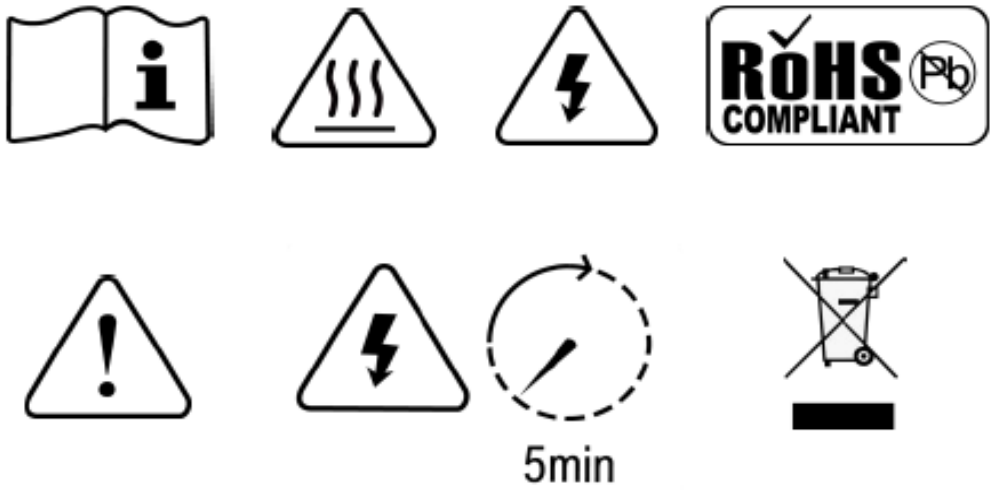
PURSUIT OF PERFECTION

eRay Pure Sine Wave Inverter Manual

IH SERIES INVERTER

A2.2

TBB POWER Co.,Ltd.
www.tbbpower.com



WARNING: HIGH VOLTAGE INSIDE

CAUTION: THE DC FUSE MUST HAVE BEENTURNED OFF BEFORE SERVICING

MADE IN CHINA

Disclaimer

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TBB offer standard warranty with its products, taking no responsibility for direct or indirect loss due to equipment failure.

About TBB

TBB Power is a dedicated designer and manufacturer of sophisticated and environmentally rugged power electronic equipment.

We are offering a wide range of power conversion product from battery charger, standalone inverter, inverter charger combination and solar charge controller.

We ensure consistent product quality by subjecting every product to strictly choice of superior quality components, rigorous testing and burn-in throughout the production process. TBB Power is certified by TUV in accordance with ISO9001 and can be your reliable power solution provider.

About this Manual

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

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1. General Safety Instruction

1.1 Safety Instruction

As dangerous voltages and high temperature exist within the eRay inverter, only qualified and authorized maintenance personnel are permitted to open and repair it.

This manual contains information concerning the installation and operation of the eRay inverter. 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 General Precaution

1) 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 INVERTER would be overheating.

2) 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.

3) Please do not put any inflammable goods near to inverter.

4) Never place unit directly above batteries, gases from a battery will corrode and damage inverter/charger.

5) Do not place battery over the inverter.

1.3 Precaution regarding battery operation

1) Use plenty of fresh water to clean in case battery acid contacts skin, clothing, or eyes and consult with doctor as soon as possible.

2) The battery may generate flammable gas during charging. NEVER smoke or allow a spark or flame in vicinity of a battery.

3) Do not put the metal tool on the battery, spark and short circuit might lead to explosion.

4) 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.

2. Introduction

eRay inverter could supply a steady pure sine wave AC to various load on board, such as coffee machine, microwave, hairdryer or sensitive electronics. It could bring home comfort and convenience for your life or work on board, either motor home or utility vehicle.

- Pure sine wave output
- High frequency design featuring compact and light weight
- 200% surge capability for 1s
- High efficiency up to 90%
- Low static consumption power
- Power save mode through dip switch
- Thermal control fan
- With built in USB charger, 5V/2A
- Output voltage and frequency settable by dip switch
- Complete protection with reverse polarity protection
  - DC input under/over voltage protection
  - Over temperature protection
  - Over load and short circuit protection
  - DC input reverse polarity protection by fuse
- Optional remote control available
- RS485 communication

3. Structure

3.1 Product drawing

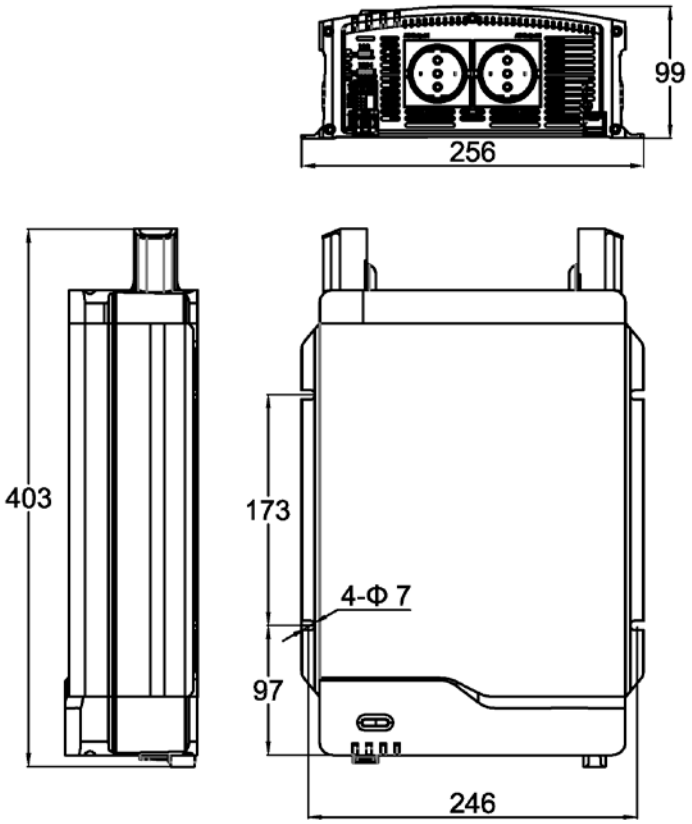


Figure 3-1 1500/2000W

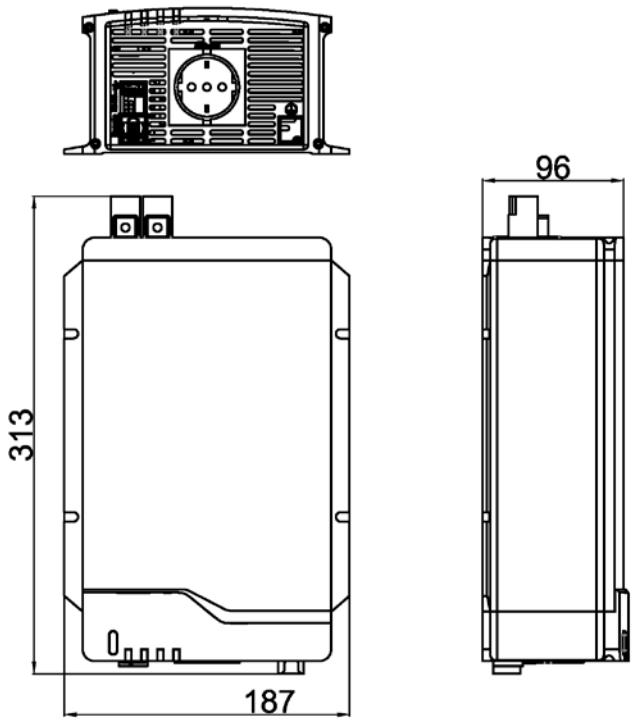


Figure 3-2 700/1000W

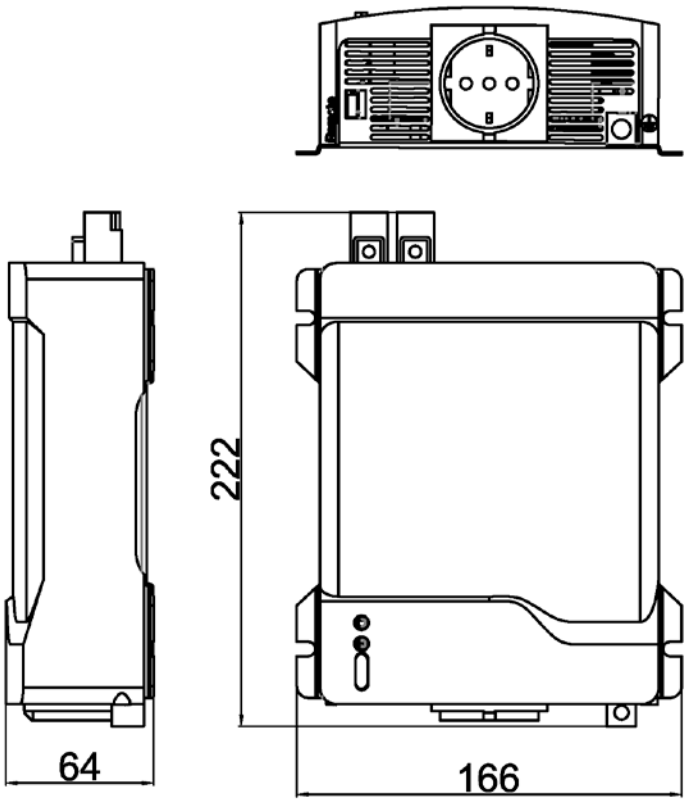


Figure 3-3 400W

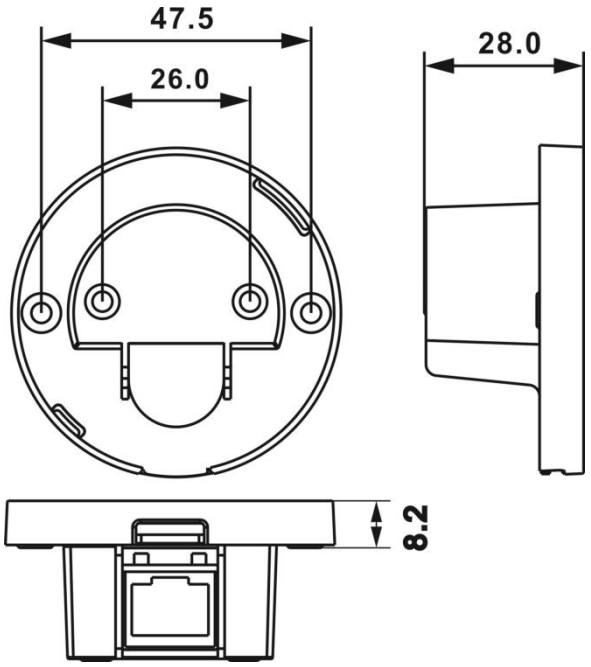


Figure 3-4 Optional remote control RIH

3.2 Control panel

➢ Rear panel

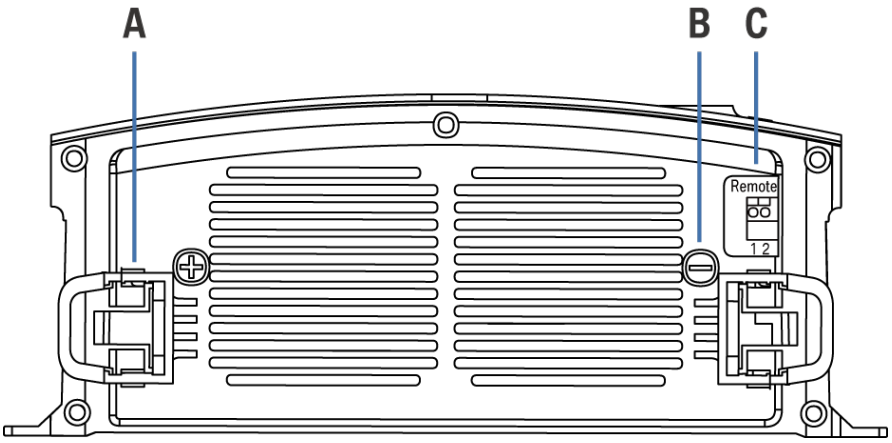


Figure 3-5 1500/2000W

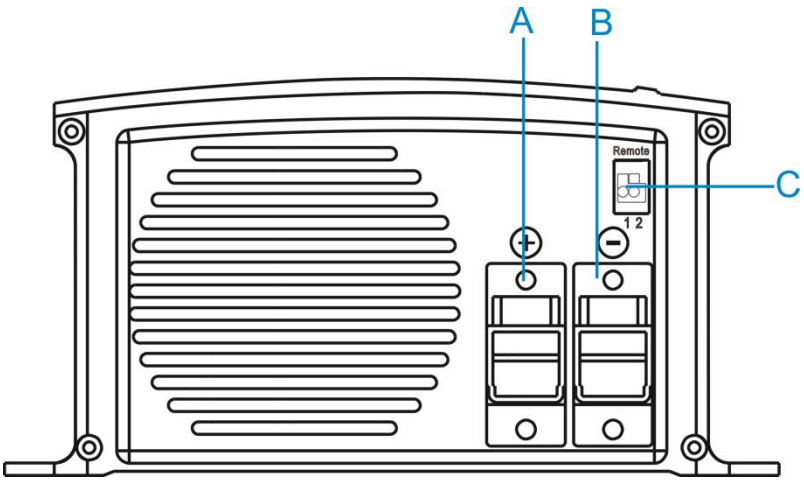


Figure 3-6 700/1000W

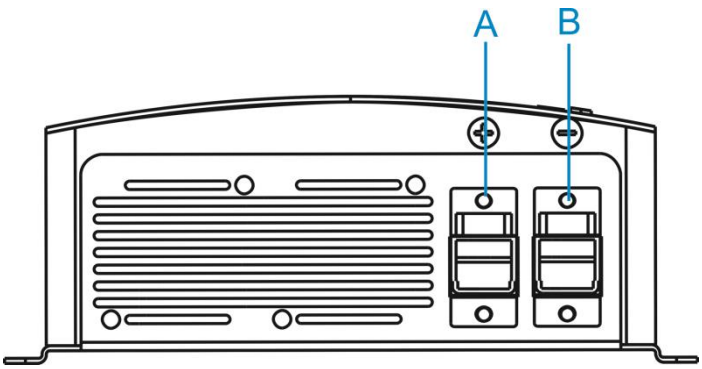


Figure 3-7 400W

➢ Front panel

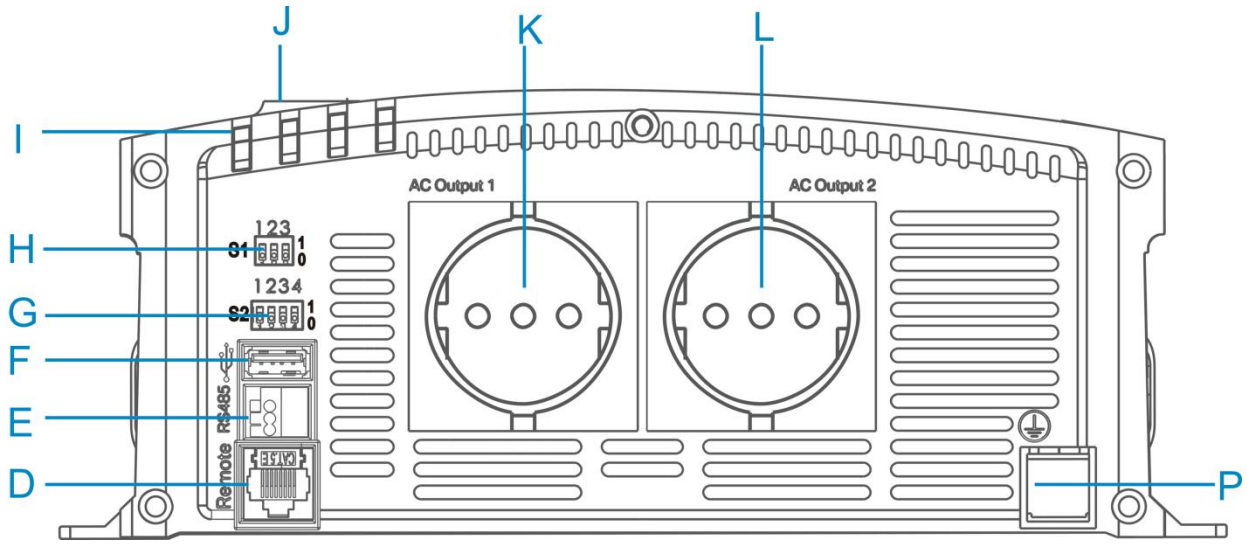


Figure 3-8 1500/2000W

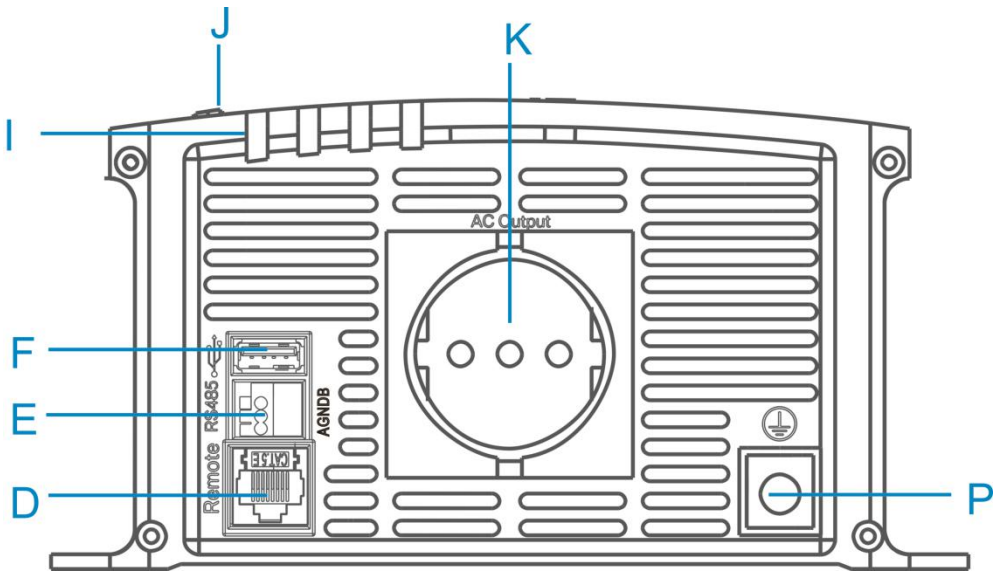


Figure 3-9 700/1000W

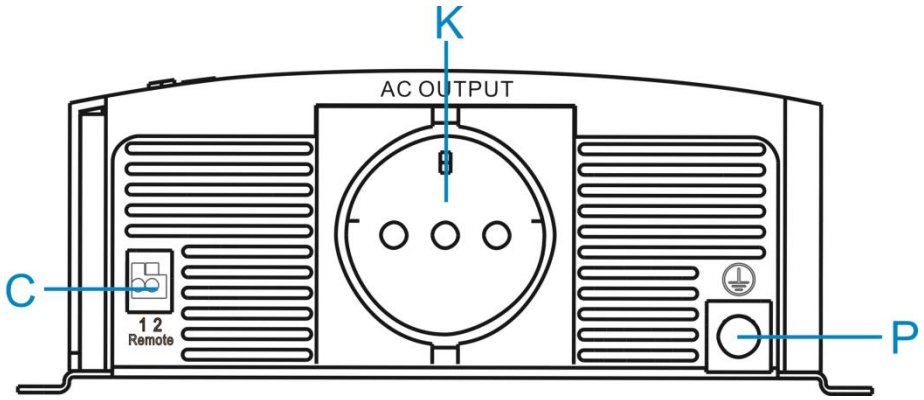
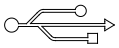


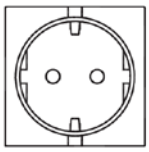
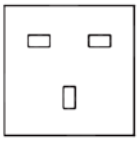
Figure 3-10 400W

Table 3-1 Port definitions

A	+	DC input +	H	S1	Dip switch for voltage and frequency setting
B	-	DC input -	I	LED	LED indicator
C	Remote	Dry contact input	J		ON/OFF
D	Remote	Reserved for remote control	K	AC Output 1	AC output socket
E	RS485	RS485 port	L	AC Output 2	AC output socket
F		USB charger	P		GND
G	S2	Dip switch for power saving mode			

3.3 Available sockets type

Table 3-2 Available sockets type

Socket type	Picture	Socket type	Picture
European type		Australian type	
UK type			

4. Configuration

The dip switch setting function is only available for 1500/2000W model.

Please do the correct configuration for voltage and frequency by dip switch S1 before installing the inverter. The default factory setting is 230VAC 50Hz.

Also the user can set the power saving mode by dip switch S2.The default factory setting of power saving is OFF.

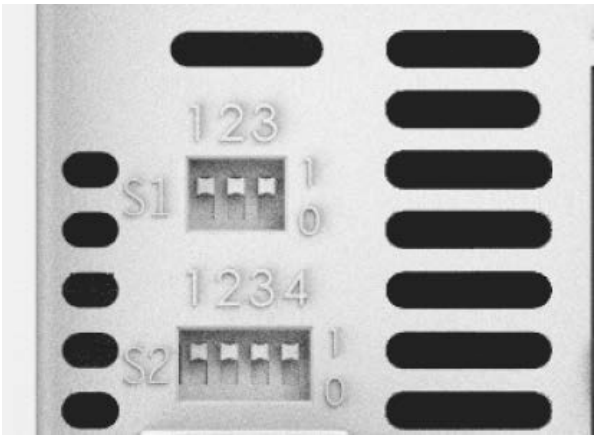


Figure 4-1 Dip switch

4.1 Set the AC output voltage and frequency

Please refer the below table for the dip switch setting.

Table 4-1 Dip switch setting

Frequency		**Output voltage**		
S1-1=0	50Hz	S1-2=0	S1-3=0	220VAC
S1-1=1	60Hz	S1-2=1	S1-3=0	230VAC
Kindly be noticed that the frequency setting only is affective after rebooting.		S1-2=0	S1-3=1	240VAC
		S1-2=1	S1-3=1	250VAC

4.2 Power saving setting

Power saving mode is enable by S2-1 Dip switch on the front panel. Please refer the below table.

Table 4-2 Enable setting

Dip switch status	Function
S2-1 = 0	Disable the power saving mode
S2-1 = 1	Enable the power saving mode

Power saving threshold setting value is adjustable by Dip switch S2-2/3/4. Please refer the below table

- When the load is less than the power-saving threshold setting value, the inverter automatically enters the power saving mode to reduce the static power consumption, thereby saving battery power.

- When the inverter is in power saving, the “inverter” indicator is flashing.

- During the period when the inverter is in power saving status, there is a discontinuous output every 6secs to detect the load status. Please adjust the threshold value if the loads are powered on shortly by the output.

- There is a small gap between the threshold of entering and exiting the power saving mode. That is to avoid the frequent switch when the load power is close to the threshold value because of the detecting deviation.

Table 4-3Threshold setting

Dip switch status			Enter threshold	Exit threshold
S2-2	S2-3	S2-4		
0	0	0	20W	25W
1	0	0	30W	35W
0	1	0	40W	45W
1	1	0	50W	55W
0	0	1	60W	65W
1	0	1	70W	75W
0	1	1	80W	85W
1	1	1	90W	95W

5. Installation

5.1 Material list

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

- eRay pure sine wave inverter
- User's manual
- DC terminal plastic cover (Black*1 and Red*1)

5.2 Location

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

- Working temperature:-20～40 ℃
- Storage temperature:-30-70 ℃
- Relative Humidity:10%-95%，non-condensing
- Cooling: Forced air

5.3 Wiring + Fuse recommendation

Please find the following minimum wire size. In case of DC cable longer than 3m, please increase the cross section of cable to reduce the loss.

We recommend connecting a DC fuse corresponding to the conductor between battery and inverter, which will offer protection to the battery cable. Please refer to following chart of our recommendations.

On the AC output side, we recommend connecting the output from the inverter to Circuit Breaker.

Model	DC Cable size		Fuse size	
	12VDC	24VDC	12VDC	24VDC
IH400	10mm²	6mm²	50A	30A
IH700	16mm²	10mm²	100A	60A
IH1000	25mm²	16mm²	160A	80A
IH1500	50mm²	25mm²	200A	125A
IH2000	50mm²	25mm²	250A	150A

5.4 Installation and Connection

For the user operation safety, cut off the power before installation

5.4.1 Fix the equipment

- Basically, eRay inverter could be installed either vertically on wall or horizontally on floor.
- Please choose a flat surface and with M6 to fix the unit securely
- In mobile application, please keep the vibration as small as possible

5.4.2 Connecting the cable

Please make sure the inverter is turned off before connection. Otherwise, high voltage could be present.

Please double check battery voltage match the model you are going to install, the wrong battery could destroy equipment and is out of warranty.

Please double confirm the polarity of DC input. Reverse polarity could cause permanent damage on equipment and it is out of warranty.

Please ensure that the protective grounding of the chassis is connected to the ground or the chassis of the vehicle when using this machine on the application platform of vehicles and ships.

➢ **Connecting to earth**

At the bottom of the enclosure, there is a ground terminal. Please connect it with EARTH or vehicle chassis via an 8# AWG wire.

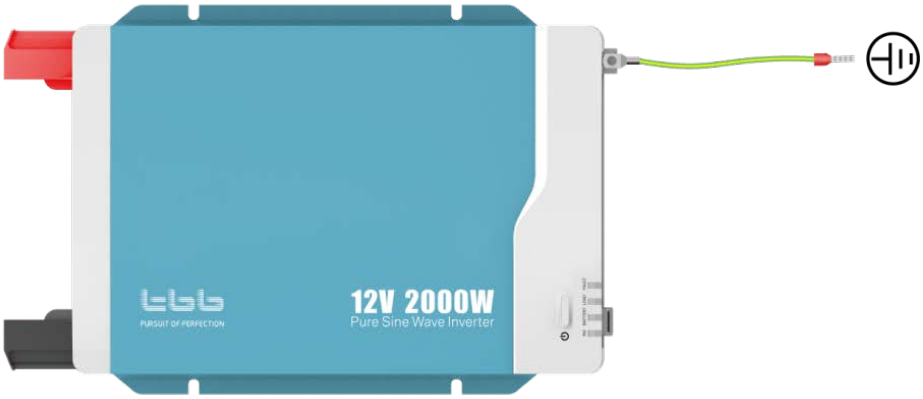


Figure 5-1 Connecting diagram of the ground terminal

➢ **Connecting to battery**

The installation of a fuse must be on a positive cable. Failure to place a fuse on positive cable between the inverter and battery may cause damage to the inverter and it is out of warranty.

Ensure all the battery cables are tight (torque to 12Nm). Loose connections may cause overheat and fire.

- Choose the right cable size (refer to 5.3 for details) and follow polarity guide marked on the panel.
- Pull the positive DC cable through the red plastic cover and negative DC cable through the black plastic cover.
- Insert the cables to the DC input terminals on the rear panel of the inverter. The red terminal is represents positive (+) and black terminal represents negative (-).
- Secure the DC cable on DC input + and DC input - terminals respectively making sure it is tightly screwed.
- Cover the red and black plastic caps on DC + and DC - terminals respectively.

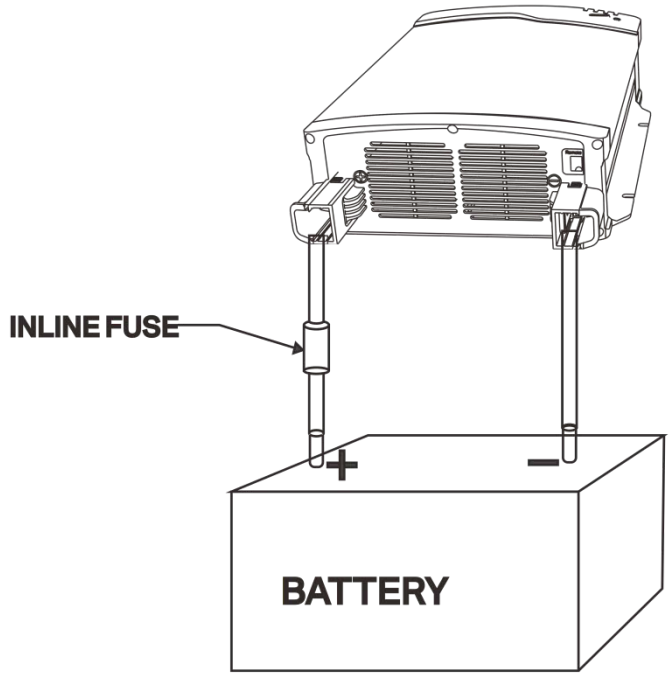


Figure 5-2 Connecting diagram of the battery cables

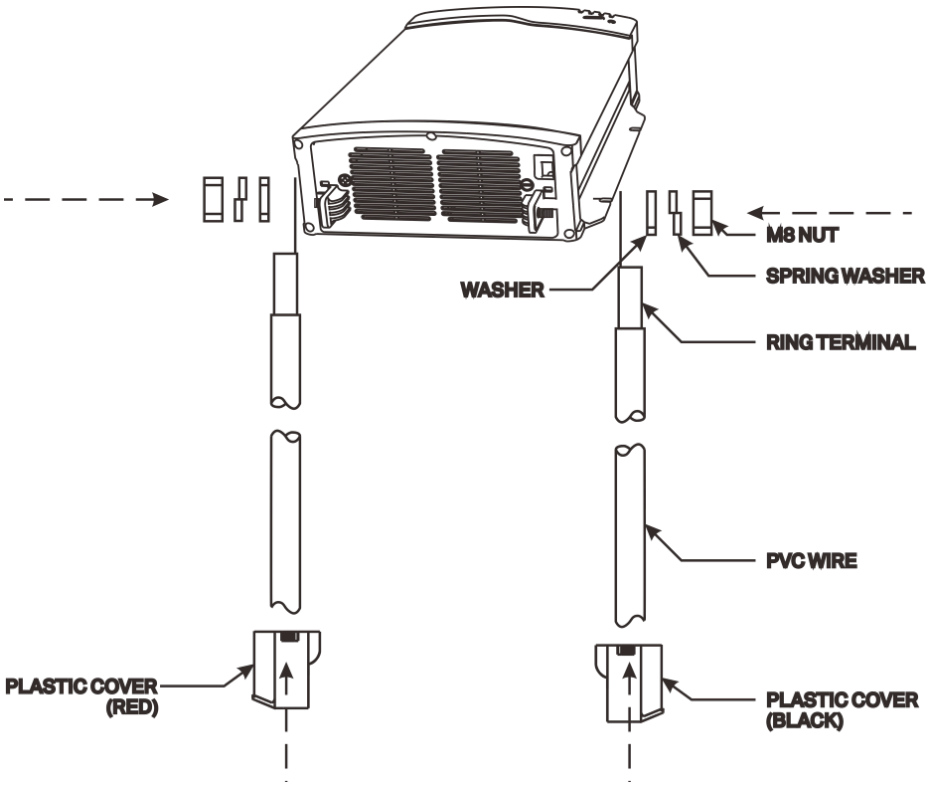


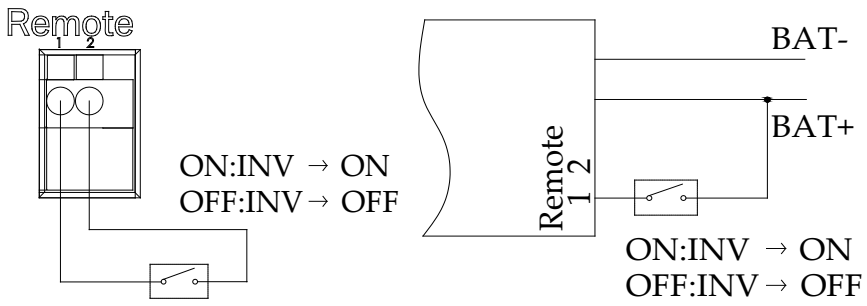
Figure 5-3 Connecting diagram of the DC input terminals

➢ **Connecting dry contact input**

1) You can use dry contact supplied to switch on/off the inverter through ignition.
2) At anytime, please use only one of them to control the inverter on/off, either main switch or dry contact.
3) Please find the following two recommended wiring for dry contact input

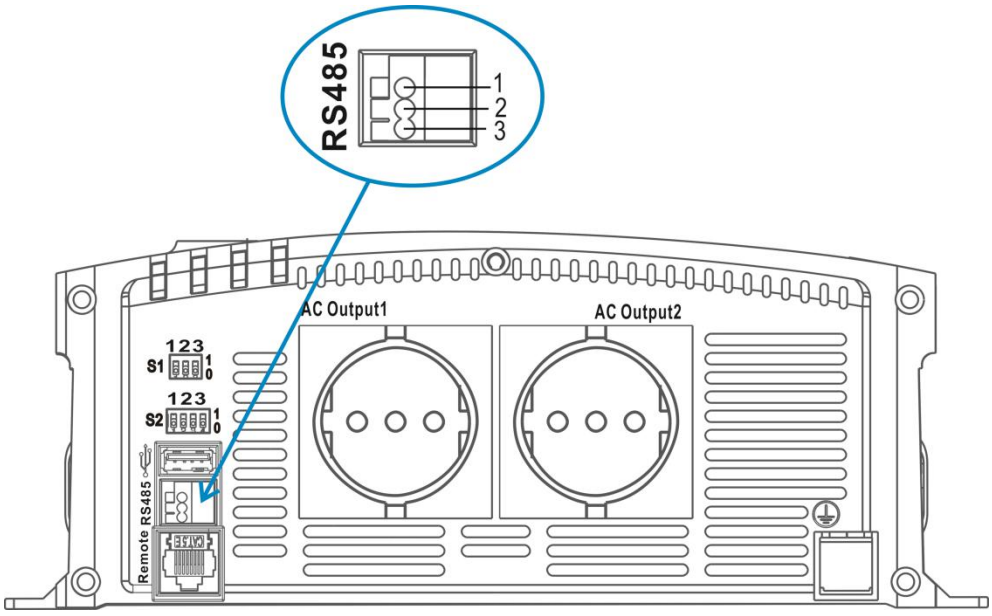
Item	Description
Remote –pin 1	
Remote- pin 2	BAT+

Notice：



➢ **Connecting RS485**

Serial port monitoring and control through computer interface.



Port	Definition
1	RS485 B-
2	GND
3	RS485 A+

6. Operation

6.1 Double Checking

- Check the DC input voltage of this inverter is same to your battery nominal voltage. NEVER try to connect different DC input to inverter.
- Inspect the right polarity of DC on service battery; otherwise the unit cannot be powered ON.
- Please check if you connect the Negative terminal of starter battery to the DC – terminal of inverter.
- Inspect AC output is correct; make sure unit is no short circuit.

6.2 Inverter operation

Press shortly the ON/OFF switch on the front panel to turn the inverter power on. After that the “INV” and “BATTERY” LED indicators are illuminated, and then the inverter is ready to deliver AC power to the loads.

The ON/OFF switch, dry contact input and optional remote control works independently. It means if you use one group switch to power on the inverter, you can only use the same group to power off.

6.3 LED indicator status

Figure 6-1 LED indicator of IH2000/IH1500

Figure 6-2 LED indicator of IH1000/IH700

Figure 6-3 LED indicator of IH400

Table 6-1 LED directive function

LED indicator	Description
INV/ INV OK	Indicates status of inverter
BATTERY/ Battery Level	Indicates battery level
LOAD/ Load Level	Indicates load level
FAULT	fault status

Table 6-2 LED indicator and audible alarm

LED name	LED color	LED status	Indication	Beep
INV/ INV OK	N/A	Extinguish	Inverter is off	/
	Green	ON	Normal	/
	Green	Flashing	Power saving mode	/
BATTERY/ Battery Level	Red	ON	<11.0V/<22.0V	Intermittent beep, once every sec
	Orange	ON	11.0~11.5V/22~23V	/
	Green	ON	11.5~15.0V/23~30V	/
	Orange	ON	15.0~15.5V/30~31V	/
	Red	ON	>15.5V/>31V	Intermittent beep, once every sec
LOAD/ Load Level	N/A	Extinguish	<20%	/
	Green	ON	20%~50%	/
	Orange	ON	50%~90%	/
	Red	ON	>90%	Intermittent beep, once every sec

7. Trouble shooting

Problem	(Possible) Cause	Solution
A buzzer sounds	The input voltage is becoming too high or too low.	Check the input voltage. Make sure that this value falls between specifications of the inverter. The inverter will re-start automatically when the input voltage is qualified again.
	Overload protection	Reduce the load power.
Redindicator ‘fault’ lights	Battery voltage too low or too high. The output is shut down.	Check the input voltage. Make sure that this value falls between specifications of the inverter. The inverter will re-start automatically when the input voltage is qualified again.
	Temperature protection	check if the fan is working and that the inverter has sufficient ventilation possibilities
		Inverter is located in a location with a high ambient temperature. Place the inverter in a cooler environment.
		- reduce the load.
Red indicator ‘fault’ blinks slowly	Output issue	There is a short-circuit or overload. Check the total load power and the connections. When the problem has been resolved, the inverter will restart automatically.
‘INV’ led ON, but the connected equipment does not work	Battery capacity too low to supply the requested power.	Connect a higher capacity battery (set).
	Weak connection between battery and inverter.	Check all connections and cables.

	The cables used are too thin.	Mount cables matching the length and capacity.
	The requested power is more than the inverter can deliver.	Check the consumption of the connected equipment. Make sure that this falls within the specifications of the inverter.
Inverter does not function at all. All LEDs are off.	No input voltage present.	Check the connections between battery and inverter.
	External fuses in battery cable defective.	Replace the fuses (only equivalent values)
	Input voltage below the minimal value.	Battery voltage too low or battery defective.
	Input voltage higher than the maximum value.	Check if the system-voltage matches with the inverter.
		Check the system on DC power supplies that give a too high voltage.
	Internal defect	When after checking the total system the inverter still doesn't work, it can be send back for repair.
Connected equipment gives disturbance.	'Ground' not connected	Connect the 'ground' connection of the inverter to the chassis of the vehicle or the minus.
	Cabling is against the housing of the inverter.	Make sure that the cables do not touch the housing of the inverter.

8. Specification

Model No.	IH400L/M	IH700L/M	IH1000L/M	IH1500L/M	IH2000L/M
Nominal voltage	12/24VDC				
Voltage range	10.5～16.0/21.0～32.0VDC				
Under-voltage protection（VDC）	10.5± 0.3/21.0± 0.6VDC				
Under-voltage recovery	12.6± 0.3/25.2± 0.6VDC				
Over-voltage protection	16.5± 0.5/33.0± 1.0VDC				
No load current	≤0.5A	≤1.0A	≤1.0A	≤1.1A	≤1.3A
Power saving mode	/	/	/	≤0.3A	
Current when power off	≤3mA				
Continuous output power	400W	700W	1000W	1500W	2000W
Maximum output power(1min)	440W±5%	770W±5%	1150W±5%	1600W±4%	2150W±2%
Output voltage	230VAC ± 5%				
Output frequency	50± 0.5Hz				
Output waveform	Pure sine wave				
Total harmonic distortion	<3% @ Nominal load				
Short circuit protection	<5s，auto-restart				
Efficiency (Max.)	90%				
Output voltage	/	5± 0.25VDC			
Maximum output current	/	2A			
Input protection	Over / under voltage protection, Reverse polarity (internal fuse)				
AC output protection	Over load，Short circuit				
Others	Over temperature				
AC output connector	Sockets				
DC output connector	/	USB socket			
Communication	/	RS485			
Cooling	Temperature and load controlled Fan				
Noise	<55dB				
Protection	IP20				
Dimension (mm) (max)	222*166*64	313*187*96		403*256*99	
Net weight (kg)	1.2	1.7	2.4	4.6	4.8
Safety	EN60950-1				
EMC	EN61000-6-1;EN61000-6-3;				
E-mark	E4-10R05-01-4418;E4-10R05-01-4419				
Operating Ambient Temperature	-20 ℃40 ℃				
Storage Temperature Range	-30 ℃70 ℃				
Storage humidity	10~95% RH				

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