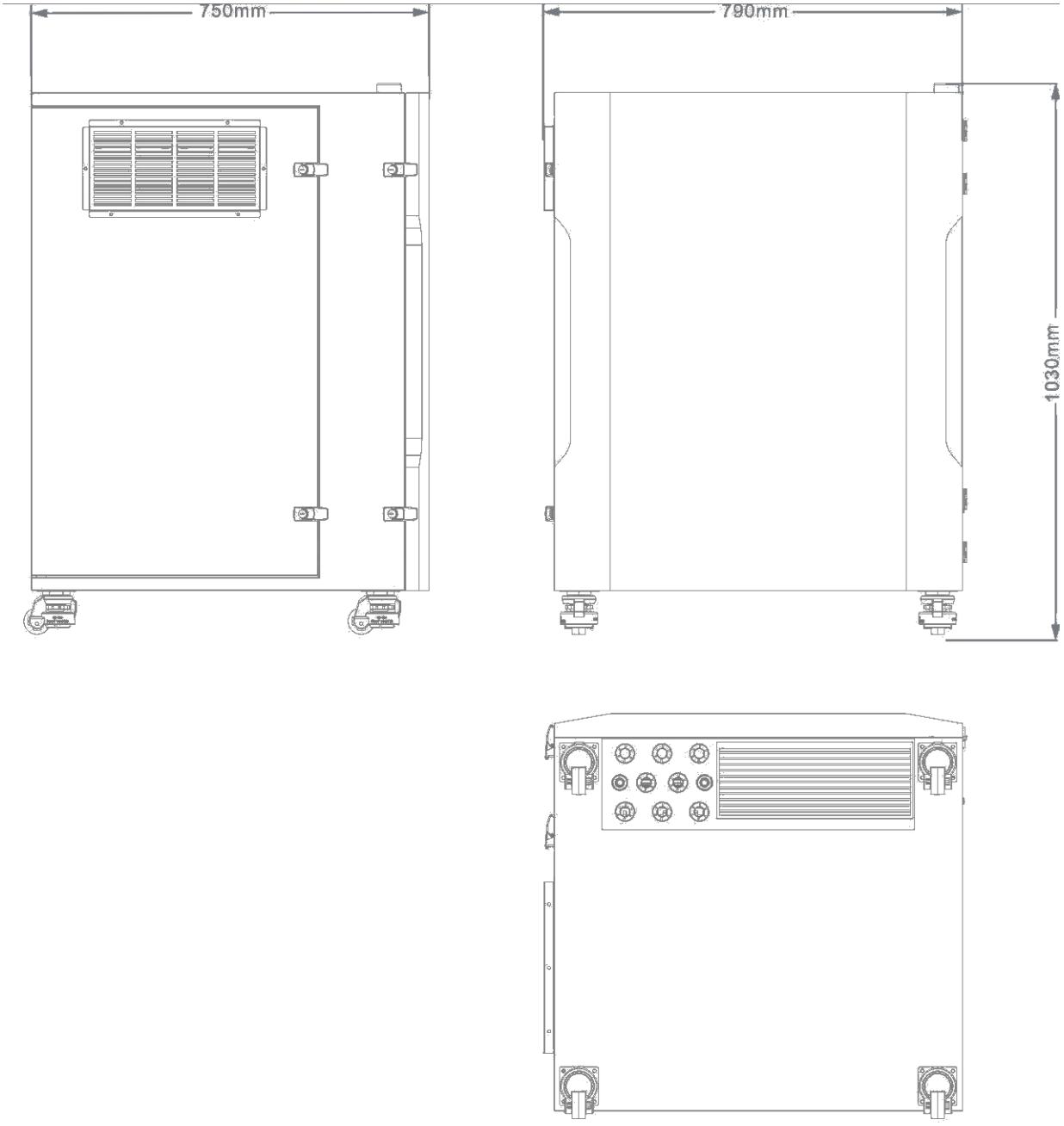


Figure 2-3 Raython R-II Cabinet Dimensions

2.3 RiiO Sun II Solar Hybrid Inverter

RiiO Sun II series all-in-one solar inverter (hereinafter referred to as RiiO Sun II) is a low-frequency transformer-based inverter integrated with multiple functions like battery inverter, AC charger, and MPPT charger, suitable for backup power and off-grid applications.

For more information about RiiO Sun II, please refer to its manual.

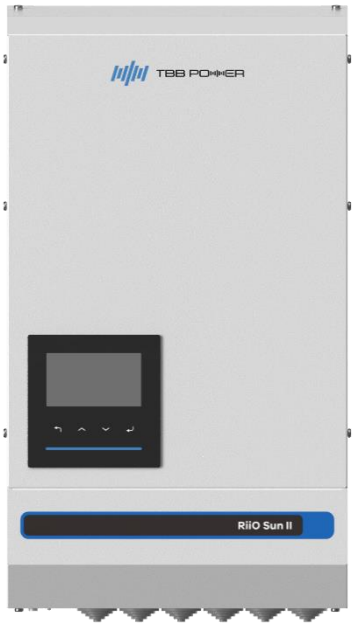


Figure 2-4 RiiO Sun II Appearance

2.4 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.

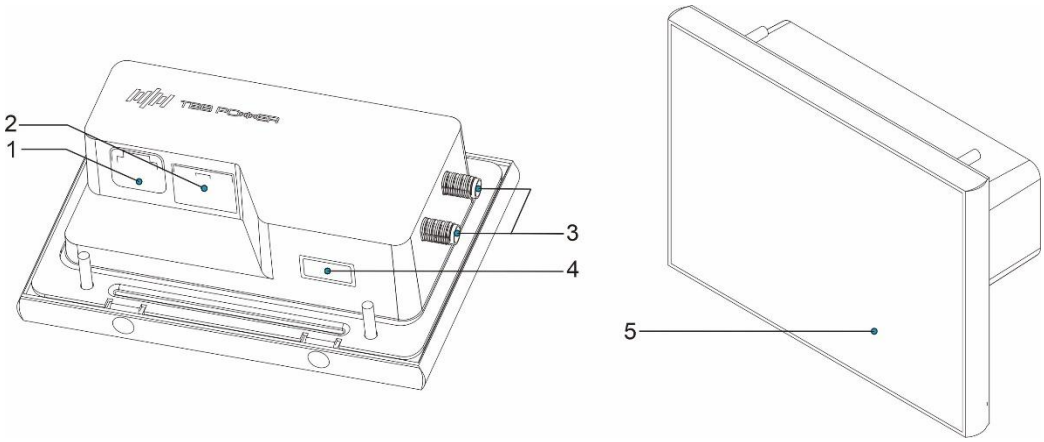


Figure 2-5 The structural appearance of the E4 LCD

Table 2-3 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.

2.5 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.

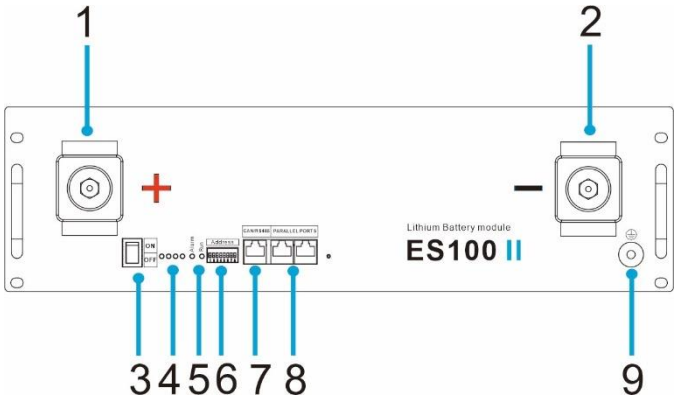


Figure 2-6 Structure layout of ES100 II

Table 2-4 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. Functional Description

Raython R-II 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.

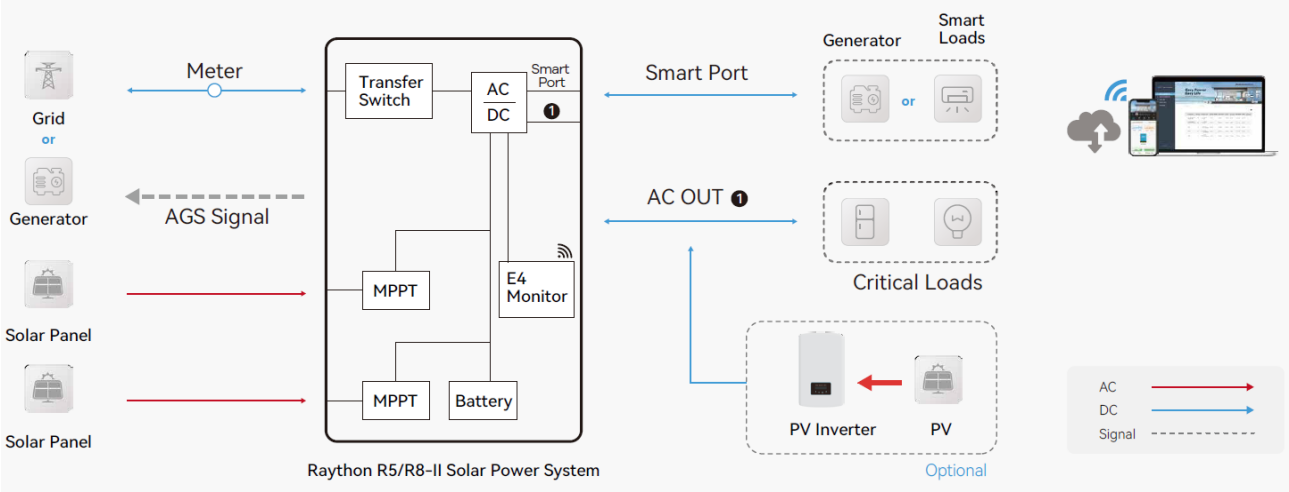


Figure 3-1 System Schematic

4. Installation

Prior to Installation

➢ Read the manual carefully and confirm the voltage and current input requirements of the load(s) are compatible with the unit's output.

➢ Also see the line voltage and current is compatible with the unit's input requirements.

➢ Wiring should be done to meet local electrical codes.

Use proper techniques when moving the unit.

4.1 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 R-II

➢ Raython R-II User manual

➢ E4 User manual

➢ RiiO Sun II User manual

➢ ES100 II User manual

4.2 Location

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

➢ Working temperature：0℃-50℃

➢ Storage temperature：-20℃-70℃

➢ Relative Humidity：0%-95%，non-condensing

➢ Cooling：Forced air



Keep it away from fire, high temperature, inflammable; explosive or corrosive material.

➢ Raython system is designed for outdoor usage. Install the system at the locations away from direct sunlight, rain or damp.

➢ The system should be installed at dry, clean, well ventilated environment. Away from dust and garbage.

➢ Guarantee the enough clearance of installation. Good ventilation is critical for proper performance of syste

4.3 Requirements of installation angle

Equipment should be installed on a flat surface.

- Do not place the unit in an inclined position.
- Do not store the unit on its side or up-side down to avoid the damage of the unit.

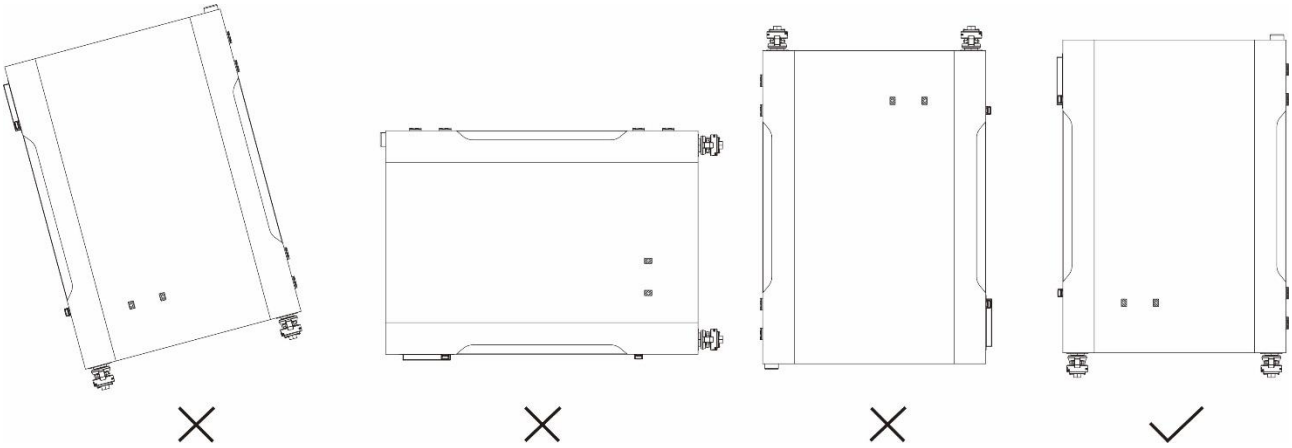


Figure 4-1 Cabinet Placement Angle requirements

4.4 Requirements of installation spacing

Following minimum clearance are requested for the installation.

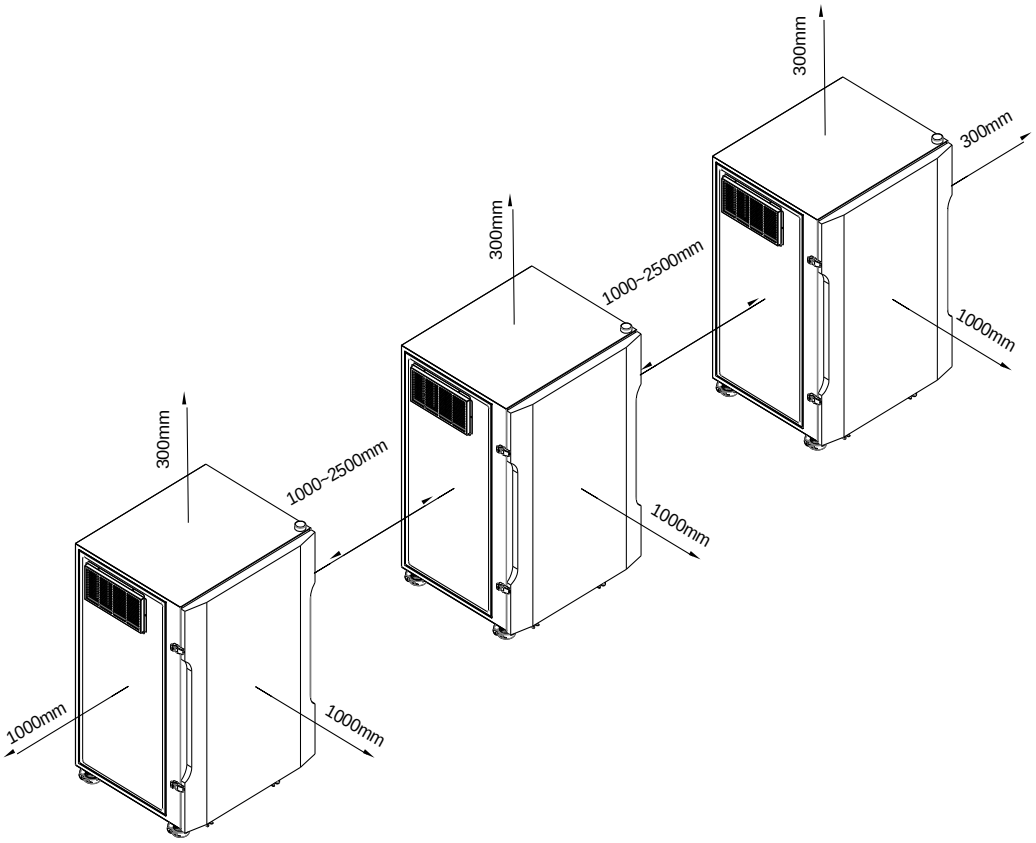


Figure 4-2 Cabinet Spacing Requirements

Table 4-1 Details of Cabinet Spacing Requirements

Direction	Minimum Clearance
Front	1m
Left Side	0.3m
Right Side	1m
Top	0.3m
distance between cabinets	1m~2.5m

4.5 Fix the Cabinet

- Rotate the four casters of the Raython cabinet counterclockwise, so that the bottom plate of the casters falls to the ground (Rotating the nut A clockwise with a spanner or other proper tool)

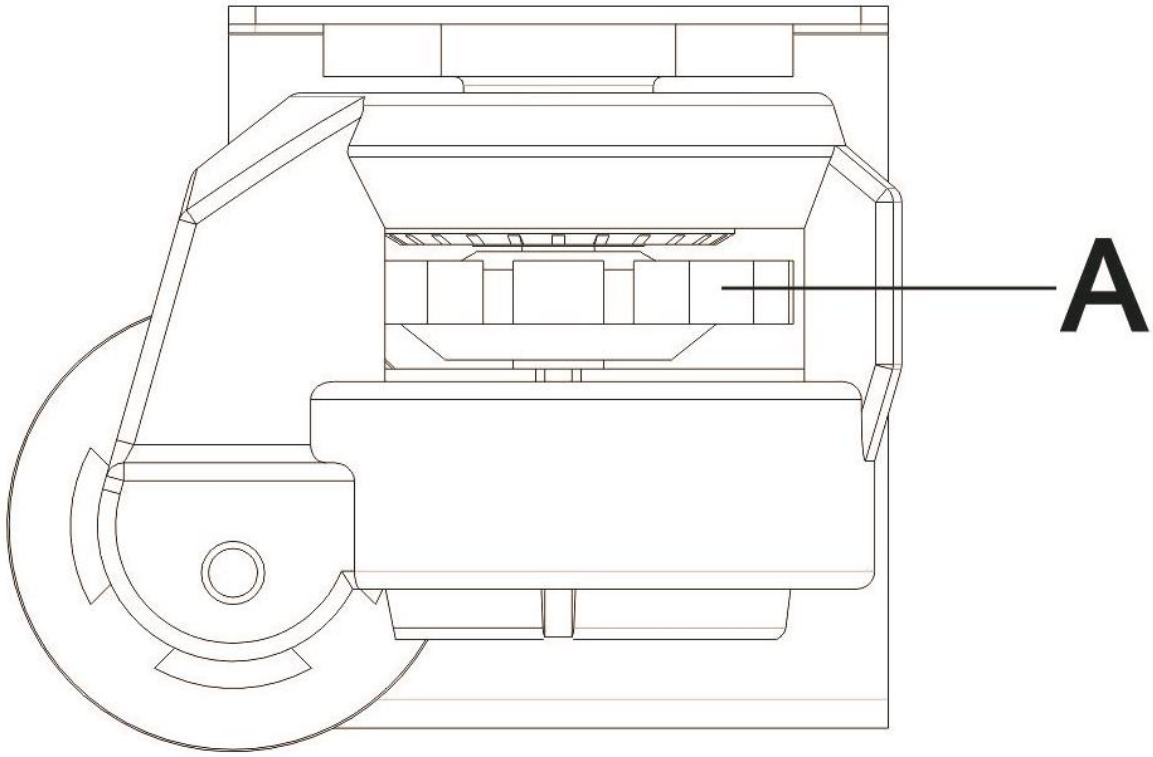


Figure 4-3 Secure the Storage Cabinet

4.6 Wiring Recommendation

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

Table 4-2 Wiring Recommendation

Item	Raython R8/R5-II	
	Cable Size	Circuit Breaker
AC input	10mm²	50A
AC output	10mm²	50A
PV input	10mm²	50A
AGS cable	1 mm²	-
External Battery	50mm²	125A/80A

4.7 Connection Terminal Description

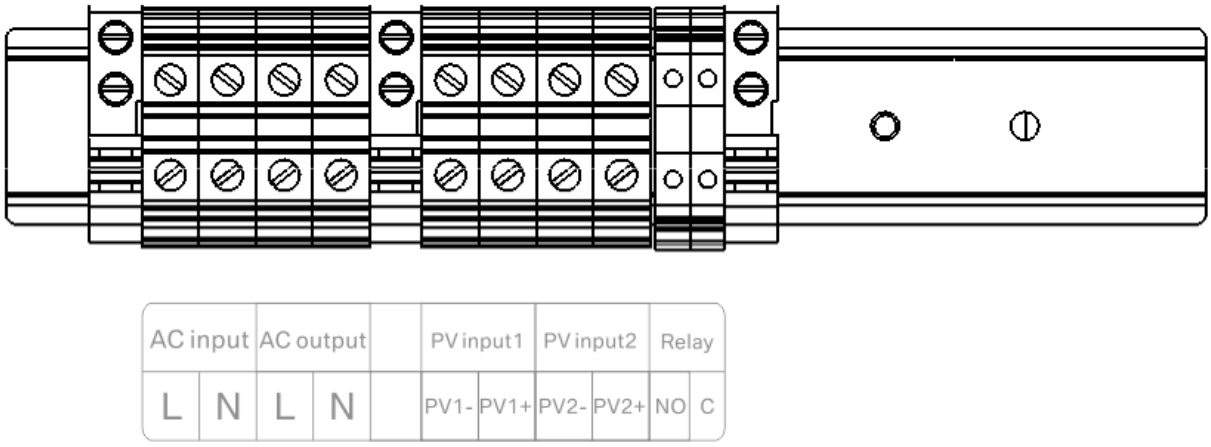


Figure 4-4 Raython R-II Layout of terminal blocks

Table 4-3 Terminal block description

Item	Name	Description	Label	Comments
1	AC input	Connect to the grid AC input	L	Line
			N	Neural
2	AC output	General load without being protected by installed MCB	L	Line
			N	Neural
3	PV input	Loads controlled being protected by installed PV switch	+	Positive
			-	Negative
4	Relay	Connect to generator start control port	NO	Normally Open
			C	Common

4.8 Wiring Instruction

All of the cables should be inserted into the cabinet through the holes at the bottom of the cabinet as below picture shows.

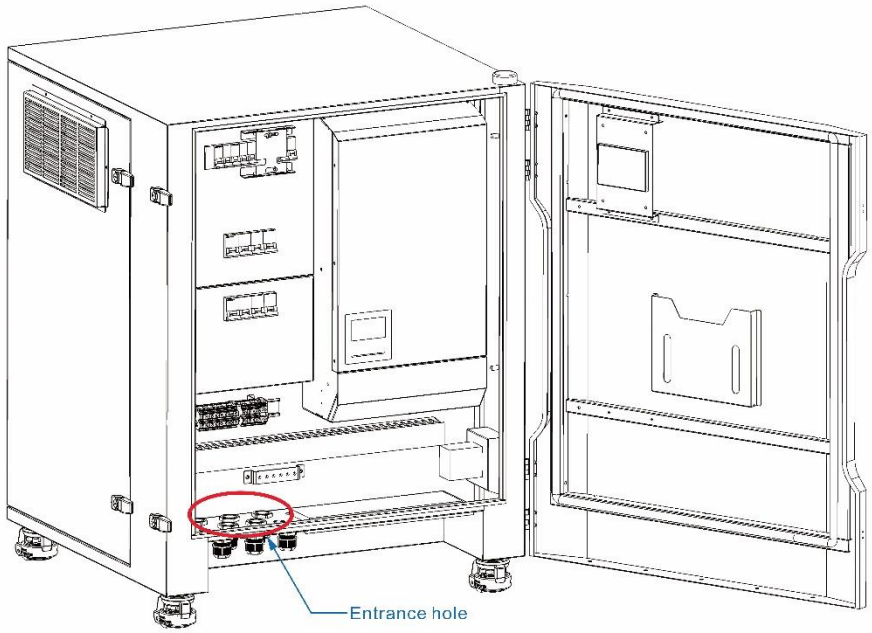


Figure 4-5 Position of Entrance Hole

Cut off the power before installation for safety. Please make sure the inverter is switched off and DC MCB is turn off at front panel before installation.

4.8.1 Connecting to Earth

At the bottom of the enclosure, there is a ground terminal. See wiring area view. Please connect it with EARTH or vehicle chassis by a 6~10mm² green yellow wire (keep wire size same with AC input cable).

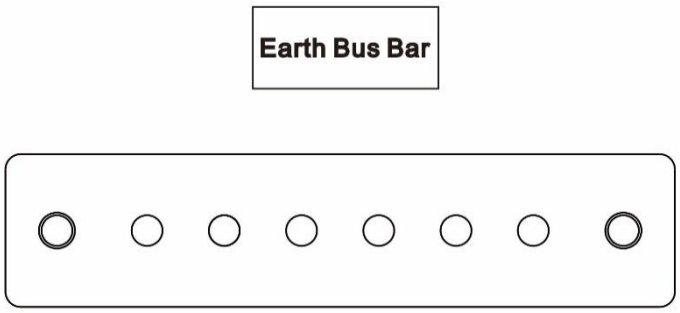


Figure 4-6 Position of Entrance Hole

4.8.2 Connecting AC Grid Cable

For safety, please turn off the Main Input MCB before the installation

Using correct cable gauge (refer to chapter 4.6), please connect the grid to the terminal labeled “AC input”. Make sure the connection is correct and tightly screwed.

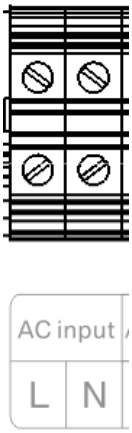


Figure 4-7 AC Input Wiring Terminal

4.8.3 Connecting the Loads

Do not connect the output of this equipment to the same line as other AC sources such as the 230V external mains or a generator.

Two groups of output terminals are supplied with this Raython system. “AC output” is supplied with protected MCB.

Using correct cable gauge (refer to chapter 4.6), please connect the load to the terminal labeled “AC output”. Make sure the connection is correct and tightly screwed.

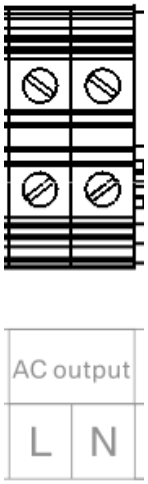


Figure 4-8 AC Output Wiring Terminal

4.8.4 Connecting PV in Cable

For safety, please turn off the PV Input MCB before the installation.

Using correct cable gauge (refer to chapter 4.6), please connect the PV to the terminal labeled “PV input”. Ensure that the positive and negative poles are not reversed. Make sure the connection is correct and tightly screwed.

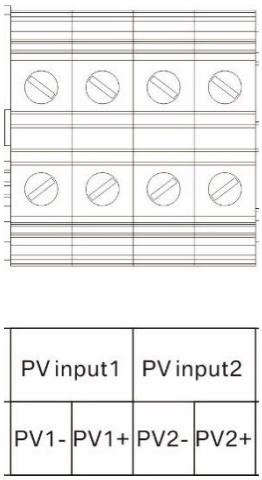


Figure 4-9 PV Input Wiring Terminal

4.8.5 Connecting the AGS Terminal

Two groups of AGS terminals are supplied with this Raython system.

Using correct cable gauge (refer to chapter 4.6), please connect the Generator to the terminal labeled “Relay”. Make sure the connection is correct and tightly screwed.



Figure 4-10 Relay Wiring Terminal

4.8.6 Battery wiring

The battery modules and the cabinet are shipped separately, during on-site installation, the main module, RiiO SUN II, 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.

4.8.6.1 Battery ground wire connection

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.



Figure 4-11 The ground position of the battery

4.8.6.2 Battery power cable connection

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.

Step 1: Raython R-II can house up to 4 ES100 II modules. The installation method is to divide them into 2 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.
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.

4.8.6.3 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 installation of the wiring harness can be referred to the following figure.

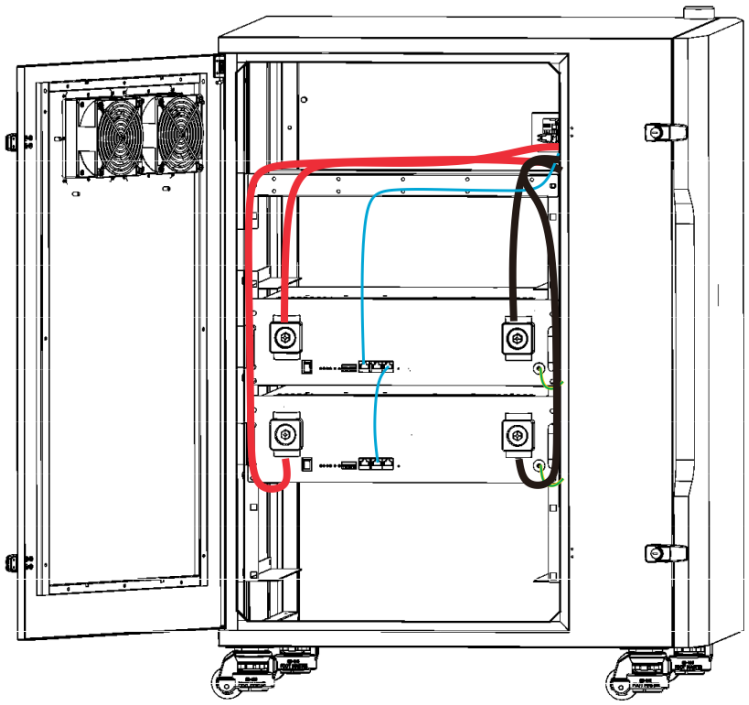


Figure 4-12 Two battery wiring methods

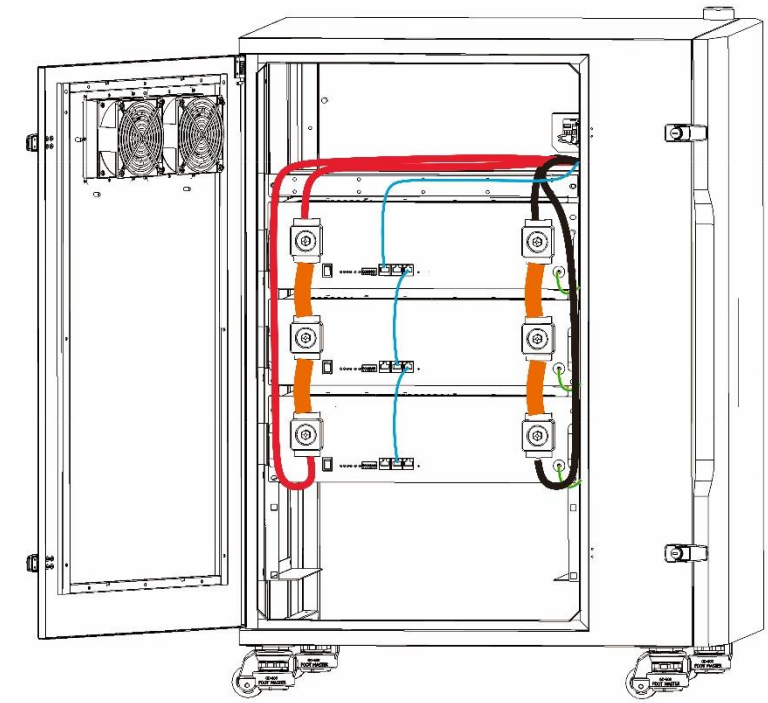


Figure 4-13 Three battery wiring methods

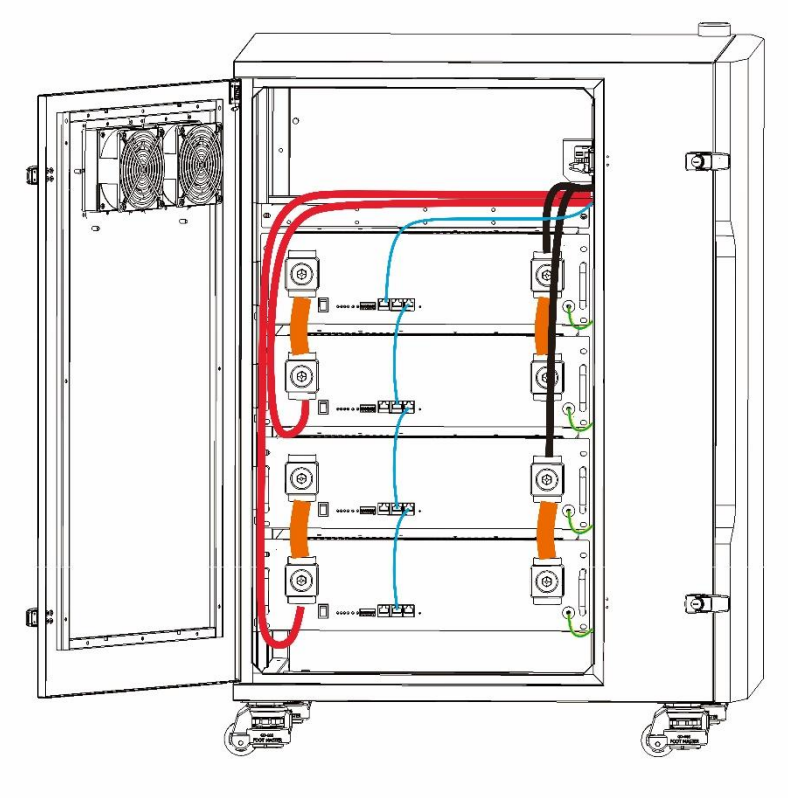


Figure 4-14 Four battery wiring methods

5. Operation

5.1 Double Checking

- The system is installed correctly and steady.
- Make sure the ground wire is properly connected firmly and reliably.
- Make sure the cables are properly connected firmly and reliably.
- The DC breaker AC breaker and PV switch is OFF before switching on the inverter
- Inspect the Ac input and AC output are correct, and make sure the unit is not short cut.
- Make sure the AC input voltage is within the nominal range.
- Make sure the PV input voltage is within the nominal range

5.2 Switching on the Battery

- Make sure the battery voltage is within the permissible range before turning ON the breaker.
- Switch on all batteries. please refer to its manual
- Switch on battery switch

5.3 Switch on the Solar Hybrid Inverter

Please follow the below instructions step by step.

- Step 1: Press the On/Off button for 2 seconds to turn on the inverter into the standby mode, the power LED will light up and the LCD will enter the self diagnostic mode.

- Step 2: Wait in the standby mode for 30 seconds, then press the On/Off button again for 1 second to turn on the inverter into the inverting mode and observe the LCD and the invert LED to make sure the inverter is running normally.
- Step 3: Turn on the PV IN Switch to power, the MPPT Charge Controller will start to charge the battery.

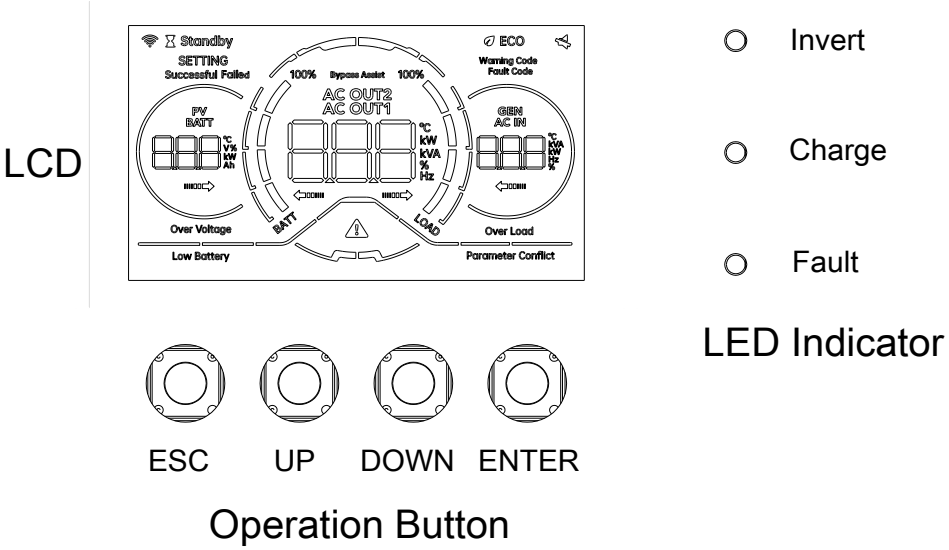


Figure 5-1 RiiO Sun II interface

5.4 Power OFF

➢ Step 1: When the inverter is in the inverting mode or charging mode, press the On/Off button for 2 seconds to turn off the inverter into the standby mode.

➢ Step 2: When the inverter is in the standby mode, press the On/Off button for 5 seconds to turn off the inverter into the complete off mode.

➢ Step 3: Turn off the circuit breaker of PV input and AC input.

➢ Step 4: Turn off the circuit breaker between the battery and the inverter.

5.5 Connect to the NOVA Monitoring Platform

Please refer to the User Manual of Kinergy/E4 and Quick Installation Guide
more details, please visit www.tbbpower.com

6. Configuration

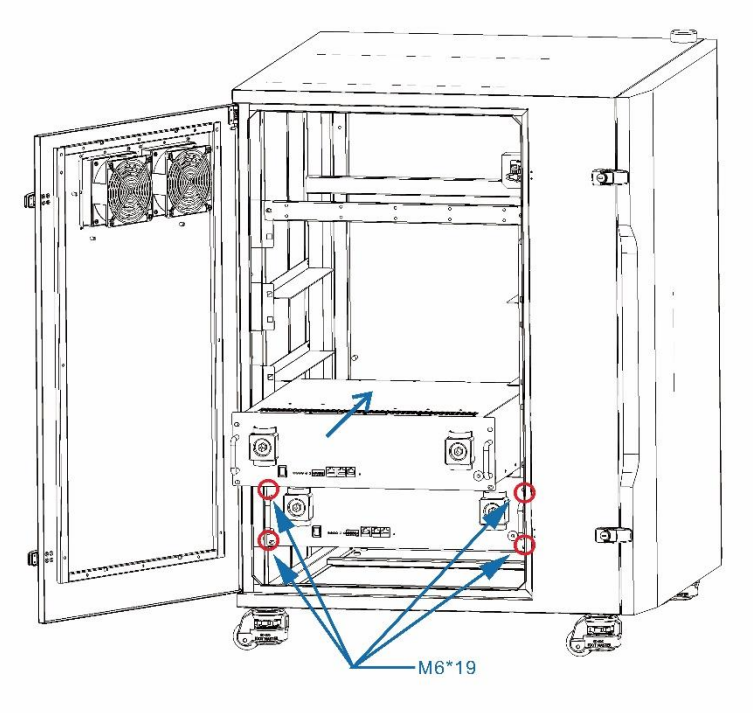
Table 6-1 Standard Setting

Model	Raython R5-II	Raython R8-II
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)	50	
Inverter		
Product Topology	Transformer based	
Nominal battery voltage (VDC)	48	
Input voltage range (VDC)	42~68	
AC output voltage (VAC)	220/230/240 ±2%	
AC output frequency (Hz)	50/60 ± 0.1%	
Harmonic distortion	<2%	
Load power factor	1.0	
Cont.output power at 25°°C (VA)	5000	8000
Max output power at 25°C (W)	5000	8000
Peak power (W)	10000	16000
Surge	300%	
Maximum efficiency	94%	95%
Zero load power (W)	22	32
Max AC charge current (A)	60	90
Transfer time	<4ms (<15ms in Weak AC source Mode>	<4ms (<15ms in Weak AC source Mode>
AC OUT1 Current (A)	50	50
Solar Charge Controller		
Max output current (A)	100(50 per tracker)	120(60 per tracker)
Maximum PV power (W)	4400+4400	5200+5200
PV open circuit voltage (V)	250	250
Maximum PV short circuit current (A)	40+40	40+40
MPPT voltage range (V)	65~245	65~245

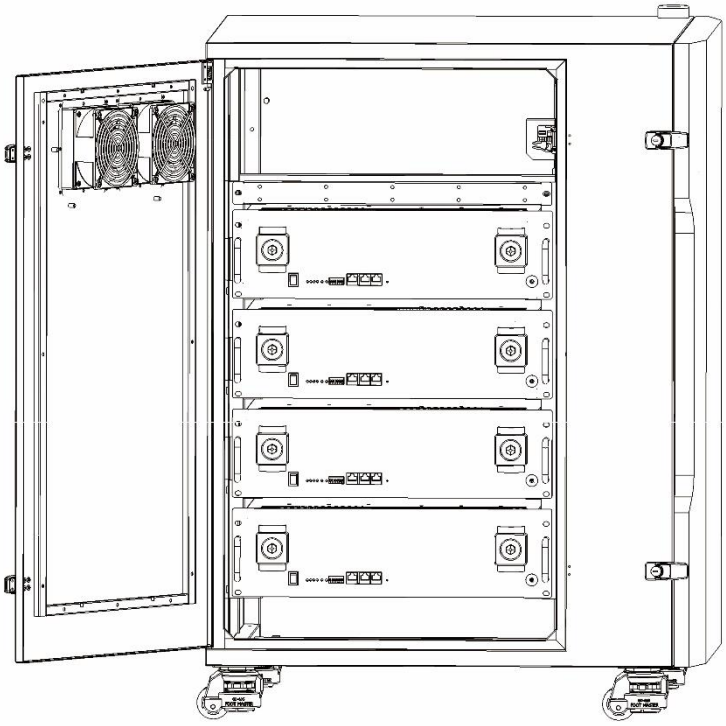
MPPT charger maximum effiency	98%	
MPPT efficiency	>99.5%	
Battery		
Battery type	Lithium	
Max AC charge current (A)	60	90
Max PV charge current (A)	100	120
Nominal energy capacity	10.08kWh/15.12kWh/20.16kWh	15.12kWh/20.16kWh
General data		
General purpose com. Port	Wi-Fi optional with E4 LCD monitor	
Operating temperature range	Inverter：-20˚C to 65˚C Battery：discharge -20˚C to 55˚C, charge 0℃ to 55℃	
Relative humidity in operation	95% without condensation	
Altitude (m)	2000	
Mechanical Data		
Dimension（W*D*H）(mm) (max)	790*750*1030	
Cooling	Forced fan	
Protection index	IP54	

Appendix 1: Battery Installation

Raython RP5&8-II can accommodate a maximum of four ES100II batteries. Align the battery with the guide rail bracket, slowly push the battery into the cabinet, and secure the battery using M6*19 screws delivered with the battery.



Attached Figure 1-1 Battery installation method



Attached Figure 1-2:Standard installation method

Appendix 2: Introduction to cabinet parallel connection

Raython series support parallel connection of two cabinets of the same type in single-phase parallel to expand the system capacity. Before conducting the parallel connection, it is necessary to purchase the accessories listed on the following table based on the actual need.

Attached Table 2-1: parallel accessories

Model	Parallel Connection Requirement	AC Distribution Box	DC Parallel Kit
Raython R5-II/R8-II	Two cabinets in parallel and single-phase	1*PDU-M2-3S	1*KIT-M1-2P

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