TBB POWER

Version: A1.1

All-In-One Standalone Solar Power System

USER MANUAL

Raython series

www. tbbrenewable. com

About **TBB Renewable**

One-stop Power Solution Provider

Found in 2007 with location in Xiamen city, TBB Renewable is specialized in providing off-grid, mini-grid and ESS solutions. With 16 years experience, TBB Renewable now is a global solution provider in the renewable market serving clients across more than 50 countries, committed to providing one-stop power solution, including power generation, power conversion, storage, system monitoring & cloud, system accessories. Integrated all-in-one system is also available for easier and quicker installation.

Increasing Installations and Comprehensive Service

Till now, more than 300,000 sets of TBB off grid system are operating stably all over the world, including commercial and residential applications. TBB Renewable also provides comprehensive service to its customers in order to achieve optimal satisfaction.

Innovative Supplier in Inverter Industry, Quality First

As a national recognized high-tech enterprise, TBB Renewable designs and manufactures its products at its own industrial park, supported by a strong R&D team with 100+ staffs. Combing the multiple modern technologies, TBB Renewable aims to supply innovative and green digital controlled system for various applications. TBB Renewable has obtained ISO9001 quality management system and more than 100 patents and copyrights, to ensure that performance and quality go hand-in-hand across the entire range.

International Green Energy Advocate

In collaboration with our partners and customers, we are helping people turn to a self-sufficient, decentralized and renewable energy supply.

Disclaimer

Unless specially agreed in writing, TBB Renewable(Xiamen) Co., Ltd

- Take no warranty as to the accuracy, sufficiency of suitability of any technical or other information provided in this manual or other documentation.
- Assumes no responsibility or liability for loss or damage, whether direct, indirect, consequential or incidental, which might arise out of the use of such information
- TBB offer standard warranty with its products, taking no responsibility for direct or indirect loss due to equipment failure.

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 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 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.

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1.0 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.

2.0 System Description

The Raython 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.

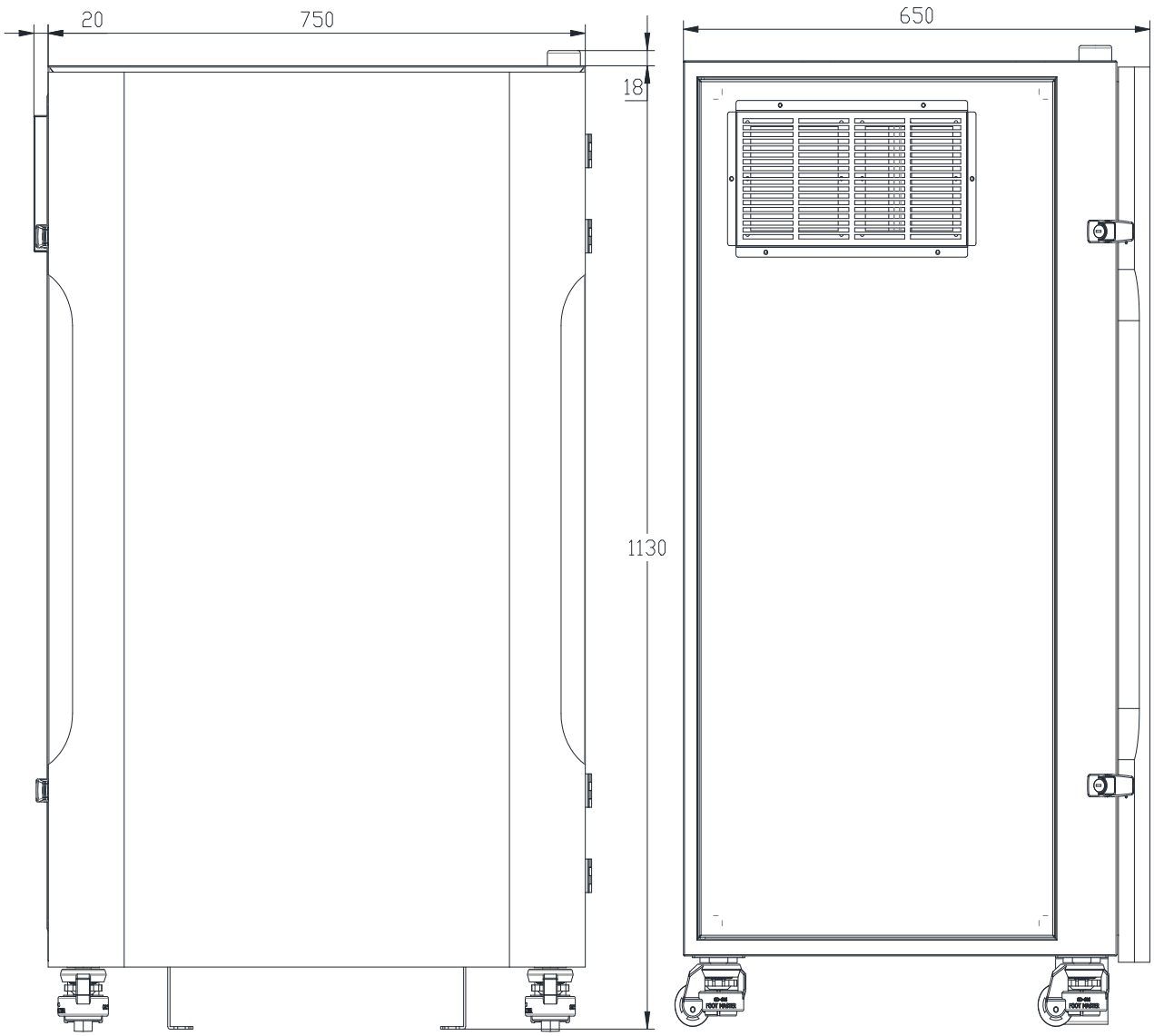
The Raython system is expertly assembled, tested and shipped as a complete system, integrating a solar hybrid inverter or an inverter charger coupled with an MPPT solar charge controller, lithium battery modules, wireless data logger, and AC and DC power distribution into one system. On arrival, Raython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

Our Raython Solar 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
- Leakage protect function on its AC output to ensure safety
- 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 Raython Cabinet Dimensions



2.2 Apollo Matrix Solar Hybrid Inverter

Apollo Matrix is the new generation solar hybrid inverter designed for various types of off-grid systems including the AC Couple system, DC Couple system, and generator hybrid system. It can provide UPS class switching speed and support parallel as well as composing three-phase system.

Apollo Matrix delivers high reliability, performance, and industry-leading efficiency for mission-critical application. Its distinguishing surge capability makes it capable to power most demanding appliances, such as air conditioner, water pump, washing machine, freezer, etc.

With the function of power assist & power control, it can be used to work with a limited AC source such as generator or limited grid. Apollo Matrix can automatically adjust its charging current to avoid the grid or generator being overloaded. In case of temporary peak power appears, it can work as the supplement source to the generator or grid.

For more information about Apollo Matrix, please refer to its manual.

2.3 Kinergier Pro Inverter Charger

Kinergier Pro is the new generation inverter charger designed for various type of off grid system including AC Coupled PV System, DC Coupled PV System and generator hybrid system. It can provide UPS class switching speed and capability to support parallel as well as composing three phase system.

Kinergier Pro delivers high reliability, performance and industry leading efficiency for mission critical application. Its distinguishing surge capability makes it capable to power most demanding appliances, such as air conditioner, water pump, washing machine, freezer etc.

With the function of power assist & power control, it can be used to work with a limited AC source such as generator or limited grid. Kinergier Pro can automatically adjust its charging current to avoid grid or generator to be overloaded. In case of temporary peak power appears, it can work as a supplement source to generator or grid

For more information about Kinergier Pro, please refer to its manual.

2.4 Solar Mate MPPT Charge Controller

SP is a solar charge controller with built-in Maximum Power Point Tracking (MPPT) technology, which can optimize the PV's output eliminate the fluctuation due to shading or temperatures variables. It tracks the maximum power point of a PV array to deliver the maximum charging current for battery, enabling PV array to increase the output by as much as 30% compared with PWM design.

SP is a multi-voltage MPPT with built-in sophisticated battery charging algorithm for various kinds of lead acid batteries, including AGM, GEL, Traction. Data management with a year of history record was offered as well. Meantime, version for Lead-Carbon battery and lithium ion battery were available upon request.

For more information about Solar Mate, please refer to its manual.

2.5 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-gird 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.

2.6 Kinergy Data Logging Stick

Available with GPRS and WIFI version, wireless data logger is an external communication device connected to the TBB inverter through DB9 interface. Through NOVA web or APP, it offers a convenient way to monitor the system performance remotely.

One Kinergy module can monitor up to 6 inverters, 6 Solar Mate MPPT solar charge controller and 2 IG PV inverter at the same time. It is widely applied with most inverter series of TBB Renewable, such as Kinergier Pro, Apollo Maxx, Apollo Matrix, RiiO and RiiO Sun.

For more information about Kinergy, please refer to its manual.

2.7 LS50/LS75 ESS unit

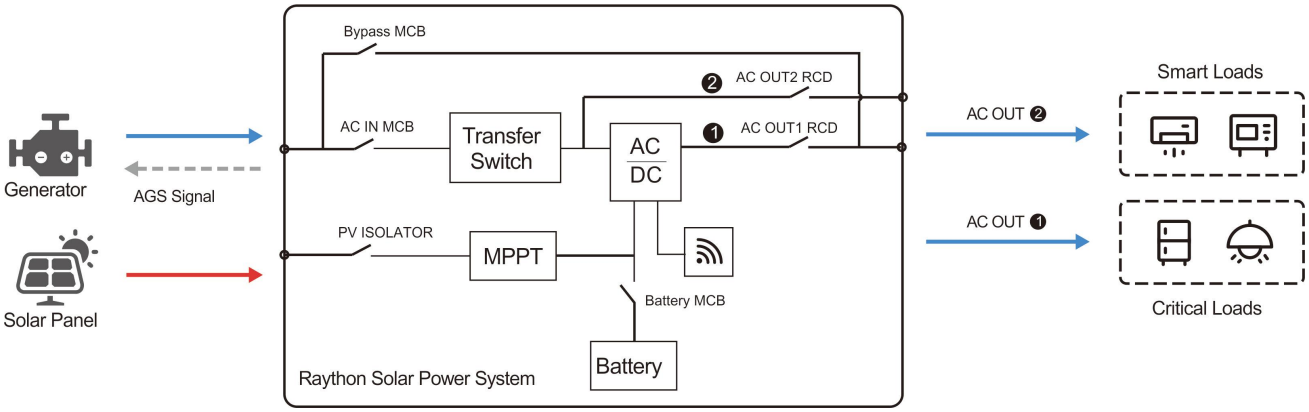
LS50 & LS75 lithium iron phosphate battery system is a standard battery system unit, customers can choose a certain number of LS50 & LS75 according to their needs, through parallel connection to form a larger capacity battery storage, to meet the user's long-term power supply needs. The product is especially suitable for applications under high operating temperatures, limited installation space, long power backup time and long service life.

2.8 ES100 ESS unit

ES100 is the latest 48V 105Ah lithium battery module provided by TBB Renewable, 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.

3.0 Functional Description

Raython is composed of Inverter, MPPT charge Controller, Kinergy, 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.



4.0 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 lifting techniques when lifting installing or 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

➢ Raython User manual

➢ Kinergy/E4 User manual

➢ Apollo Matrix User manual/Kinergier Pro User manual/Solar Mate User manual

4.2 Location

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

- Working temperature ： -20℃-60℃
- Storage temperature ： -40-70℃
- Relative Humidity ： 0%-95%，non-condensing
- Cooling ： Forced air

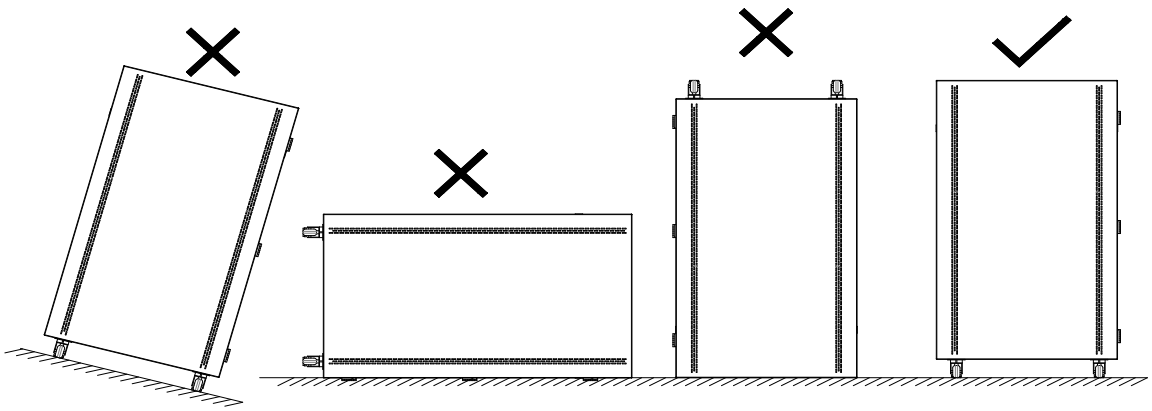
Keep it away from fire, high temperature, inflammable; explosive or corrosive material.

- 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 system.

4.3 Placement

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.



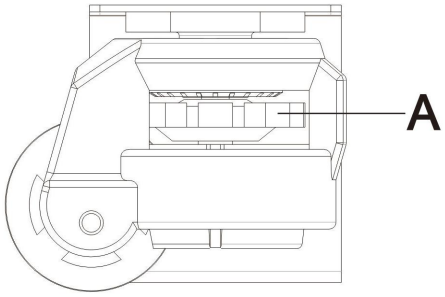
Following minimum clearance are requested for the installation.

Direction	Minimum Clearance
Front	1m
Back	0.3m
Left Side	0.3m
Right Side	1m
Top	0.3m

4.4 Fix the castor

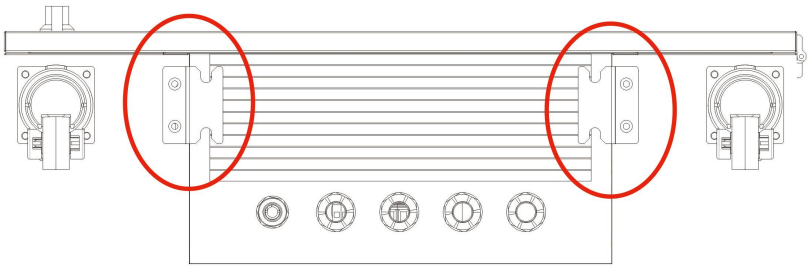
After installation and moving the system to the correct place, the castor should be fixed to avoid any further movement.

1> Clockwise rotating the nut A shown on the below picture with a spanner or other proper tool.



4.5 Fix the Cabinet

Fix the foot support to the bottom of the cabinet, and take a point at the screw hole of each foot support. Then drill a suitable hole, and put the expansion screws into the hole. Finally push the cabinet into the hole position, and fix the expansion screws.

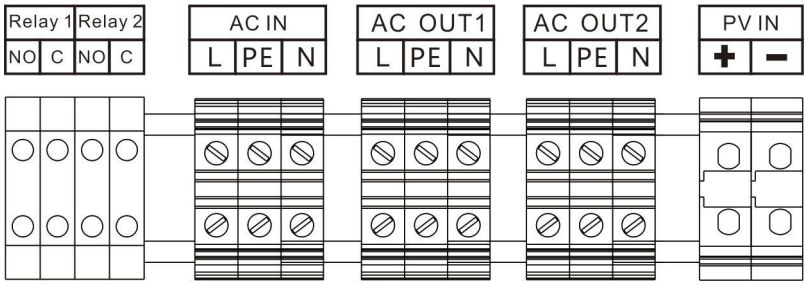


4.6 Wiring Recommendation

Please find the following minimum wire size. In case of DC cable longer than 1m, please increase the cross section of the cable to reduce the loss.

Item	Raython Model 1A		Raython Model 1		Raython Model 2	
	Cable Size	Circuit Breaker	Cable Size	Circuit Breaker	Cable Size	Circuit Breaker
AC input	6mm²	32A	10mm²	50A	10mm²	50A
AC output	6mm²	32A	10mm²	50A	10mm²	50A
PV input	10mm²	40A	16mm²	60A	25mm²	80A
AGS cable	1 mm²	-	1 mm²	-	1 mm²	-

4.7Connection Terminal Description



Item	Name	Description	Label	Comments
1	Relay1	Connect to generator start control port	NO	Normally Open
			C	Common
2	Relay2	Connect to generator start control port	NO	Normally Open
			C	Common
3	AC IN	Connect to the grid AC input	L	Line
			PE	Protecting Earthing
			N	Neural
4	AC OUT 1	General load without being protected by installed MCB	L	Line
			PE	Protecting Earthing
			N	Neural
5	AC OUT 2	General load without being protected by installed MCB	L	Line
			PE	Protecting Earthing
			N	Neural
6	PV IN	Loads controlled being protected by installed PV switch	+	Positive
			—	Negative

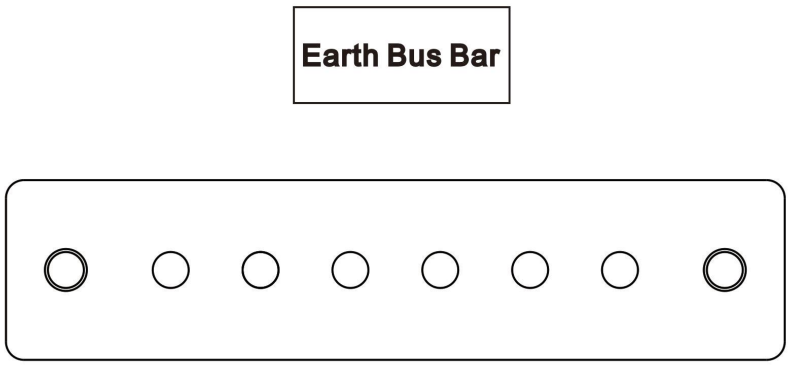
4.8 Wiring Instruction

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

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

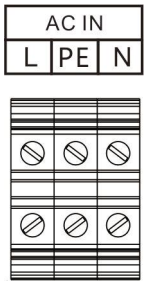
At the bottom of the enclosure, there is a ground terminal. See wiring area view. Please connect it with EARTH or vehicle chassis by a 6~10mm² green yellow wire (keep wire size same with AC input cable).



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 4.4), please connect the grid to the terminal labeled “AC IN”. Make sure the connection is correct and tightly screwed.

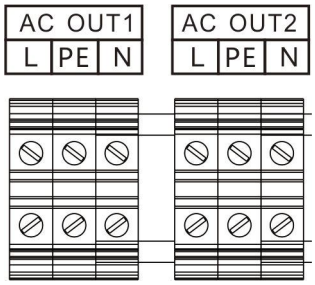


4.8.3 Connecting the Loads

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. The labeled terminal is supplied with protected MCB.

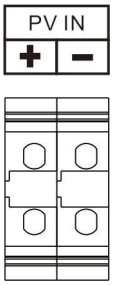
Using correct cable gauge (refer to chapter 4.4), please connect the load to the terminal labeled “AC OUT1”“ AC OUT2”. Make sure the connection is correct and tightly screwed.



4.8.4 Connecting PV in Cable

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

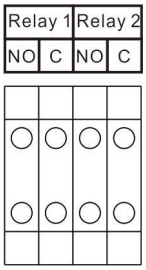
Using correct cable gauge (refer to chapter 4.4), please connect the PV to the terminal labeled “PV IN”. Ensure that the positive and negative poles are not reversed. Make sure the connection is correct and tightly screwed.



4.8.5 Connecting the AGS Terminal

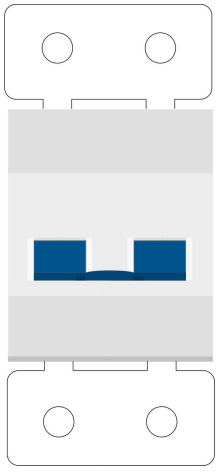
Two groups of AGS terminals are supplied with this RAYTHON system.

Using correct cable gauge (refer to chapter 4.4), please connect the load to the terminal labeled “Relay1”“Relay2”. Make sure the connection is correct and tightly screwed.

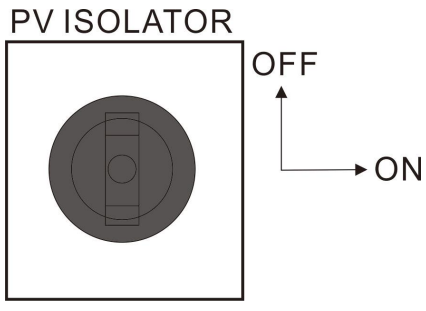


4.9 All Switches of the unit

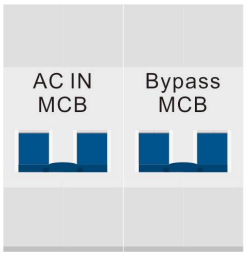
Battery Switch

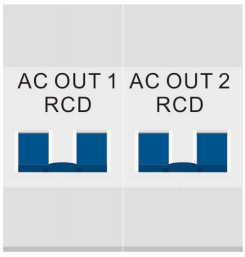


PV isolate Switch



AC MCB





5.0 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

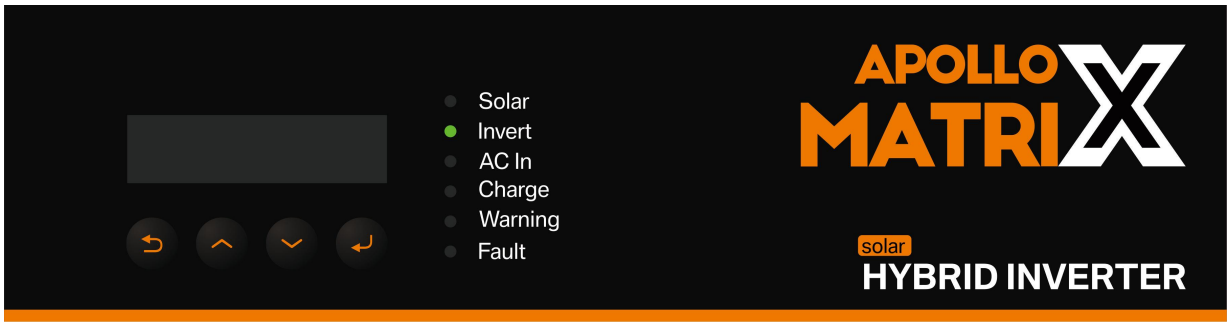
5.2 Switching on the Battery

- Make sure the battery voltage is within the permissible range before turning ON the breaker.
- Switch on all batteries；Press the On/Off button for 0.5 second to turn on the batteries
- Switch on battery switch

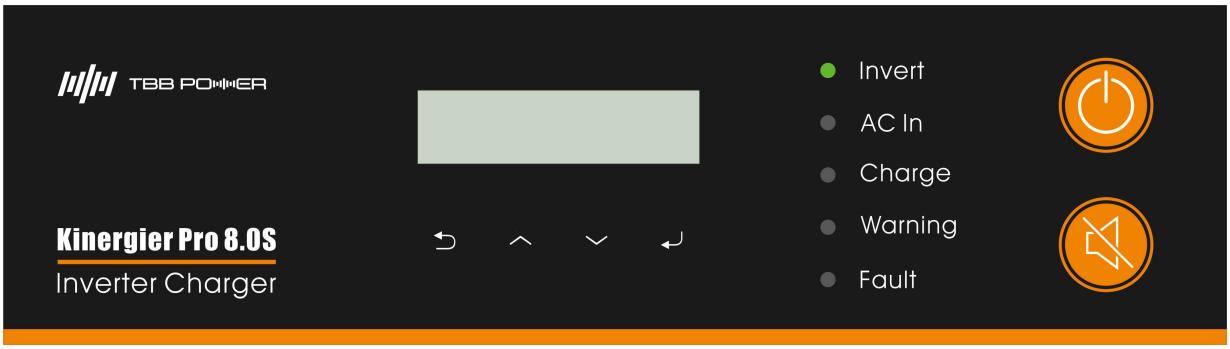
5.3 Switch on the Inverter

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.



Apollo Matrix interface



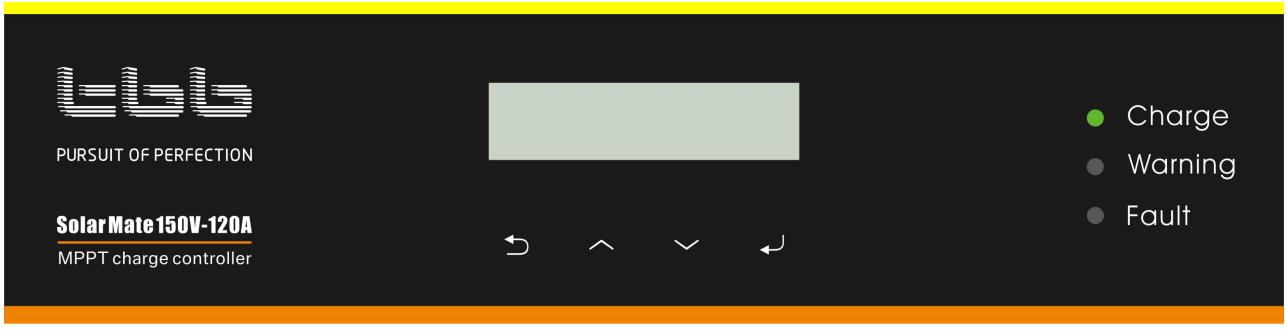
Kinergier Pro interface

5.4 Power on PV

➢ Close the PV IN Switch to power

➢ The MPPT Charge Controller will start to charge the battery.

Apollo Matrix interface



Solar Mate interface

5.5 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.

5.6 Bypass Switch Application

When the system fails to supply power, you can use this switch to supply power to the load from the grid or generator.

The power is only supplied to the load connected to the AC OUT1.

- Step 1: turn off the AC OUT1 and AC input break
- Step 2: turn off the battery switch and the PV in switch
- Step 3: Release the baffle switch and push the baffle switch to the AC OUT1 side
- Step 4: Close the Bypass switch

5.7 Connect to the NOVA Monitoring Platform

Please refer to the User Manual of Kinergy/E4 and Quick Installation Guide

more details, please visit www.tbbrenewable.com

6.0 Configuration

Standard Setting

Setting	Value
Rated AC Voltage	230VAC
Rated AC frequency	50Hz
AC in source Selection	Generator
Input frequency range	45-55Hz
Input voltage range	175-265VAC
AC Wave Harmonic Adaption	Weak AC Source
Battery Type	TBB Super-L
SOC Low Protect	10%
SOC Low Warning	20%
SOC charge Enough	80%
AC in Logic	AC in First mode
AC OUT2 Control	Power By AC in
Relay Control	AGS Function
GEN Start SOC	30%
GEN Stop SOC	80%
GEN load control	Disable
GEN Time Window	Disable
Relay 1 signal type	Level
Relay 2 signal type	Pulse

For more settings, please refer to its manual.

7.0 Specification

Model	Raython Model 1A	Raython Model 1	Raython Model 2
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)	3000	5000	6500
Max output power at 25°C (W)	3000	5000	8000
Peak power (W)	9000	15000	16000
Maximum efficiency	96%		
Zero load power (W)	17	21	26
Max AC charge current (A)	40	70	110
Main Output (AC Out1) Current (A)	32	50	50
Transfer time	<2ms (<15ms in Weak AC source Mode)		
PV in			
Max output current(A)	60	90	120
Maximum PV power(W)	4000	6000	9000
PV open circuit voltage (V)	150		
Maximum PV short circuit Current(A)	35	54	80
MPPT voltage range(VDC)	65~145		
MPPT charger maximum efficiency	98%		
MPPT efficiency	>99.5%	>99.5%	>99.9%
Battery			
Battery Type	LiFePO4 Li-ion battery		
Nominal Energy Capacity	10.08kWh-20.16kWh		

General data			
General purpose com. Port	GPRS/WIFI optional with Kinergy/E4		
Operating temperature range	Inverter：-20˚C to 65˚C/Battery：discharge -20˚C to 55˚C, charge 0-40℃		
Relative humidity in operation	95% without condensation		
Altitude (m)	2000		
Mechanical Data			
Dimension（W*D*H） (mm) (max)	750*650*1130		
Net Weight (kg) （without battery）	120	135	150
Cooling	Forced fan		
Protection index	IP54		
Standards			
Safety	EN-IEC 62477-1, EN-IEC 62109-1,EN-IEC 62109-2		EN-IEC 60950-1， EN-IEC 62109-2
EMC	EN61000-6-1, EN61000-6-2, EN61000-6-3, EN61000-3-11,EN61000-3-12		
Grid Code	NRS 097-2-1:2017		/

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