HBI® Hybrid PV Inverter

JDA

HBI®

Installation & Operation Manual

Table of Contents

Safety Precautions

Refer to the Operating Manual
There are information of caution, operation and installation, please read and keep this manual.

Caution: Risk of Electric Shock
Alternating Current (AC) and Direct Current (DC) sources are connected to this device. To prevent risk of electric shock during maintenance or installation, please ensure that all AC and DC connections are disconnected.

Caution: Risk of Electr ic Shock
Energy is stored inside the device and components, even when converter is not operating. Wait for 10 minutes before opening it.

10 min.

Electric Shock on all Battery circuits
Danger voltage exists on all conductive wires and terminals of battery circuit. Please protect and prevent touching of them.

PV modules ONLY
PV (Solar Input) is designed for PV and solar power conversion only; do not use it for other DC sources and purpose.

Caution: Risk of Danger
If the Product is used in a manner that is not covered by the scope of warranty, the protection provided by the product may be impaired.

![JDA 日煬科技有限公司 JD Auspice Co., Ltd.]

Safety Precautions

⚠️	***Caution*** Must be installed by a competent person
⚠️	***Caution*** Do not stay permanently at a distance of less than 30 cm to this converter. Device generates electromagnetic radiation could be harmful in such a close range.
⚠️	***Do not Connect Generator in 0n-grid Mode*** In this mode, HBI inject power into AC mains, only grid can be connected to AC mains. If a generator is connected, the injection may cause damage of generator
⚠️	***Caution: Hot Surface*** Some metallic parts of enclosure may be hot during operation.
♻️	***Recycle*** Do not throw this electronic device into the trash when discarding. To minimize pollution to environment, please handle according to local regulations.

Contact Information

JDA 日煬科技有限公司 JD Auspice Co., Ltd

TEL : +886 2 25959780
FAX: +886 2 25959412
3F., No.288, Sec. 2, Zhonghua Rd., Xinzhuang Dist.,
New Taipei City 242, Taiwan R.O.C.
service@jdauspice.com
www.jdauspice.com

Warranty Information

Warranty or liability will be void if damage caused by any, but not limited to the followings:

1. Unauthorized opening of the unit
2. Installation faults such as improper environment, wiring and application
3. Working conditions beyond the unit specifications
4. Improper operation of the unit
5. Violation of safety instructions inside this manual
6. Damage during transportation
7. Any internal modification
8. Replacing or installation of unauthorized software
9. Unforeseen calamity or force majeure

HBI® Hybrid PV System
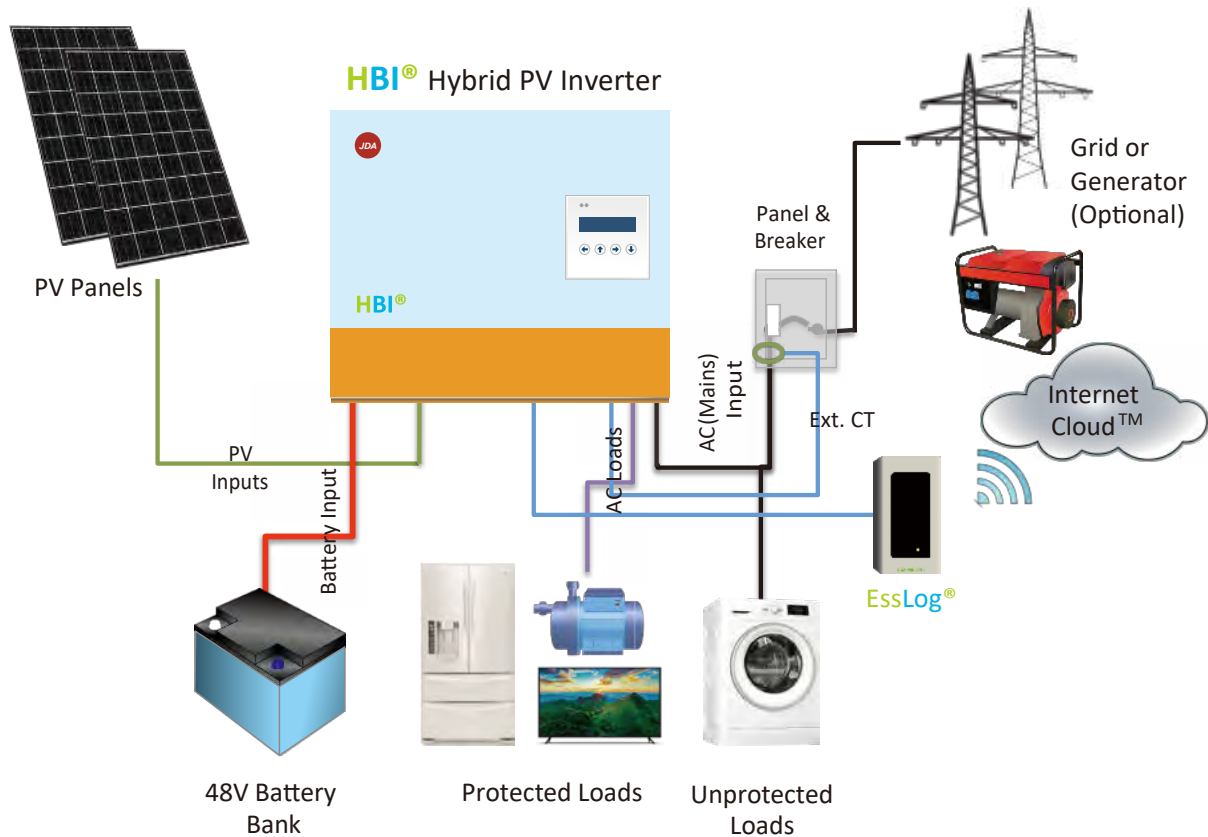
Glossary

1. **HBI®** Hybrid PV Inverter (**HBI®**): Manager of PV inputs, charging, discharging and load supplying functions
2. PV panels: Receive sunlight and convert it into electricity
3. Battery Bank: Stores energy from mains and PV inputs
4. Protected Loads: Appliances & devices take AC power from **HBI®**, especially in blackout
5. Unprotected Loads: Loads supplied by grid or generator (mains) directly. In case no AC from grid or generator, unprotected loads are not powered any more. Usually, loads larger than **HBI®** rating power should be connected here
6. Grid: Public AC utility
7. Ext. CT: Sensor for detecting power from utility
8. **EssLog®**: The data gateway for transmitting inverter data to Cloud server

Principles of Operation

Functions

The **HBI**® PV inverter is an intelligent and automatic power manager of a PV storage system, it is

On-grid Power Manager

In places with grid (utility), **HBI**® can manage the power from PV, grid and battery. For protected loads connected to **HBI**®, during blackout, **HBI**® can supply power to them from PV and/or batteries.

Off-grid Power Supply

In places without grid, protected loads will be powered by the **HBI**®. The power may come from PV panels and/or batteries. In case a generator is connected, whenever power from PV and batteries are not enough, **HBI**® switches loads to generator directly.

Charge/Discharge Controller

While there is surplus PV power, **HBI**® will direct it to battery; while PV power is not enough, **HBI**® will supply loads from batteries.

In case you have enabled charging battery from mains, **HBI**® will charge battery from mains whenever there is no PV power.

UPS

In case AC main is absent, inverter can supply "protected loads" from PV and/or batteries.

> ⚠️ **Use on-line UPS for very critical load**
> The time of recover power after blackout is 4mS. It is short enough for most of equipment's. For very critical devices, please use a on-line UPS between inverter and devices.

Working with Grid

There are varieties of connections to work with grid; the differences are the connections of inverter output and loads.

Off- grid mode

The loads get power EITHER from Mains (Grid or Generator) or inverter output. Normally, **HBI**® provides power to loads, in abnormal conditions such as failure, overload or fully discharging; the loads will be switched to Mains directly.
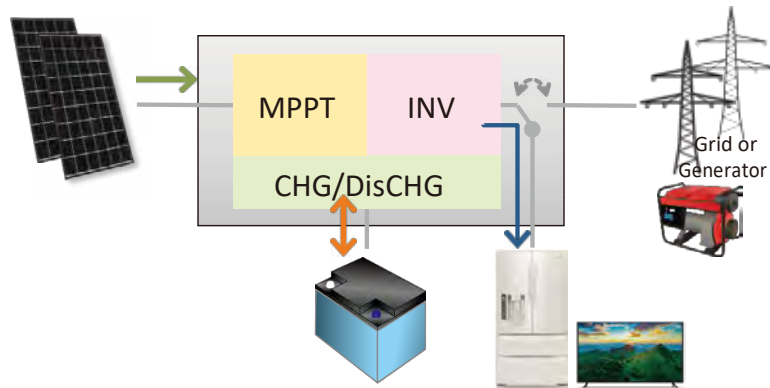
This application is suitable for

1. No utility
2. With utility, but user DO NOT want to use utility or use utility as a backup source

In this mode, inverter output is physically separated from grid; there will be no way to feed power to grid.

On-grid mode- Net Metering

Inverter is physically connected to grid (Mains). The power to loads is managed to be:

1. From **HBI®** only: In case the power from solar is enough, **HBI®** converts PV power to loads. In addition, surplus PV power is fed to grid
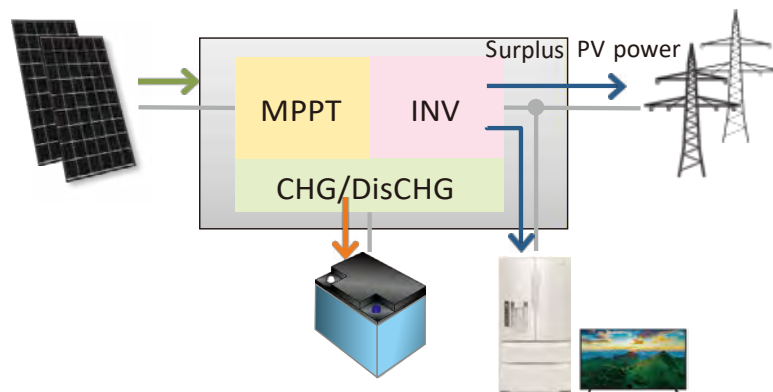
2. From both **HBI®** and grid: While the power from PV is not enough, **HBI®** and grid share the power to loads
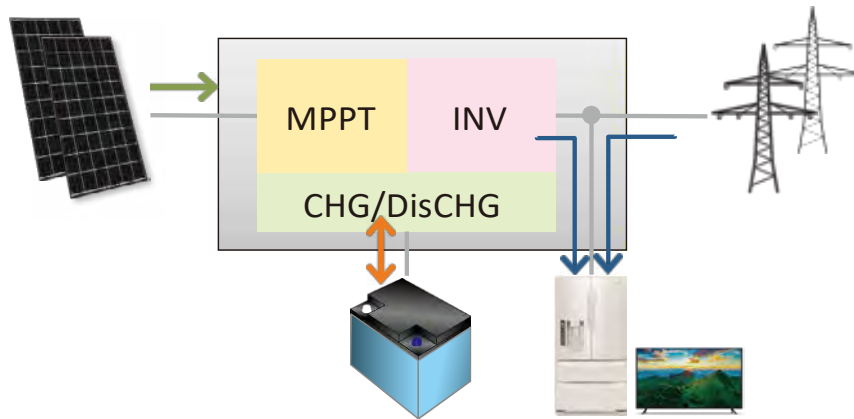
This application is suitable for Surplus PV power is allowed to feed to grid.

On-grid mode- Self Using

In some applications, surplus power feeding is not encouraged or allowed; PV power is used by their own. This is "Self Using". The operation principles are the same as "Net Metering" except that surplus power is not fed to outside inverter or external CT.

1. No external CT: The surplus PV will not flow outside the inverter AC mains
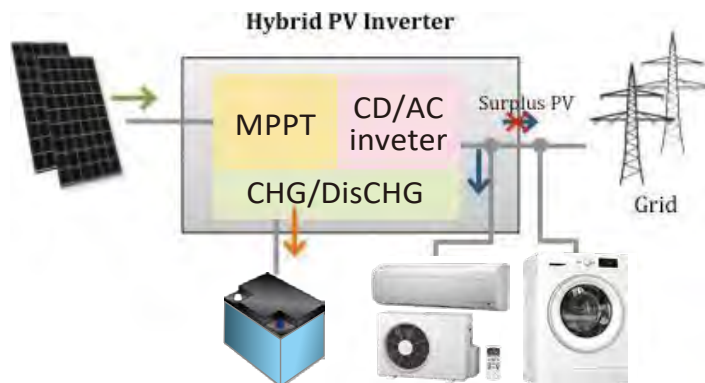
2. With external CT: The surplus PV will not flow outside external CT
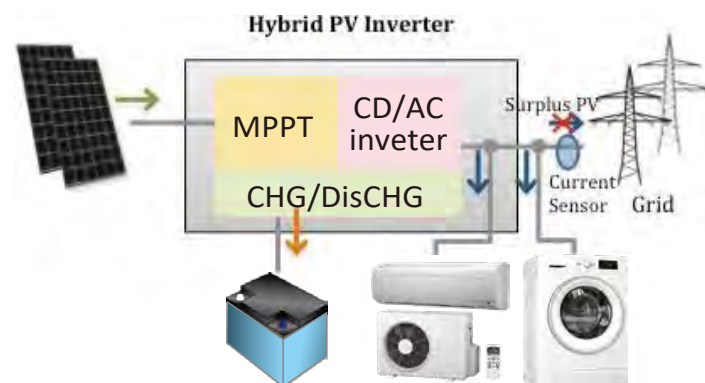
This application is suitable for PV power can be fed to grid but not paid.

> ⚠️ **Do not Connect Generator in 0n-grid Mode**
> In this mode, HBI inject power into AC mains, only grid can be connected to AC mains. If a generator is connected, the injection may cause damage of generator

Compensating Loads from Batteries

This **HBI®** can use energy in batteries to compensate power from mains. This will minimize the power demand from your grid supplier.
Once enabled, there are 2 ways:

1. No external CT: Inverter will take battery power to compensate the power demands of "Protected Loads" or devices connected to "AC Loads".
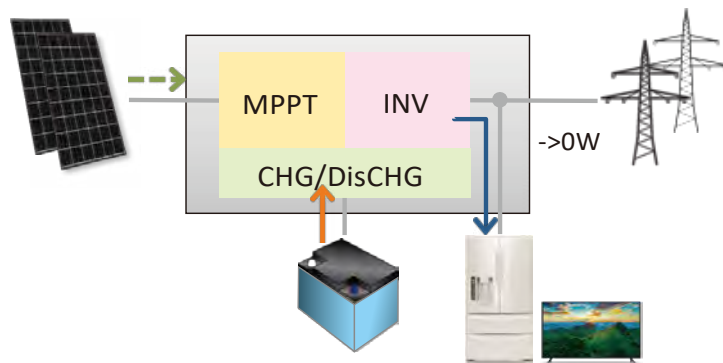
2. With external CT: Inverter will take battery power to compensate the power demand of loads inside the power network
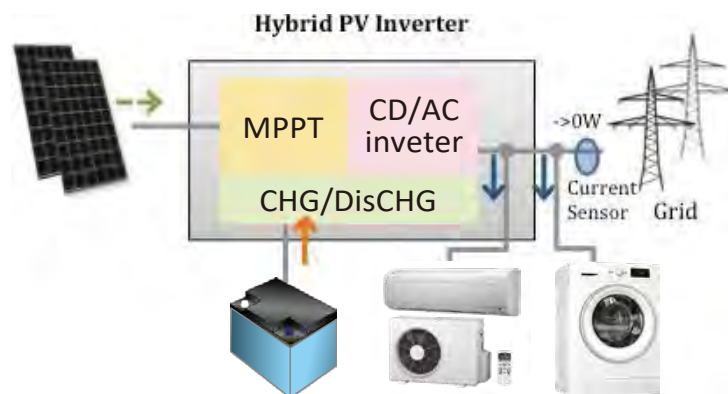
To do this, please enable the "BAT-> Load" function is settings menu.

> **BAT**
> For some areas, it is not allowed to feed battery power to/with grid. Please understand your local \ regulation before enable this function.

Power Priority[1]

To Loads

The power supplied to loads from different sources follows the priorities. In off-grid mode, it is

<p style="text-align:center">PV -> Battery -> Mains (AC)</p>

In on-grid mode, it is

<p style="text-align:center">PV -> Mains (AC) -> Battery</p>

If Battery -> Load function is enabled, it is

<p style="text-align:center">PV -> Battery -> Mains (AC)</p>

To Battery (Charging)

The power charged to batteries from different sources follows the priorities:

Operation without Battery

HBI® can also work without battery due to our special design. HPI can still provide power to protected loads even in blackouts, from PV panels. However, there are some points you need to know:

1. The power to is not stable due to unstable PV
2. **HBI**® can not store surplus PV to battery
3. **HBI**® can not compensate load power

> **Devices may be damaged**
> For some devices, unstable power may damage them. We can not guarantee the operations of your devices.

---

[1] Some customized models may apply different priority, contact your installer to get more information.

Product Overview

Outline & Dimensions

Status LED

Display LCD

Operation Keys

425

388

120

JDA

HBI®

CAN BUS port (for multiple units operation)

Manual on/off Switch

RS485 port

BAT+ BAT-

PV+

PV-

AC LOAD

AC MAINS

FUSE 30A/250V

Battery Input (+) (-)

PV input

USB port

AC Load

AC Mains
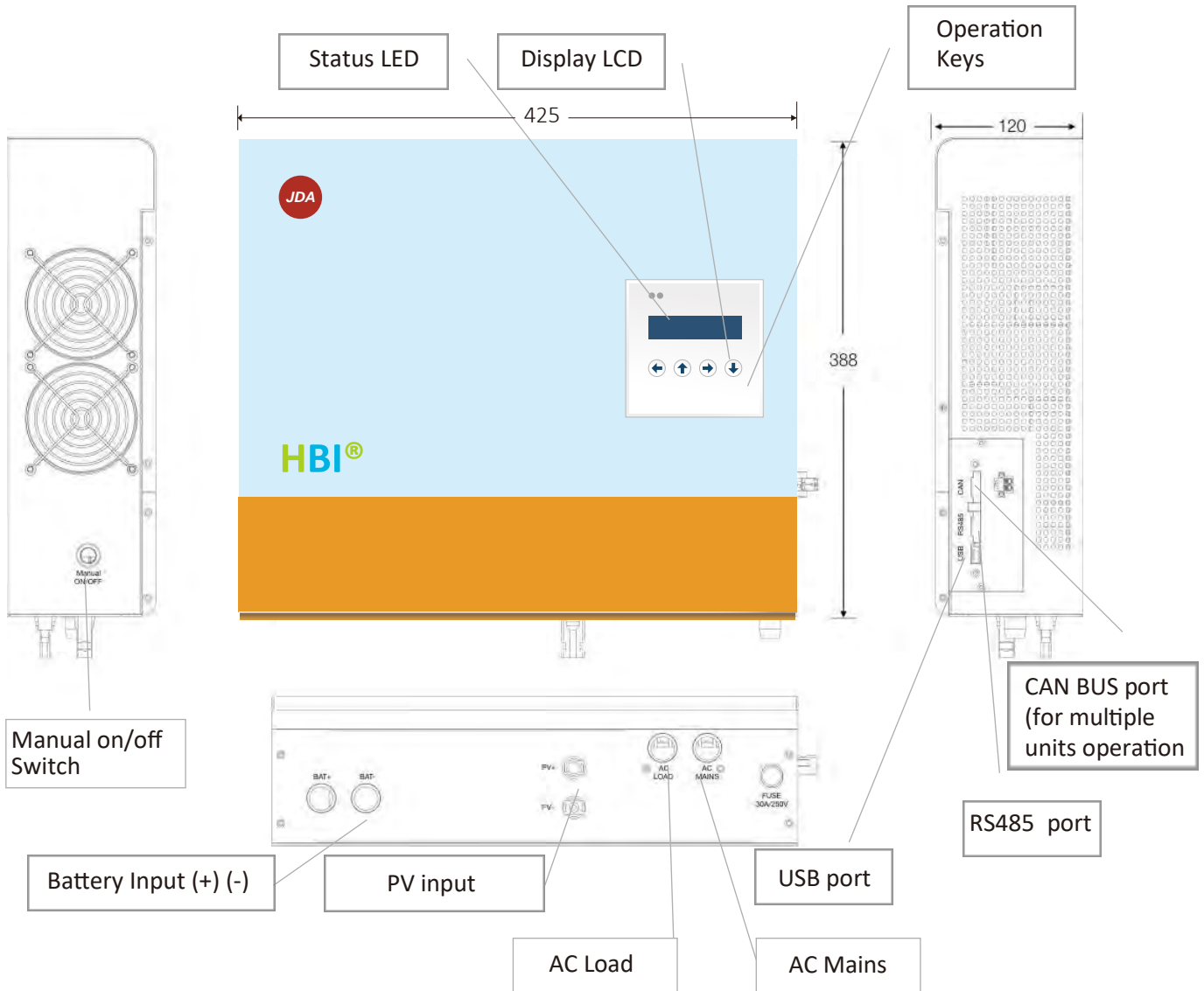
Installation

Inside the Package
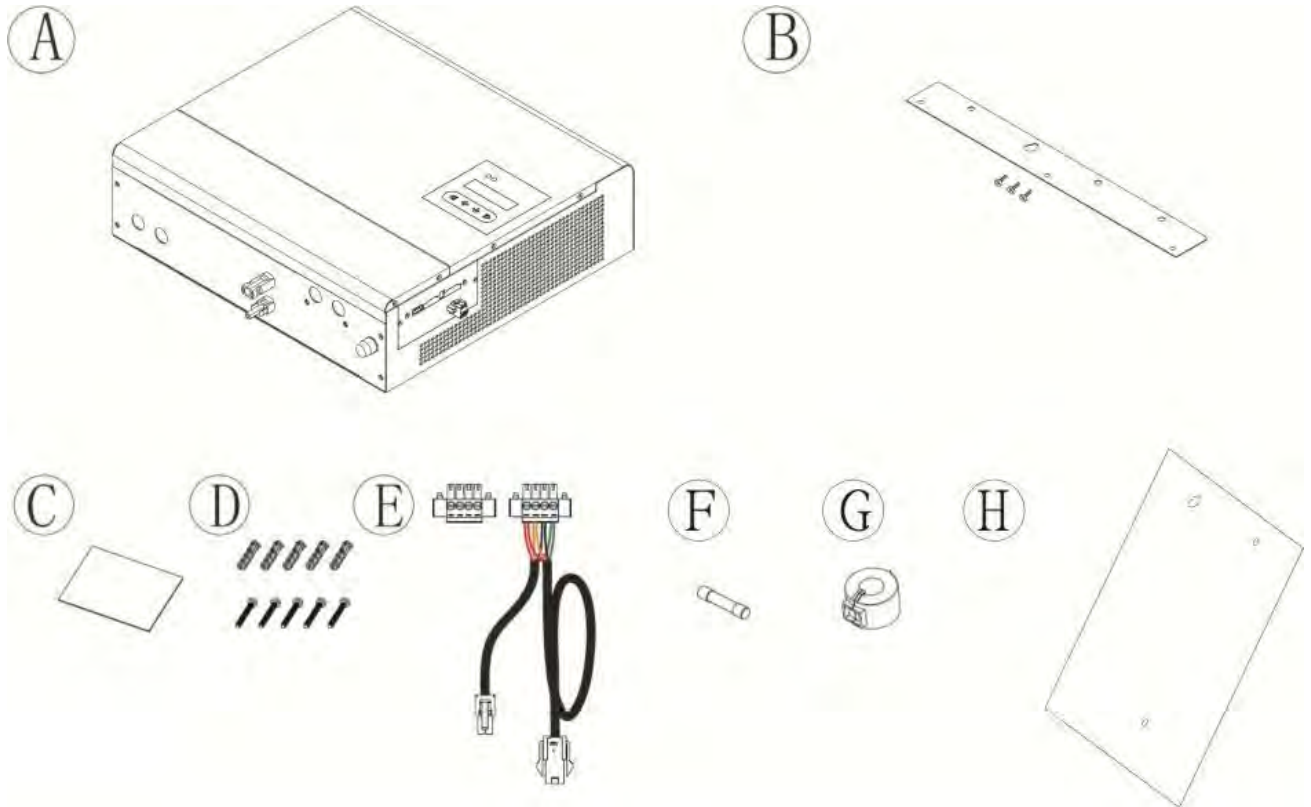
Item	Description
A	Inverter
B	Mounting bracket & screws
C	User manual
D	Plastic anchor & screws x 5,used to fix bracket on wall
E	RS485 connector/plug & CANbus connection cable
F	Spared AC Fuse x 1 (30A/250V)
G	Bead for RS485 cable
H	Template for mounting

Choosing Proper Location

Do not expose the **HBI**® to sunlight, rain or water.

Sunlight

Rain or Water
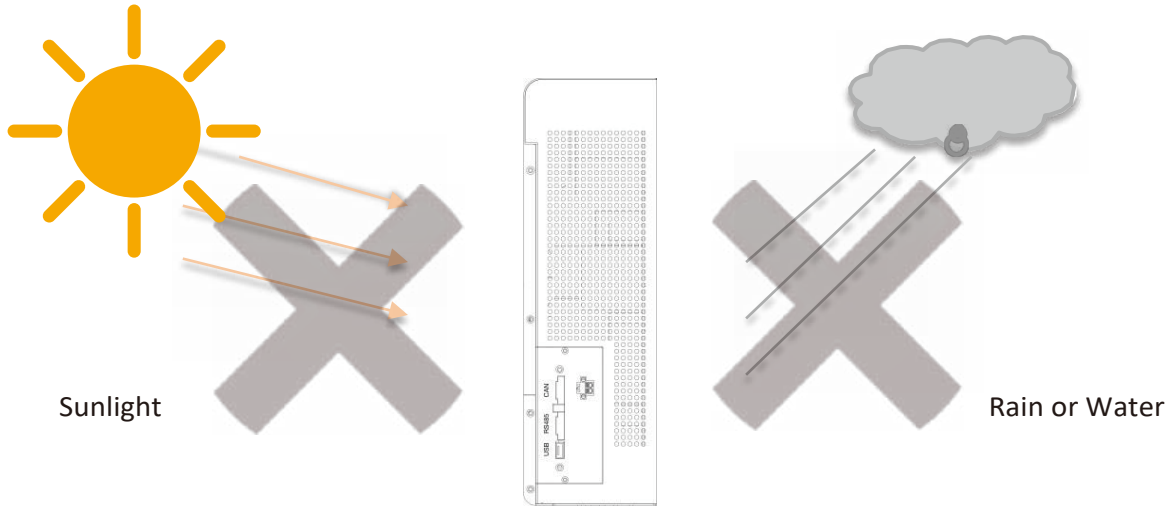
Install **HBI**® at visible level so you can see its status.
Fix **HBI**® on a solid, surface.

Visible level
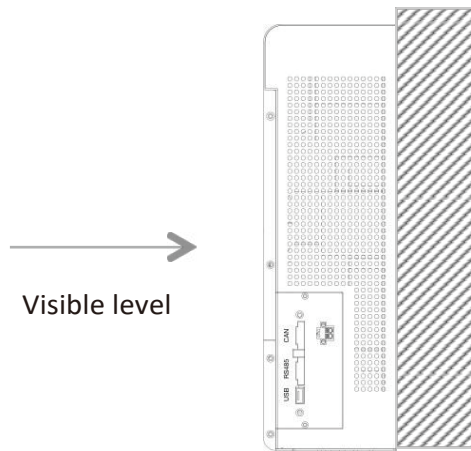
Mounting surface	
Concrete	OK
Metal	OK
Stone	OK
Wood	Not Recommended

Keeping Clearance

Reserve at least 50 cm distance between **HBI**®.
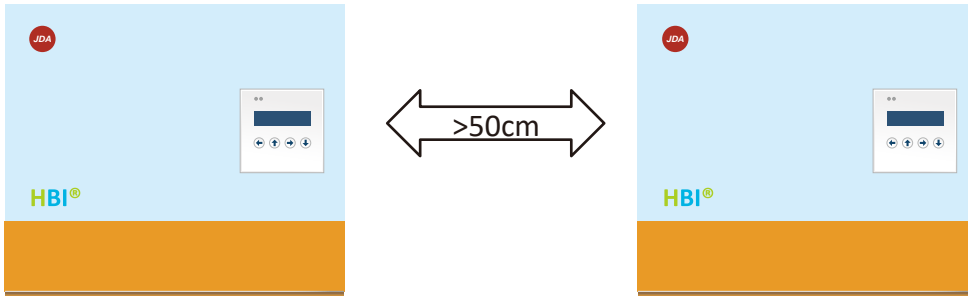
Keep distance for the airflow to dissipate heat.

Airflow

>20cm
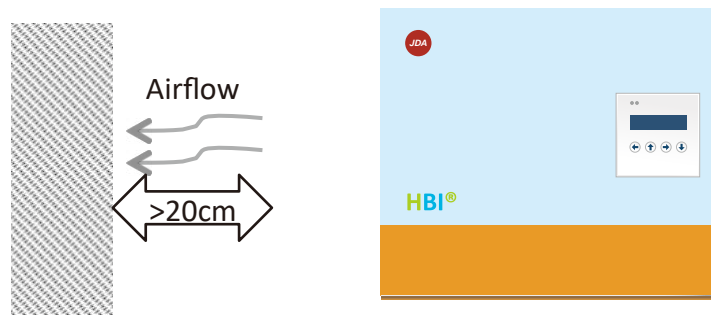
Mounting Procedure

1   2   3
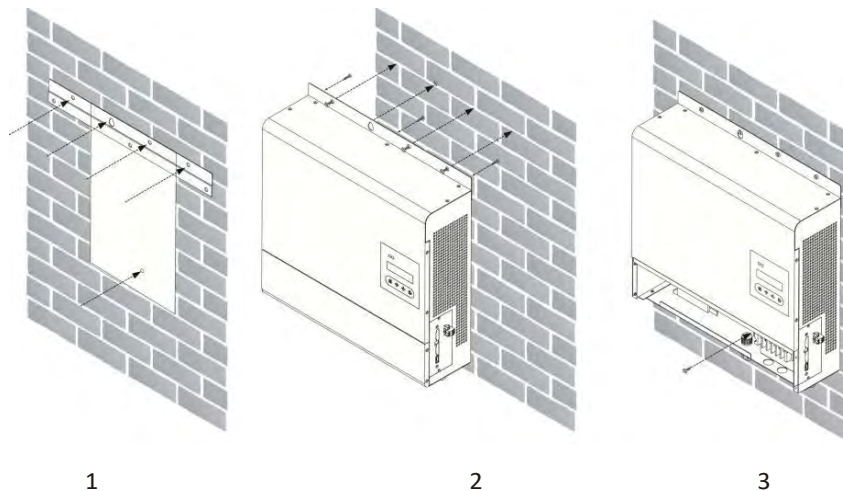
1. Marking drill holes by bracket and template
2. Fix the bracket on inverter, attach and fix inverter on wall
3. Take the wiring cover off and fix the inverter by screws

16

Wire Connections

Typical System Diagram
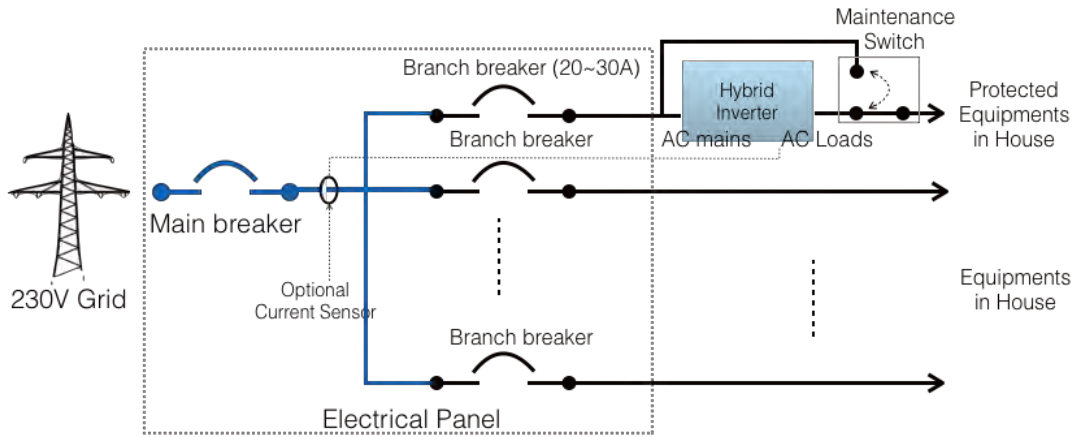
	Maintenance Switch
i	We suggested installing this switch to power the protected equipment in case of replacing inverter

Power Connectors
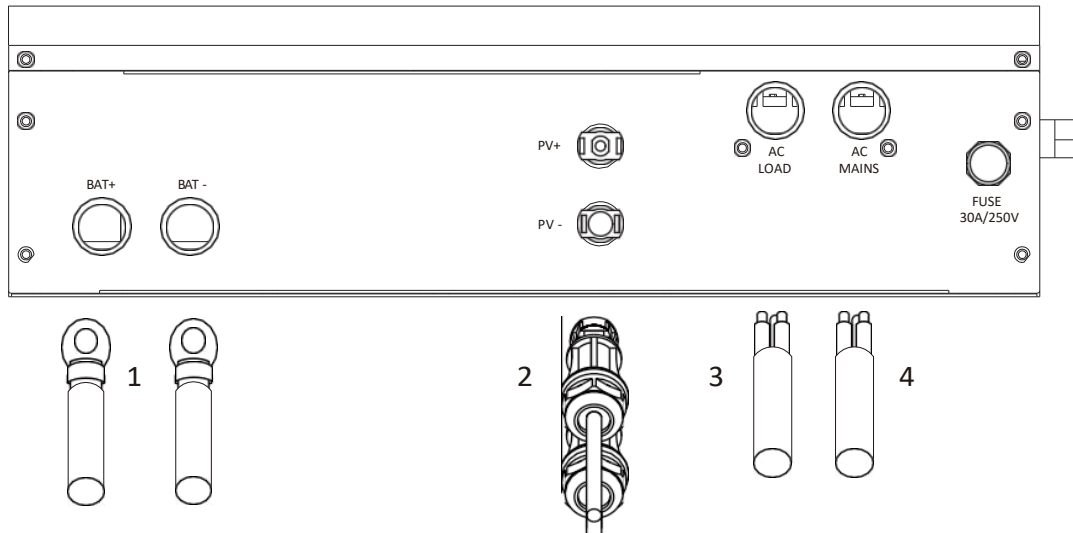
1. Battery Cables (Positive & negative)
2. PV input
3. AC Load output
4. AC Mains input

Connecting AC Mains

1. Open side cover for wiring
2. Select L and N wires as right figure and table2 below:


```
Wire cross section                           External
max. 5.5mm                                   diameter
                                             Ø12.  Ø16
P7
½
¹
ca. 7mm
```
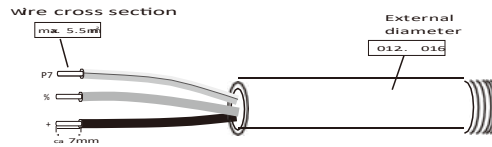
Cross Section (mm^2)	Maximum Length for 1% Loss (Meter)	
	HBI-3000-E-xx*	HBI-5000-E-xx*
2.5	11	7
4	18	11
6	26	16

3. Insert wires through bottom plate
4. Crimp the wires with y-terminals
5. Insert wires with terminals, fix them according to polarity and torque on terminals as figure
6. Fix wires with cable ties
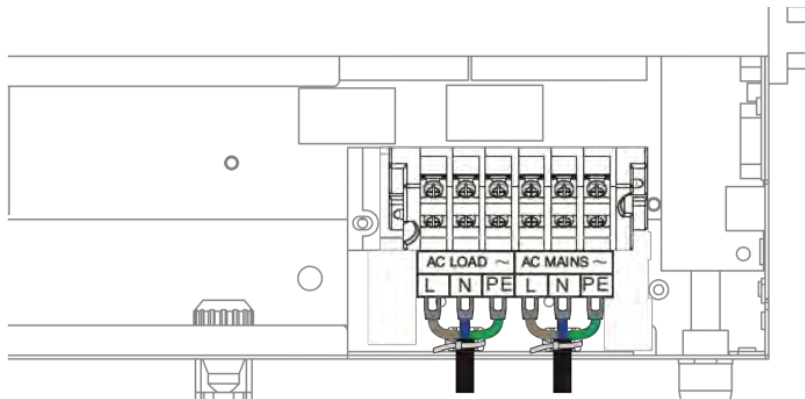
i Protected Earth (PE) Conductor Requirement
The cross section of the conductor shall not be less than 4mm^2.

i Torque Information
The torque for AC terminal is 0.6~0.8 Nm (Newton-meter).

---

^{2} The table is based on 20°C environment, installer need to adjust according to application andlocal regulation

Connecting AC Loads

1. Prepare similar wires as AC mains
2. Repeat steps as AC mains connection
3. Fix them on AC Loads terminals

Connecting PV

1. If there is DC switch on **HBI®**,
   Switch off it in advance
2. Use following connectors for PV DC cables
   • Wieland PST40i1 (Preferred)
   • Multi-Contact MC4
3. Prepare wires according table below[3]

Cross Section (mm²)	Maximum Length for 1% Loss (Meter)	
	HBI-3000-E-xx*	HBI-5000-E-xx*
2.5	24	6
4	39	10
6	54	23

4. Plug connectors to **HBI®**
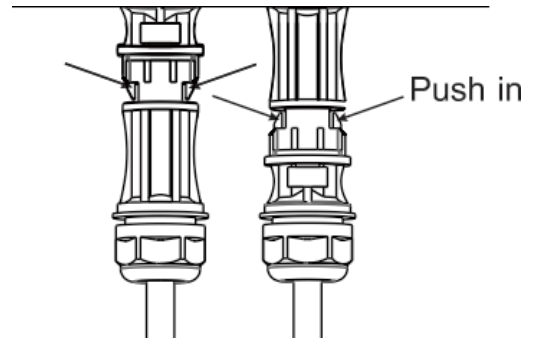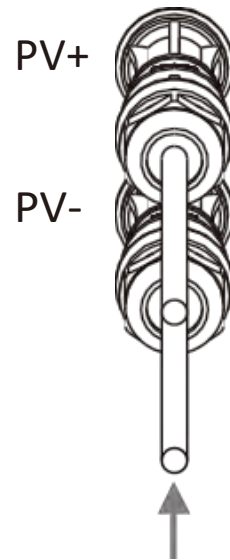
Disconnect PV

To disconnect PV cables, please

1. Turn off DC switch if available in advance
2. Push in the inter-locker on PV connectors
3. Pull off the connectors & cables

Connecting External CT (Optional)

External CT is used to detect power of a circuit. Inverter uses this data to decide the power flow in different modes. Connecting the CT on inverter as right figure. Pay attention on the polarity K and L. They must be correct.
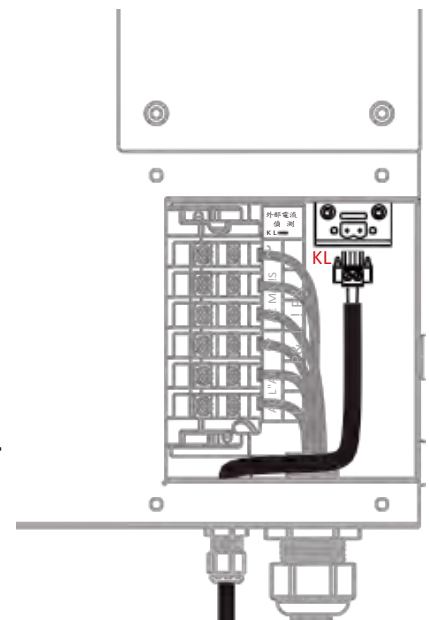
Single inverter

[3] The table is based on 20°C environment, installer need to adjust according to application and local regulation
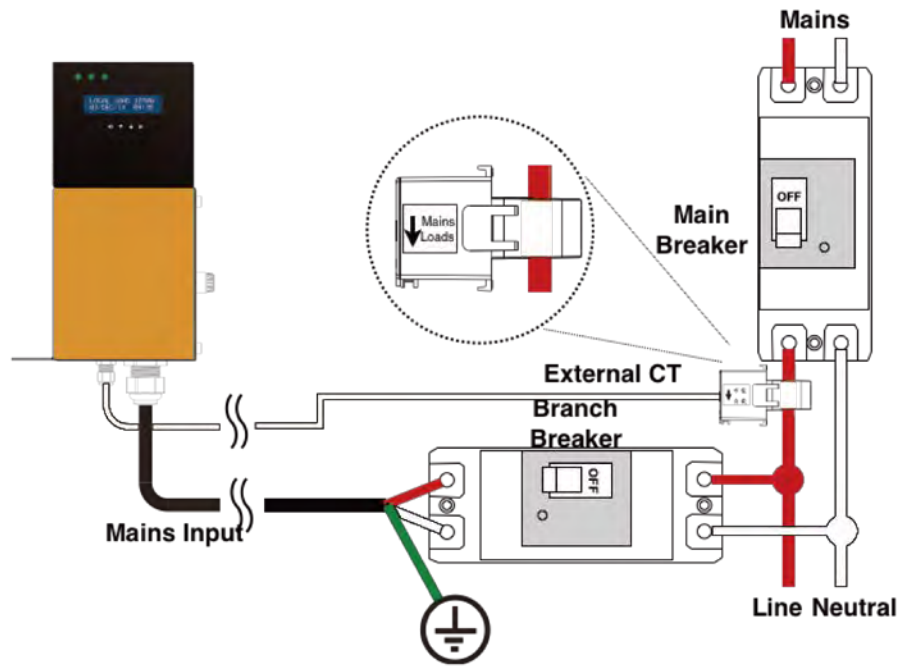
Single unit- split phase
Using a external TX to convert single-phase output to split phase output.

Master

CANbus

Slave

CANbus

Mains

Main Breaker

110V/110V

2 external CT

110/220 Ext. TX

Branch Breaker 1

Branch Breaker N

L   N
220V

21

JD Auspice Co.,Ltd.   TEL: 886-2-8991-2796   FAX: 886-2-8991-9298   service@jdauspice.com   www.jdauspice.com
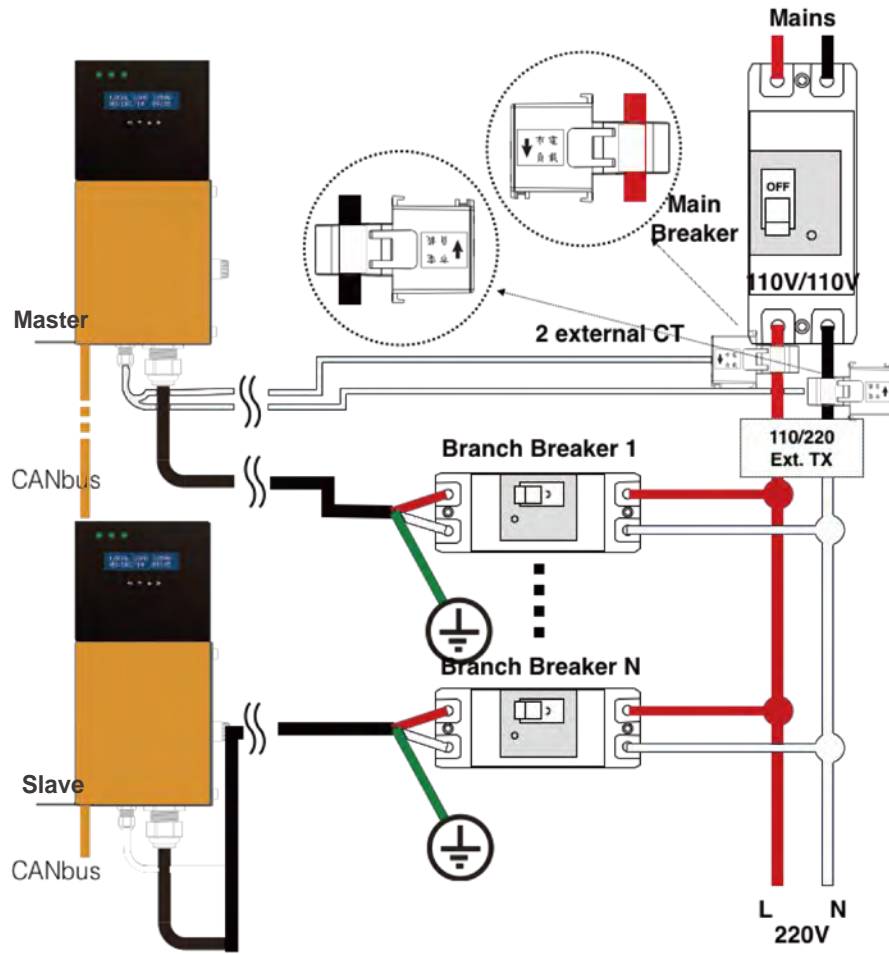
Multiple Units- Single phase
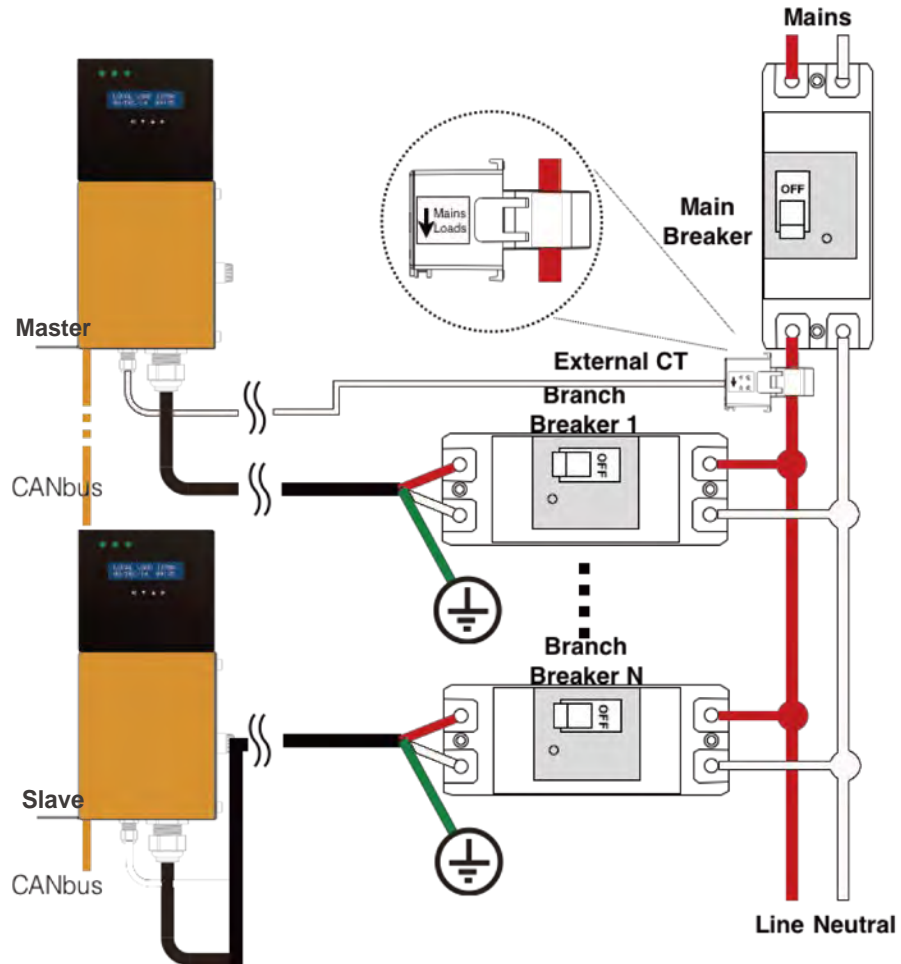
Connecting Battery Bank(s)

The voltage of battery bank is 48VDC. The recommended numbers of battery packs are 1~5. Please refer to specification for recommended battery type. There will be some other batteries can be used, please contact your local dealer and service for latest information.

⚠️ **Use Official Battery**
Official batteries are designed for **HBI®** considering safety, life and performance. Using other batteries may cause danger and/or poor performance.

⚠️ **SWITCH off all DC and AC sources**
Before connecting battery wires, please switch off DC from batteries, PV and all AC in advance.

Preparing Wires and Connectors for Battery

1. Select wires of cross-section > 50mm2. RED color is for positive (+) wire and black for negative (-)
2. Prepare a breaker/switch of 100A/125VDC
3. Prepare cover or sleeve for battery terminals

To Inverter

BAT breaker or fuse

To Batteries

+ −
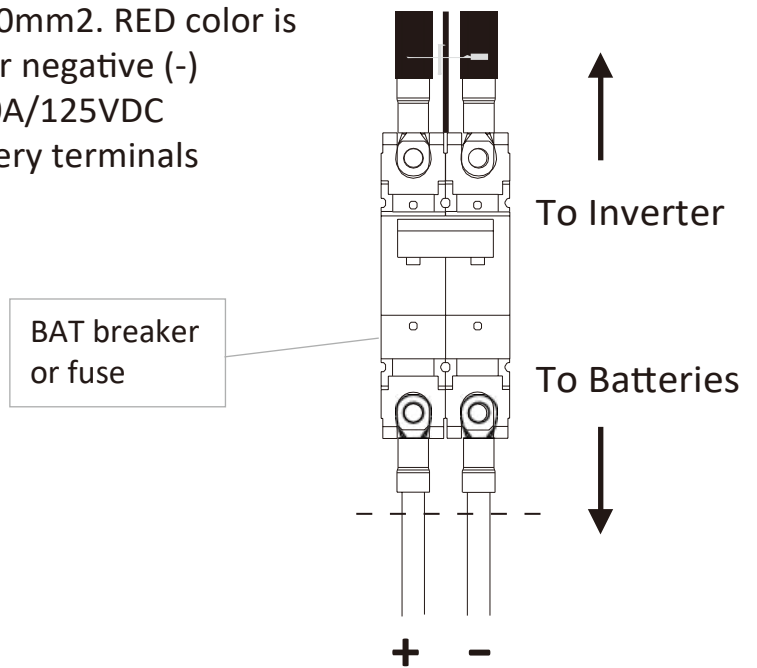
Connecting Batteries

To connect battery, please follow the steps below.
1. Pay attention and follow the instruction of warning label on the unit
2. Prepare wires of AWG 4 (or 50mm2)
3. Crimp (+) and (-) wires with ring terminals
4. Watch out the polarities
5. Fix wires on both sides of DC breaker/switch
6. Protect and hide all the cables in conduits
7. Use battery terminal covers on all battery wires
8. Fix the wires on battery terminals as figures below
9. Make sure all terminals on batteries are protected, not touchable by any person

DANGER

ELECTRICAL HAZARD

Danger voltages exist on all conductive wires and terminals. Please protect and prevent touching of them.

Protection
cover

Battery sensor
(Accessory F)

Protection
cover

From BAT breaker

− + − + − +

+ − − + + −
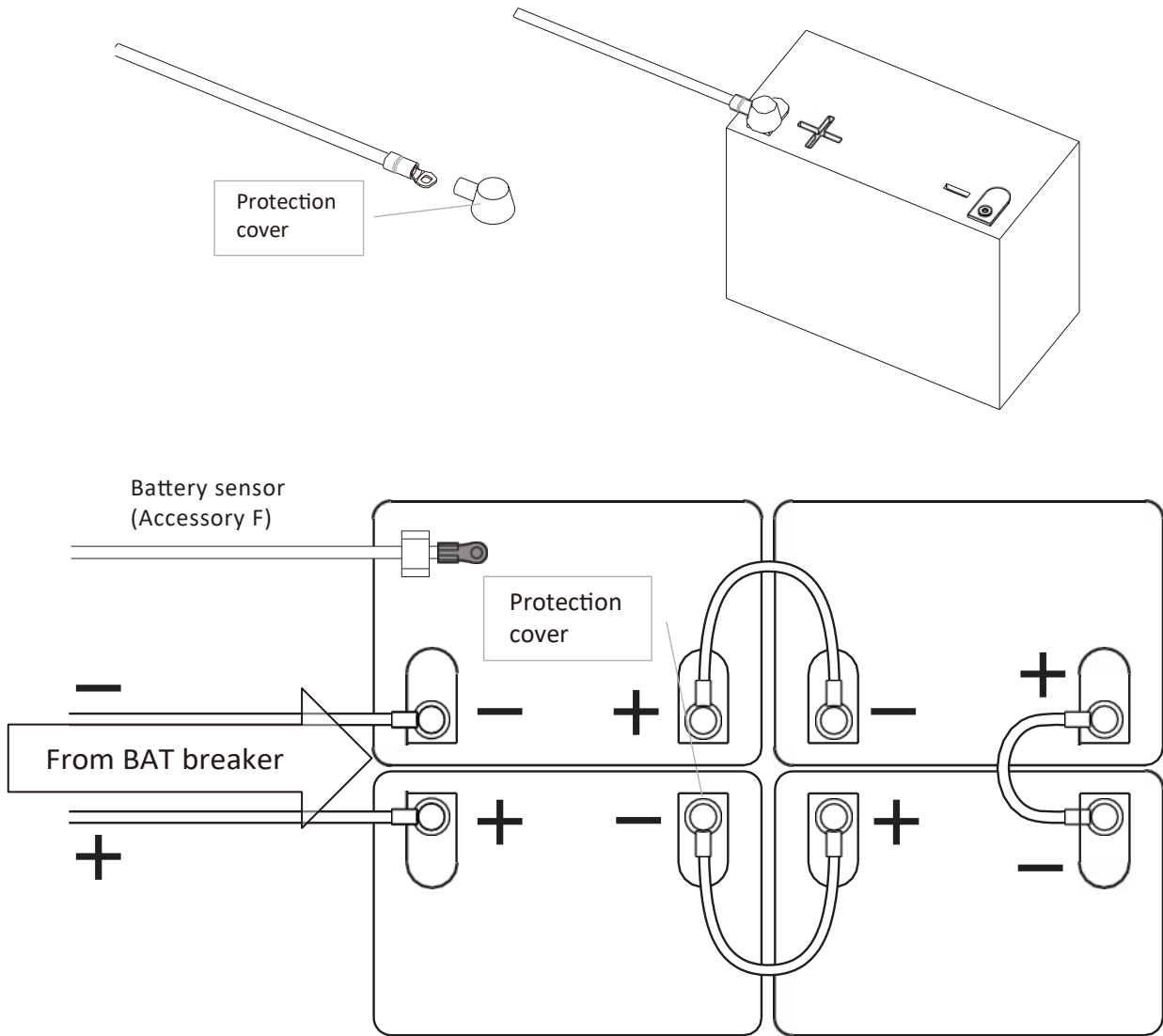
Watch out polarities

Reverse connections of positive (+) and negative (-) will damage the unit. Incorrect wiring is not covered by warranty.

Way to Correct improper battery polarities

If the battery polarity is reverse, switching on the battery breaker will cause internal fuse broken. Please ask your technical engineer to replace the fuse.

> **ℹ Recommendation for multiple battery banks**
> If you are using multiple battery banks, we suggest being less than 3 banks in parallel. This will ensure better balance of different banks.

> **⚠ Tightly connect all DC cables and contacts**
> Make sure all the connections are well contacted.
> Any loosen may cause fire and damage.

Connecting RS485

To monitor and control inverter by external devices such as computer, you need to connect them by RS485. A typical RS485 connection diagram is shown below.
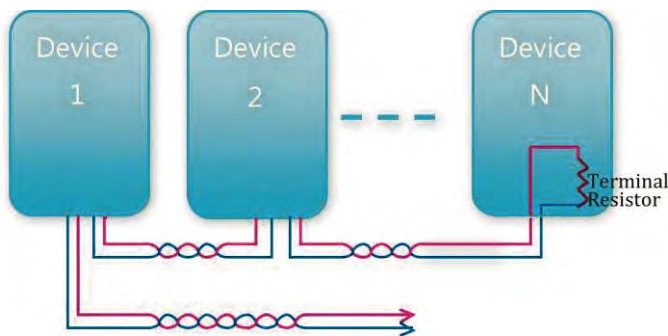
Connecting to device or computer with RS485 interface

There are some points highlighted.
1. All wires between devices and computer shall be twisted
2. Maximum allowable wire length is 1000 meters
3. The terminal-end device may need a terminal resistor
4. Due to multiple connections, each individual device should be assigned an address so as to recognize by computer or device

Connection
The RS485 port is located beneath the inverter as below:

USB   RS485   CAN   Terminal resistor switch (1)
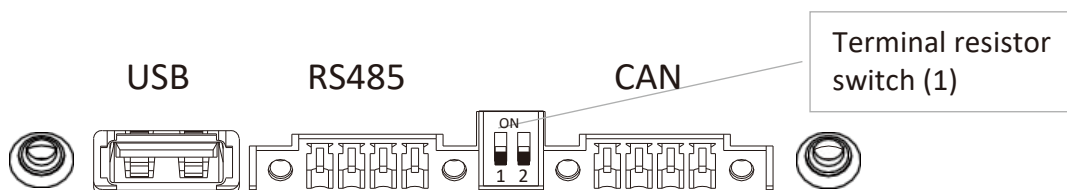
For single unit, please
1. Prepare a 2-wire, twisted cable
2. Insert and wound the cable on the bead in accessory as right drawing
3. Fix cable wires on plug (accessary E). Take care of the polarity
4. Push the plug to RS485 port
5. Connect another end of cable to monitor device
For multiple connections, please connect them as figure below.
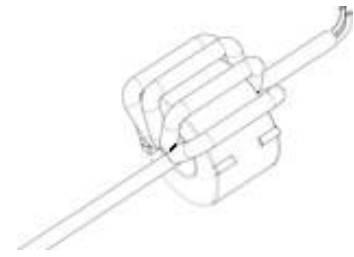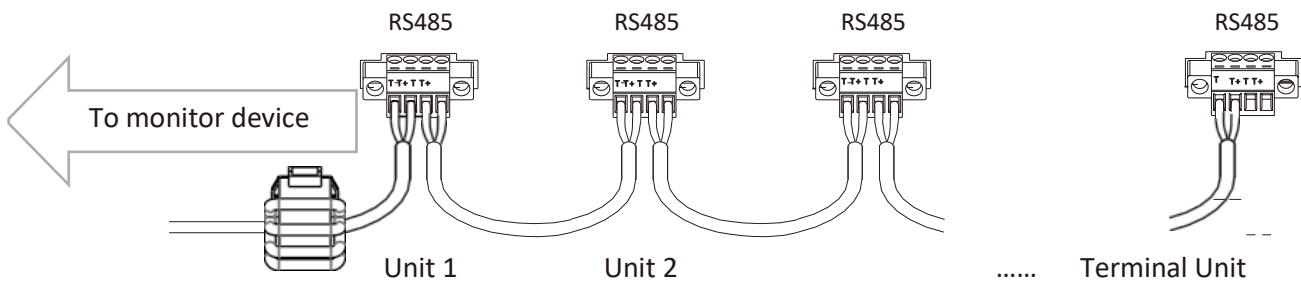
The DIP switch (1) is the terminal resistor switch of the RS485. The default position of this switch is "off ". However, if the communication does not work well, please try to switch it to "on" to improve.

Setting Address

For multiple connections, you need to assign each unit with different address. To set the address, please refer to section of "

⚠️ Caution for Multiple-unit Operations
It is very important to confirm above settings for each unit are the same. Mismatch settings could cause improper o perations.

Set RS485 Address".

Wire Connections- Multiple Units

To build a bigger system with multiple units, you can build the system according to below figure.
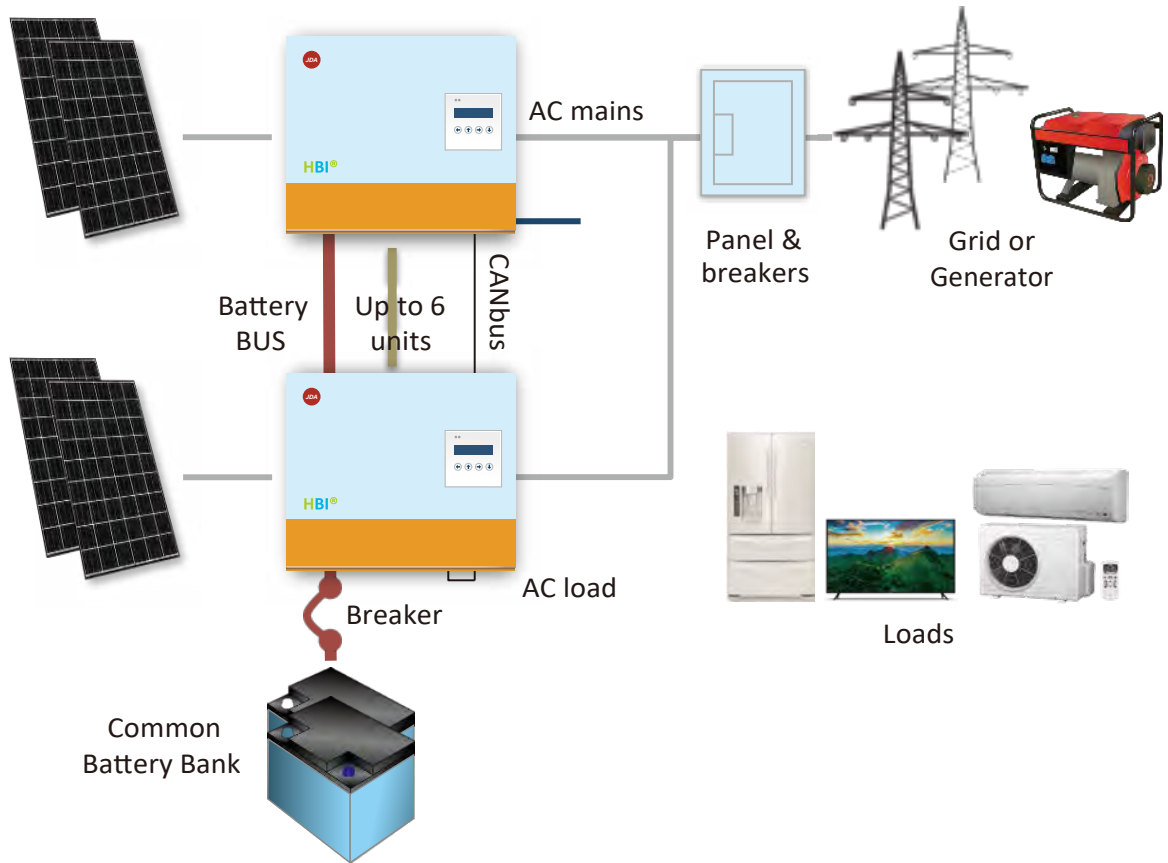
The wire connections on AC side are indicated as below:
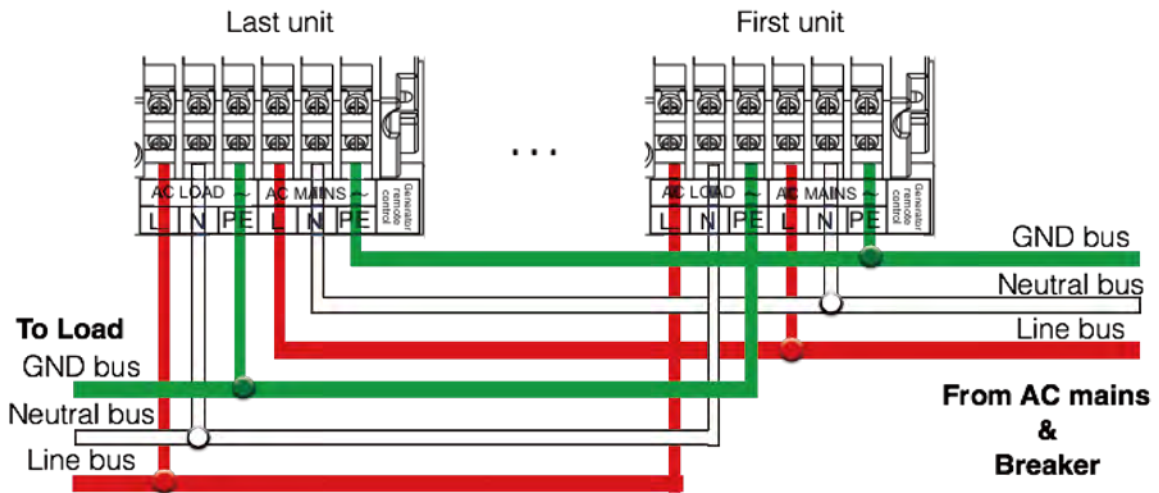
⚠️ **Caution for Multiple-unit Operations**
It is very important to confirm above settings for each unit are the same. Mismatch settings could cause improper operations.

<table>
<tr><td>

i

</td><td>

Wire lengths to bus should be equal
To make sure the current balance, the wire lengths to bus of each inverters should be as equal as possible.

</td></tr>
</table>

<table>
<tr><td>

!

</td><td>

Use Common Battery Bank
For multiple units' connection, all inverters should use the same battery bank.

</td></tr>
</table>

Connecting CANbus cable

1. Use the CANbus cable in accessory as right figure
2. Plug each cable into CAN socket
3. Connect the cable to other cables of inverters

Setting the switch for CANbus

The CANbus switch is located the right side of RS485 switch, labeled as "2". This DIP switch is used to match the impedance for CANbus so as to ensure the communication quality. To set this, please:

1. Set first and last CANbus switch to "ON" position as be figure
2. Set units in between to "OFF"
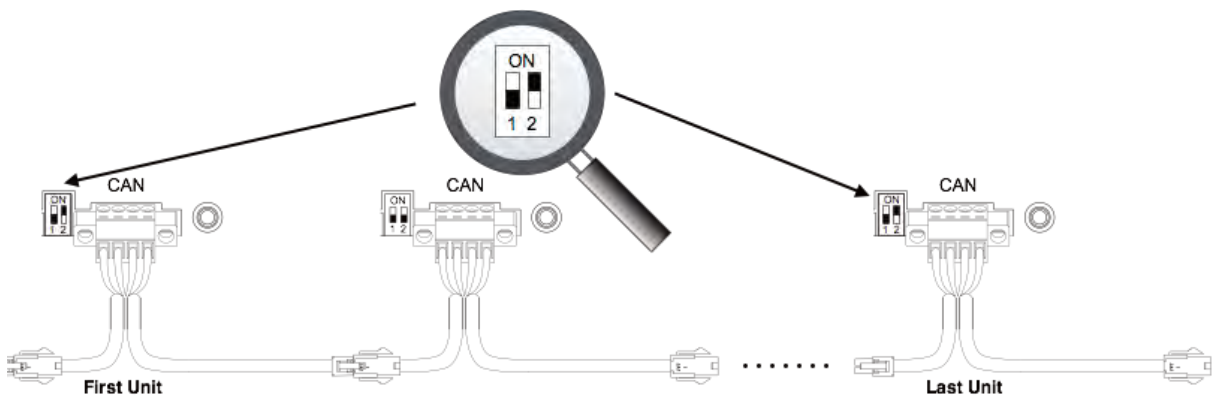
<table>
<tr><td>

!

</td><td>

Be Sure to Connect CANbus Cable
The CANbus cable between inverters is used to control and synchronize the inverter operations. You must connect them for proper operating.

</td></tr>
</table>

Notes for Extending CANbus cable Length
If the cable is not long enough, please extend the cable length by similar wires. However, please limit the length up to 5 meters. And, all the lengths should be the same.

Ready to Start

Check List

Before starting the system, check following items:

Item	Point of check	Checked?
Mounting	• **HBI®** is firmly mounted on the bracket • Bracket is firmly fixed	
AC	• All wires are firmly fixed on terminals • All polarities are correct • Protective Ground is available and connected	
PV	• All wires are firmly fixed on connectors • Polarities are correct • PV open voltage (VPV, OPEN) is less than maximum voltage of PV input • Internal and/or external DC switch are on before operation	
RS485	• Wires and cables are locked and fixed • Polarities are correct • For multiple units, be sure to set their RS485 in different addresses	
DC (Battery)	• All cables are firmly secured • Polarity is correct • Breaker/Fuse is on • Battery sensor is installed and connected	
CANbus cables	• All cables are firmly secured • Polarity is correct • Check DIP switch 2 positions • The wire lengths of different inverters should be the same	

Start-up Procedure

```
                              ┌─────────────────┐
                    ┌────────▶│      Start      │
                    │         └────────┬────────┘
                    │                  │
                    │                  ▼
                    │             ◇─────────────◇
              No    │            ╱  Check List   ╲
                    └───────────◇   & Settings?   ◇
                                 ╲               ╱
                                  ◇─────────────◇
                                        │
                                       Yes
                                        ▼
                              ┌─────────────────┐
                              │ Switch on PV ONLY │
                              └────────┬────────┘
                                        │
                                        ▼
                              ┌─────────────────┐
                    ┌────────▶│ Switch on main AC.│
                    │         │ Wait for 30 seconds│
                    │         └────────┬────────┘
                    │                  │
                    │                  ▼
   ┌──────────────────┐     ◇─────────────◇
   │ Switch off AC;    │ No ╱   LCD turns   ╲
   │ check AC          │◀──◇      on?        ◇
   │ connections       │    ╲               ╱
   └──────────────────┘      ◇─────────────◇
                                    │
                                   Yes
                                    ▼
                          ┌─────────────────┐
                          │  Initial Setup  │
                          └────────┬────────┘
                                    │
                                    ▼
   ┌─────────────────────────────────────────┐
   │ Confirm connection and settings          │
   │ again. Switch off PV and AC.              │
   └────────┬─────────────────────────────────┘
            │
            ▼
   ┌─────────────────────────────┐
   │ Switch on BAT, PV then AC    │
   └────────┬─────────────────────┘
            │
            ▼
   ┌──────────────────┐      ◇─────────────◇
   │ Refer to trouble  │ Yes ╱    Fault?    ╲
   │ shooting and      │◀───◇               ◇
   │ correct           │     ╲             ╱
   └──────────────────┘       ◇─────────────◇
                                    │
                                    No
                                    ▼
   ┌──────────────────┐      ◇─────────────◇
   │ Check RS485       │ No  ╱   RS485       ╲
   │ connection        │◀───◇    OK?          ◇
   └──────────────────┘     ╲                ╱
                             ◇─────────────◇
                                    │
                                   Yes
                                    ▼
                          ┌─────────────────┐
                          │      END        │
                          └─────────────────┘
```

For multiple- unit connection, be sure to confirm the settings of every unit are the same

Operation

Display and Keys
Display
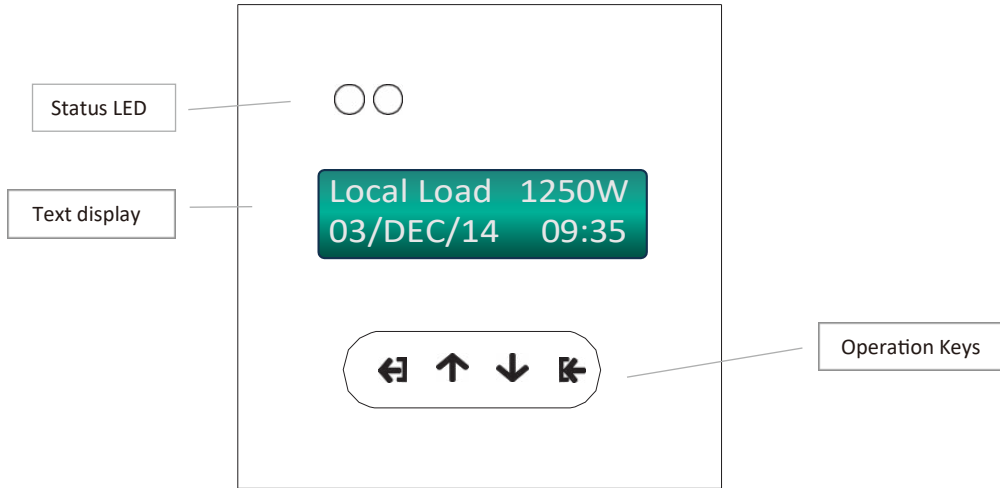
1. Status LED: There are 2 LED's to indicate **HBI**® status. In normal condition, green one4 turns on; in abnormal or warning conditions, red one turns on
2. Text display: 2 lines, showing status, data and instructions

Display and Keys

Key	Function	Note
↵	Exit to previous display	
↑	Menu Up	
↓	Menu Down	
⇐	Enter or Confirm a setting or selection	

Operation Chart

By pressing operation keys, different displays appear accordingly. Please refer to section of LCD Frames for detail information

---

4 In case green LED is flashing, there is internal comm. Error, please call your local service

Settings

Initial Settings

Will not appear for off-grid models

Setting Flow

Initial SETTINGS
TAP [⊹ to Enter

SYSTEM CONNCTION
Single

Single
TAP [⊹ to Enter

SET MODE
NET Metering

Net Metering
TAP [⊹ to Enter

BAT -> Load: ON
TAP [⊹ to Enter

SET CLOCK
03/DEC/14 09:35

03/DEC/14 09:35
TAP [⊹ to Enter

BUZZER CONFIG
ON

BUZZER ON
TAP [⊹ to Enter

PV STRING CONFIG
AUTO

PV AUTO
TAP [⊹ to Enter

BATTERY CONFIG
Generic 100Ah

Generic
TAP [⊹ to Enter

BAT 100Ah
TAP [⊹ to Enter

FREQUENCY CONFIG
60Hz

60Hz
TAP [⊹ to Enter

MAINS CHGs BAT
Disable

Disable
TAP [⊹ to Enter

RS485 Address
001

001
TAP [⊹ to Enter

Initial SETTINGS
Completed

You need to set inverters after first installation so as to have proper operation in the future.

After switching on PV and AC (recommend no battery at this moment) of the first installation, the initial setting frame comes out automatically. The chart is indicated.

> **Flow of Initial Settings**
> Initial Settings is a "one-way" flow. You can not go back to previous setting even you set wrong. In case incorrect operation during setting, please set it again later on.

System Connection

This setting is to set single or multiple inverter connection of the system. The selections are:
1. Single: only one inverter in this system
2. Parallel: The inverter AC mains are connected together; AC loads are connected together to build up a bigger systemSet Mode

The selections are:

1 Off-grid: for pure off grid operation
2 Net Metering: Grid interactive mode. Extra PV power feeds to grid.
    2.1 BAT -> Load: Off. Disable above function
    2.2 BAT -> Load: Night. This will enable load compensation from battery during night
3 Self Using
    3.1 BAT -> Load: Off. Disable above function
    3.2 BAT -> Load: Night. This will enable load compensation from battery during night only
    3.3 BAT -> Load: Day. This will enable load compensation from battery during day only
    3.4 BAT -> Load: Always. This will enable load compensation from battery during all the time

> **Disable Mains Charging Battery function**
> To enable load compensation from battery function, you need to disable the mains charging battery function in settings

Set Clock

To set clock, press up and down keys to increase or decrease on blinking characters; press Enter to change among day, month, year, hour and minute; press Enter to confirm settings.

i	Make sure clock is correct Incorrect clock causes improper operations. Make sure HBI's clock is correct all the time.
!	Time of keeping clock setting after losing power In case switching off HBI for more than 5 days, the internal clock setting will lose and change back to the default settings.

Buzzer Configuration

The step is to set buzzer on/off. Press Enter to start setting. Press Up and Down to change setting. Press Enter again to confirm your selection.

Battery Configuration

This text shows the battery type and its string number. The available selections are:

1. Generic 1 & 2: They are general types of Lead-acid batteries. If you are using types other than official ones, please select one of this according to your battery parameters
2. YUASA NPA100-12I
3. CHLORIDE12CDC100
4. Panasonic LC-T12105x
5. No Battery

Except 1 & 2, all the other batteries are official ones. Each configuration has its own parameter. Please refer to Battery Charging/Discharging in Appendix for detail information. After setting the type, you have to set Ah (Ampere-Hour) of the battery bank equally divided by individual inverter number. For example, if you have a common 1000Ah battery bank for 5 inverters, the Ah of individual inverter should be 200Ah.

The possible selections are "100Ah~400Ah" and "≥ 500Ah".

JDA 日煬科技有限公司
JD Auspice Co., Ltd.

ⓘ	**Using Charging/Discharging Parameters** If you know parameters of non-official battery, please choose similar battery type of the list to have best performance.

⚠	**Operation without battery** If battery is not connected, the output of inverter may not be stable, please not to connect critical load

Frequency Configuration

The setting is to set the AC output frequency to 50 or 60Hz.

ⓘ	**Be careful to set the frequency** You can set the Frequency ONCE ONLY in initial setting. Please select proper one for your applications.

⚠	**Frequency follows AC mains** In case AC mains are connected during setting, HBI will follow AC mains' frequency. In this case, frequency configuration frame will not appear during initial settings.

Mains Charging Battery

This item is to set whether inverter will use AC mains to charge battery or not.
In some applications, you may need AC mains (Grid or Generator) to charge the battery bank when PV power is not enough and battery capacity is low.
Select "Enable" so as to charge battery in this case; select "Disable" to skip this function.

ⓘ	**Charging current while using Mains** Mains maximum current limits the charging current. Charging power equals mains power minus load power.

⚠	**Caution for Multiple-unit Operations** It is very important to confirm above settings for each unit are the same. Mismatch settings could cause improper operations.

Set RS485 Address

The selectable address is from 1~200. Default address is 1.

To know the detail of addressing of RS 485, please refer to section of "Connecting RS485".

> ⚠️ **Check settings and restart the unit**
> After initial setting, please confirm again all the connections and settings, especially for battery, then switch off all sources, wait for 30 seconds and switch on all sources to restart the unit.

Normal Settings

Normal setting is used to set the unit whenever you would like to. Its process is similar to initial setting except operation flow as below.

SETTINGS
TAP [⊹ 3 times

↕ Up/Down Keys   ↔ Enter/Escape   → Enter

SYSTEM CONNCTION
Single
↔
Single
TAP [⊹ to Enter

SET MODE
NET Metering
↔
Net Metering
TAP [⊹ to Enter
↔
BAT -> Load: ON
TAP [⊹ to Enter

SET CLOCK
03/DEC/14 09:35
↔
03/DEC/14 09:35
TAP [⊹ to Enter

BUZZER CONFIG
ON
↔
BUZZER ON
TAP [⊹ to Enter

PV STRING CONFIG
AUTO
↔
PV AUTO
TAP [⊹ to Enter

BATTERY CONFIG
Generic 100Ah
↔
Generic
TAP [⊹ to Enter
↔
BAT 100Ah
TAP [⊹ to Enter

MAINS CHGs BAT
Enable
↔
Enable
TAP [⊹ to Enter

RS485 Address
001
↔
001
TAP [⊹ to Enter

In case you would like to set the unit, just use and to Setting Frame and press 3 times in 2 seconds to start.

i	**SET MODE Selection** The "SET MODE" option appears only for **HBI®** models with dual "On-grid" and "Off-grid" operations.

Factory Setting

HBI® can be restored to factory setting. If you like to do this, please ask for your local service.

Manual ON/OFF

The manual ON/OFF switch is on the left side or front side as figure.

This switch is used to turn on/off <u>individual</u> inverter manually. There are some situations:

1 AC exists: turning off inverter switches load to AC mains

2 AC does not exist:

    2.1
In case battery capacity is enough, push the button to start inverter [5].
Inverter will supply power from battery bank to your loads

    2.2
To turn off Inverter, push the switch again, all the AC output will be off and inverter will shutdown itself.

3 Multiple units: Turning off one inverter will switch off INDIVIDUAL inverter only
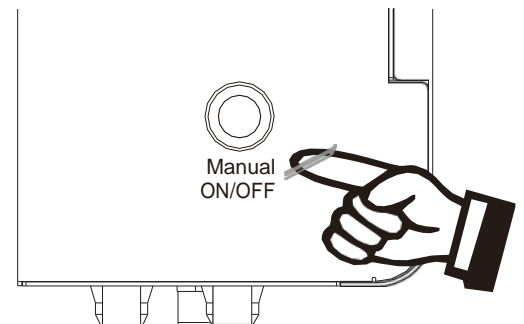
Operation

Display and Keys

Inverter Starts

| BOOT Ver 1.0 Waiting... |

Up/Down Keys

| Local Load 1250W 03/DEC/14 09:35 |

| From Solar 1700W To BAT   450W | **Power Frame 1** |

| LEtoday   12kWh MEtoday   6kWh | **Power Frame 2** |

| BAT Charging BAT Level MEDIUM | Battery Frame |

| SETTINGS TAP [✛ 3 times | Setting Frame |

| Error 50 TAP [✛ to Enter |

| F/W Version 01.02 |

| SYSTEM VOLT(V) PV1:360 PV2:374 |

| Role of Control MASTER |

| 105% Load Pls. Reduce Load | Event Frame |

Tap Enter to clear Event

Note:

1. In case no operation for 1 minute, LCD will go back to Home Frame automatically
2. Event Frame will not appear in case there is no error/event
3. To enter the setting Frame, you have to press ⌨ three times in 2 seconds

Home Frame

Home Frame shows the operation status and related data at first text line. It shows date and time at second line.

| Local Load 1250W 03/DEC/14 09:35 |

Mode	Display in 1st line	Description
Normal &	Local Load XXXXW	Indicating the power of XXXXW delivered to loads connected to the inverter.
Waiting	ConnGrid in XXXS	Indicating the remaining time for connecting Grid
Warning	Refer to warning	On warning or error happening, Inverter shows the warning messages

Error	Refer to error message	On error happening, **HBI**® shows the error messages
Manual Off	Manual Off, Push On/Off to turn on	Manual off. Load will continuously be supplied by AC mains if it exists.

Power Frame 1

> From Solar 1700W
> To BAT   450W

Showing the instant power from different sources of individual inverter except mains power.

Display in 1st line	Description
From Solar XXXXW	The power coming from PV under normal mode

Display in 2nd line	Description
To BAT XXXXW	The power charged to battery
From BAT XXXXW	The power comes from battery
To MAINS XXXXW	The power fed to AC mains.
From MAINS XXXXW	The power get from AC mains.

Where To BAT (or From BAT) and To MAINS (or From MAINS) appear alternatively in this line

For multiple-unit connection, press ⏎ in this frame will show total grid and load power of the system. It is in the form of

TGrid   XXXXW
TLoad   XXXXW

Home Frame

Home Frame shows the operation status and related data at first text line. It shows date and time at second line.

Display	Description
LEtoday XXXkWh	Local Energy consumption of the day
MEtoday XXXkWh	Mains Energy supplied of the day in total. If " - " appears in front of XXXkWh, it means feed -in energy is more than consuming.

Battery Frame

Showing battery status.

Display	Description

BAT Charging	Battery status. "Charging", "Discharging", "Standby" or "Disconnected"
BAT Level Medium	Battery capacity level. "Full", "High", "Medium" and "Low"

Notice of Battery Power

Battery efficiency varies from many factors and is difficult to calculate. The power reading on **HBI®** display is a calculation for indication of system operation.

Setting Frame

By pressing ⮐ 3 times in 2 seconds on setting frame, the setting procedure starts. Refer to Setting in previous section for detail information.

Display in 1st line	Description
Error XX	Error number

Display in 2nd line	Description
No Error	No error recorded
ERROR message	The error type, please refer to next section

Total Errors can be logged

The total errors can be recorded are 50. For error large than 50, latest one will replace earliest one.

If you like to view the error type, please tap ENTER and using UP and DOWN keys to see the detail. The format will be.

Line 1	Line 2	Description
Error XX	Error Message	Line 1 shows the error number, line 2 tells you the error message. The messages are listed in tables of error and warning in section Event Frame

Version Frame

The F/W version of inverter appears in this frame. In case service is required, please tell this information to your service agent.

Monitoring Frame

This frame displays inverter monitoring data of PV1 (DC), PV2 (DC), Mains (AC), Battery (DC), Mains frequency and internal temperature alternatively.

Role Frame

In multiple connections, this frame will appear. It indicates the inverter role of the multiple units. There are 2 roles: Master and Slave. There is only one master in a system. The others are all slaves. Master is assigned randomly in each start-up

Event Frame

> 105% Load
> Pls. Reduce Load
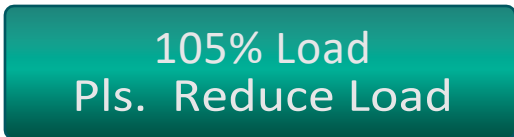
In the cases there are events such as errors, warnings and reminding, event frame will appear automatically. The prompt information is listed in error and warning tables below.

Error message

Line 1	Line [2]	Buzzer	Meanings
AC VOLT HIGH	Vac XXX V	Silent	ACV is higher than upper limit
AC VOLT LOW	Vac XXX V	Silent	ACV is less than lower limit
AC FREQ HIGH	fac XX.X Hz	Silent	AC frequency is more than upper limit
AC FREQ LOW	fac XX.X Hz	Silent	AC frequency is less than lower limit
PV VOLT HIGH	Vpv XXX V	Cont.	PV is higher than upper limit
BAT VOLT HIGH	Vbat XX.X V	Cont.	Battery voltage is higher than upper limit
OVER LOAD	Output is off	Cont.	Output is overloaded more than defined time, output is cutoff
O/P Short CKT	REMOVE CKT	Cont.	Output is short
No Battery	Check BAT Conn.	Cont.	Battery is not

42

			connected
PV- E Low Insul.	Check PV Wiring	Cont.	Insulation resistance between PV and Earth is too low
CX	No Display		C1~C7 errors, reserved for internal diagnose
EX	No Display	Cont.	E6~E12 errors, indicating errors for multiple connection

Warning message

Line 1	Line 2	Buzzer	Description
1XX · Load	Pls. Reduce Load	On 0.5 Off 0.5	The load is more than 103%, inform user to reduce load
Low Bat. Cap.	Will Shutdown	On 0.5 Off 4.5	Battery capacity is low. HBI® will shutdown
Fan Fails	Check or Replace	On 0.5 Off 4.5	External fan does not work properly

Monitoring HBI®

To do this, you need to have RS485 connection and related software.
Please refer to Connecting RS485 for proper connection and setting;
please refer to separate software manual for installation and application.

If you need send monitoring data to Internet,
please use EssLog® gateway.
Please contact with your local dealer for further information.

Using USB

Download Data to USB stick

You can plug in a pre-formatted USB stick into USB port to download the operation data. The stick must be FAT or FAT32 formatted.

To do this, plug in a USB stick. LCD will show "Download Data Processing".

After plugging in the USB, all data inside the HBI® will be downloaded to the stick automatically. LCD will show corresponding status.

USB   Bat. RS485
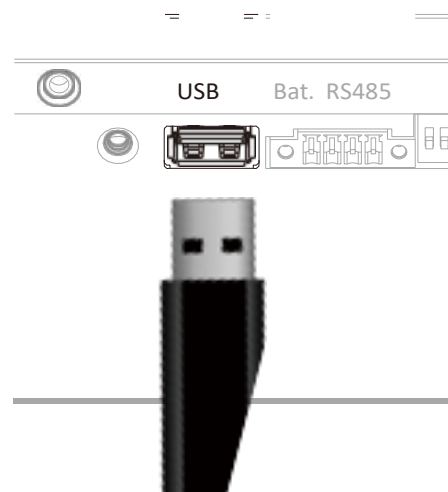
After downloading, while LCD shows "Download Data Finished", you can then pull off the USB disk.

i	**Data Format** Incorrect clock causes improper operations. Make sure HBI's clock is correct all the time.
i	**USB Disk Contains Firmware** In case switching off HBI for more than 5 days, the internal clock setting will lose and change back to the default settings.

Set Clock

You can upgrade **HBI®** by USB disk with official firmware. To do this, you need to have the firmware in a USB stick. To update by USB, please get the latest firmware, put it into a blank USB disk, plug the USB disk to **HBI®**, it will start the upgrade automatically. Contact your local dealer for more information.

i	**PV or Mains must be available** To prevent unexpected stop, before starting upgrade, make sure PV or mains are available

Capacity of Memory

The internal memory can store up to 12 months length of data. Data older than this period will be replaced by latest data automatically.

⚠	**Backup Data Periodically** Once data in the logger has been deleted, it cannot be recovered. Therefore it's recommended to backup the data periodically if you wish to retain this information.

Trouble Shooting

In case **HBI**® detects any problem, it will behave as the situations in table below.
Please follow the instruction to solve the problem. If the problem continues, please
contact your local service for further assistance.

General Fault

Trouble	Treatment
No display or incorrect display	1. Make sure all PV and battery are properly connected 2. Check Battery fuse and switch (breaker) is on 3. Check AC (mains). If no AC, try to push "Manual On/Off" button 4. If above actions are useless, please DO NOT push manual on/off any more, call your service immediately
No PV or very small PV power	Please check 1. PV polarities 2. PV wiring and connections[6]
Error on display	Refer to error table in Error Frame section 1. Errors on list：Read related meaning and take suitable action 2. "C#" Error：Switch off all AC and DC. Then switch on the DC and then the AC again 3. If above error continues, please contact with local service and tell he the error on LCD
C4 appears	Error code C4 stands for internal over-temperature. 1. Review installation location, cooler ambient is preferred 2. Clean up dust on fans and ventilation holes 3. If C4 continues, please contact with your local service
E3 (or PV -E LOW INSUL.) appears	This error code stands for insulation problems between Line (or Neutral) and earth GND

[6] In most cases, they are caused by contacts of the wiring and plugs contact. A way to confirm this is to short the PV string, measure its current.
During day time, the short-circuit current should be higher than 1A.

	1. Make sure GND is correctly connected at mains input 2. Check system GND connection 3. Check whether there is obstacle such as bug between Line (or Neutral) and GND 4. Check the insulation of wires to GND 5. Check the insulation between PV+ (or PV-) and GND
X4 appears	If you find this in initial installation, please check 1. AC mains and Load connection 2. AC load is to be connected to load, NOT AC main
Unable to charge batteries	1. Improper battery type. Please use official batteries 2. The life cycle of battery ends. Please replace batteries 3. Improper battery connection. Please check the wirings between HBI® and battery bank
RS485 does not work	1. Check all wirings, connections and polarity 2. Try to switch "on" or "off" terminal DIP switch
"BAT -> Load" does not work	1. Enable this function in setting menu 2. Make sure "Mains charges Battery" function is off
Internal Comm. Error	1. Green status LED is flashing 2. Call your local service
Frequent disconnection in on-grid operation	Caused by unstable grid satiation, please 1. Improve the AC cables to larger and/or shorter 2. Check the AC voltage and frequency Ask local service for adjusting operation parameter
Overload	1. Please reduce the load 2. Please check the load PF (Power Factor). For some loads (such as lighting) with less PF, it may take higher current; even its wattage is small. In this case, please correct or replace such kinds of loads

	1. Current could normally deviate about 10% for different inverters
Current unbalance in multiple -unit operations	2. Check AC input and output cables of different inverters, every input (output as well) cable should be same length
	3. Check CANbus cable lengths, the y should be the same

Multi-unit Fault

E6	1. FW versions are not same among inverters 2. Check the FW version of every inverter. If different, please as FW for update
E7	Mode settings for multiple -unit operation are not consistent. 1. Please check individual mode setting 2. Correct if necessary
E8	Frequency of faulty unit cannot be synchronized with other units. 1. Make sure AC loads of all inverter in the same phase are connected and short 2. Make sure AC phases are same for all inverters
E10	Faulty unit cannot receive Master's signal. 1. Make sure CAN cables are correctly connected 2. Restart the units
E11	Operation status of faulty unit cannot be synchronized with other units. 1. Adding new unit in a running multiple inverters could raise this error 2. Make sure AC loads of all inverter in the same phase are connected and short 3. Make sure all units are in parallel modes 4. Make sure CAN cables are correctly connected 5. Restart the units
E12	Over current is detected at mains input. 1. Check loads, reduce them if necessary

	2. Check AC mains connections of all units 3. Restart the units

	Caution of Adjusting Operation Parameters This may violate local grid-tie regulation. Please ask your qualified technical support to do this ONLY!

Maintenance

Regular maintenance

For best results, please follow below points:

1. Keep proper distance from other obstacles. Make sure air-flow and heat dissipation path is cleared
2. Clean up any dust on this unit, especially on the ventilation holes
3. Check operation and status if possible
4. Check all wiring and cables

Cleaning Dust

Use a brush the clean the dust on ventilation holes on both sides
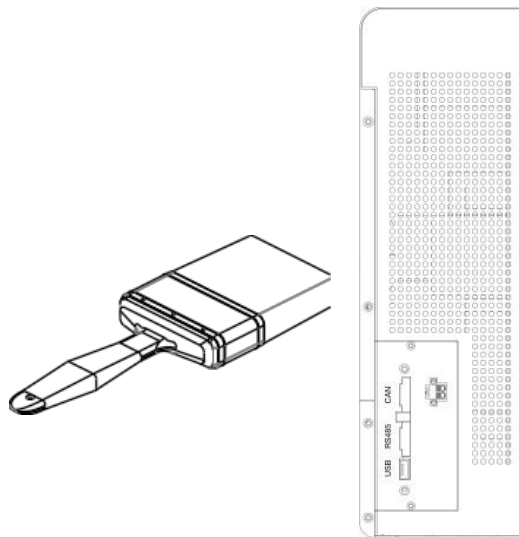
Replacing AC Fuse

For some abnormal situations such as over load on AC out, the AC fuse may be broken. If this happens, you need to replace the fuse (30A/250VAC, fast- acting).

There is a spare fuse in accessory. Take that fuse, follow figure on right side and replace it.

Maintenance

Regular maintenance

Model Item	Unit	HBI-3000-E-xx*	HBI-5000-E-xx*
Input (Mains, AC)			
Nominal Voltage	V	230	
Voltage Range	V	190 ~ 300	
Nominal Frequency	Hz	50/60	
Power Factor		0.99	
Maximum Current	A	15	25
Inrush Current	A/μS	100/200	
Max. Power	VA	3000	5000
Input (PV, DC)			
Maximum Power	W	3000	5000
Maximum Voltage	V	500	500
MPPT Range [2]	V	100~450	100~450
Start-up Voltage	V	150	150
Maximum Current	A	10	20
Absolute Max. Current (Isc)	A	15	30
MPP tracker No.		1	1
Max. Backfeed Current	mA	1.6	1.6
Battery I/O (DC)			
Nominal Voltage	V	48	
Voltage Range	V	40 ~ 59	
Nominal Current	A	54	93
Maximum Current	A	65	100
Max. Charge Current [3]	A	40	60
Max. Leakage	mA	1	
Output (Load, AC)			
Nom. Power	VA	3000	5000

Note:
*stanealone-SA.

Item \ Model	Unit	HBI-3000-E-xx*	HBI-5000-E-xx*
Max. Power	W	2400	4000
Inrush Current	A/µS	100/200	100/200
Max. Fault Current	A	50	79
Max. Protection Over-current	A	50	79
Nominal Voltage	V	120, 230	
Nom. Frequency	Hz	50/60	
THDV	%	5	
Voltage Regulation	%	2	
DC injection	mV	±100	
Overload Capacity		600 seconds for 100% ≤ load ≤ 110% 30 seconds for 110% < load ≤ 150% 10 seconds for 150% < load ≤ 200%	
General			
Temp. Range [4]	°C	-20 ~ 55	
Max. Eff. (PV/AC)	%	95	96
Max. Eff. (BAT/AC)	%	92	92
Protection		IP20	
Humidity	%	0~95, non condensing	
Cooling		Forced Air -cooling Variable fan speed control	
Protection Class		I	
Environment Cat.		Pollution Degree III	
Overvoltage Cat.		DC input: II, AC input: III	
Amplitude	m	<2000	
Transfer Time [5]	mS	<4	
Reconnect Time [6]	S	300	
Features			
LCD		2-line 16 characters text	
Interface		USB, RS485 & CANbus for multiple -unit operations	
RS485		2 wires, half -duplex	
Date Logging		Yes	

Note:
*stanealone-SA.

| Item	Model	Unit	HBI-3000-E-xx*	HBI-5000-E-xx*
Parallel Operation			No	Yes
Max. Units for Parallel Operation			NA	6
Mechanical				
W x H x D		mm	425 x 388 x 120	
Weight		kg	12	14
DC switch			No	
Compliance				
Grid Monitoring			VDE0126 -1-1/A1 IEEE 519 CEA (2013), IEC 61727 , IEC 62116	
Safety			IEC 62109 -1, 62109 -2	
EMC Emission			EN61000 -6-4,	
			EN61000 -3-2, EN61000 -3-3	EN61000 -3-11, EN61000 -3-12
EMC Immunity			EN61000 -6-2	
Battery				
Capacity			100Ah/12V x 4 per bank	
Official Type			Refer to table below	

Note:
1. Specifications are subject to change without prior notice
2. The input power may be reduced for voltage lower than 250V
3. Charge current will adjusted according to battery configuration
4. Output power may be reduced for temperature > 40°C
5. AC to backup, single unit mode
6. Only for on-grid mode

*stanealone-SA.

Battery Charging/Discharging

Charging Method

This inverter apply 3-step charging algorithm as below figure.
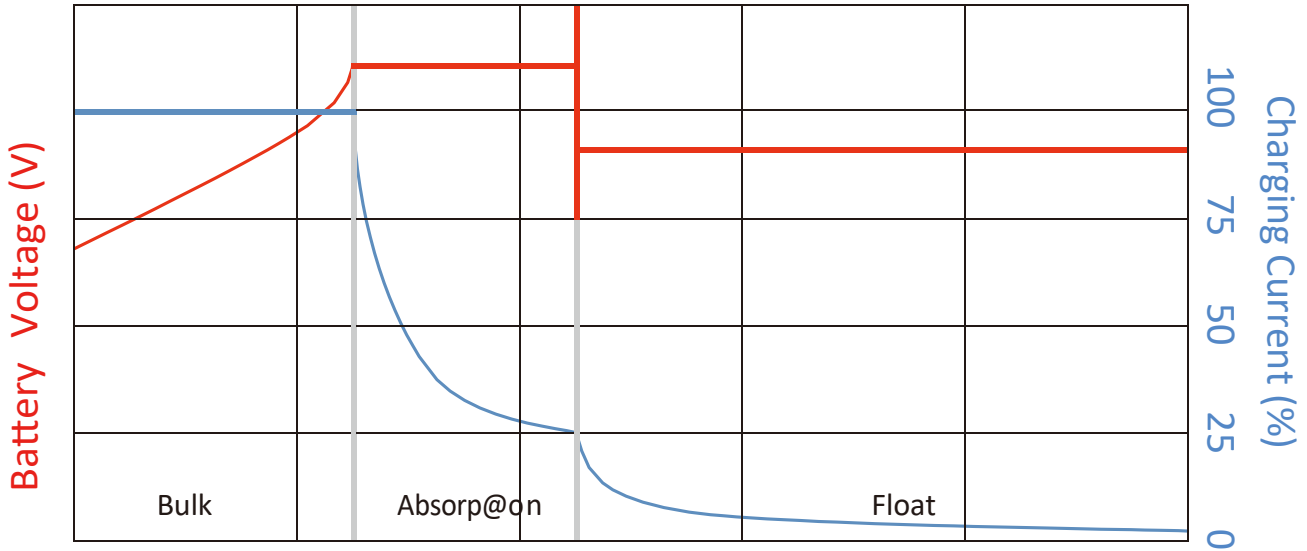
1. Bulk stage: Constant current charging
2. Absorption stage: Constant voltage charging
3. Float stage: Constant voltage charging with lower voltage

Charging/Discharging Parameters

Type	Ah	Buck Charging Current	Absorption Voltage	Float Voltage	Cut-off Voltage
Generic 1	100	20	14.1	13.6	11.0
	200	40	14.1	13.6	11.0
	300	60	14.1	13.6	11.3
	400	60	14.1	13.6	11.3
	≥500	60	14.1	13.6	11.3
Generic 2	100	20	14.4	13.6	10.5
	200	40	14.4	13.6	10.5
	300	60	14.4	13.6	10.8
	400	60	14.4	13.6	10.8
	≥500	60	14.4	13.6	10.8
Yuasa NPA100 -12I	100	20	14.5	13.6	11.3
	200	40	14.5	13.6	11.3
	300	60	14.5	13.6	11.6
	400	60	14.5	13.6	11.6
	≥500	60	14.5	13.6	11.6
ChI	100	20	14.7	13.6	10.2

	200	40	14.7	13.6	10.2
	300	60	14.7	13.6	10.5
	400	60	14.7	13.6	10.5
	≥500	60	14.7	13.6	10.5
Panasonic LC-T12015	100	30	14.5	13.6	10.2
	200	60	14.5	13.6	10.2
	300	60	14.5	13.6	10.5
	400	60	14.5	13.6	10.5
	≥500	60	14.5	13.6	10.5

Note:
1. The voltage indicated is for single 12V battery
2. Cut-off voltage is the stop voltage of rated discharging power. E.g. for one string, it is the voltage of 115A discharging