

Battery Energy Storage System BESS5 Instruction Manual

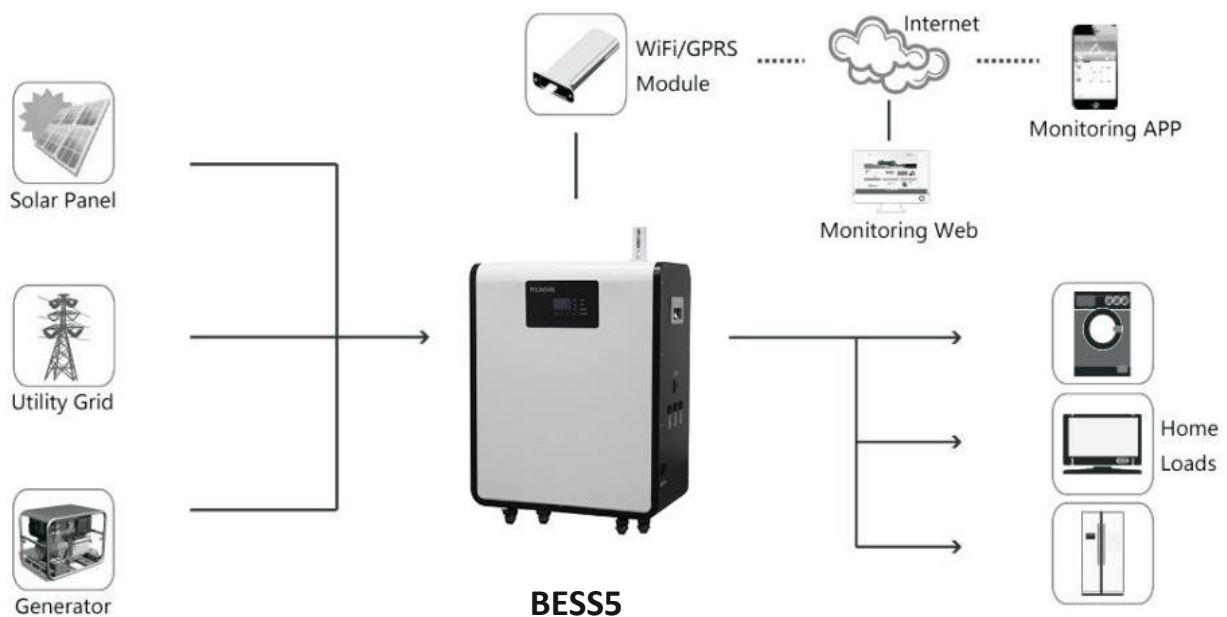


- This manual provides important safety-related information. Thoroughly read and understand this manual before installing and using the product.
- Keep this manual in a convenient location so that you can refer to it whenever necessary.
- The contents of this manual are subject to change without notice.

Introduction

Features of this product

- Thank you for purchasing Polinovel's Battery Energy Storage System (BESS).
- This is a highly integrated multi-function BESS that integrates MPPT/PWM solar charging controller, high-frequency pure sine wave inverter and 5KWH lithium battery system.
- The entire system may require other equipment to achieve complete operation, such as photovoltaic modules, generators or public power grids, and household loads. Please consult your system integrator to obtain other system architectures that may be required according to your needs.
- The BESS protects computers and other devices from power failures, voltage variations, instantaneous voltage drops, and surge voltage such as that caused by lightning (a phenomenon in which extraordinary high voltage occurs instantaneously).
- Under normal conditions, commercial power is converted to direct current, and then it is converted back to a stable sine wave AC power before it is output. When a commercial power failure is detected, the unit switches to battery supply to provide continuous sine wave output. This is especially suitable for use where power supply conditions are poor (for example, when there are large variations in voltage).
- This BESS also integrates WIFI module, users can monitor the operating status of the the whole system anytime, anywhere through the mobile phone APP.
- Output capacity is 3000W for BESS5, and backup battery storage is 5KWH.
- Battery type is the long life cycle LiFePo4 lithium battery.



Notes on the use of the Energy Storage System

- This product is designed and manufactured for use with home appliance or consumer electronics, such as TV, personal computers, etc.
Do not use it when very high reliability and safety are required as listed below.
 - Medical equipment that may cause death directly
 - Applications that may cause injury (applications that directly affect the operation and control of planes, ships, railroads, elevators, and so on)
 - Applications in which a failure of this product may cause significant damage or effect to the society and public (important computer systems, main communication equipment, public transportation systems, and so on)
 - Equipment with the same level of importance
- For equipment that greatly affects the safety of people and maintaining public functions, special considerations related to operation, maintenance, and management must be taken such as duplicating the system and emergency power generation facilities.
- Observe the contents of this manual such as the use conditions and environments.
- When you want to use this product for an important system that requires very high reliability, contact us: _____
- Do not modify/alter this product.

Disclaimers

We are not liable for any damage or secondary damage resulting from the use of our product, including malfunction and failure of equipment, connected devices, or software.

- Make sure to read the safety precautions before using the unit.
- In the event you transfer or sell this unit to a third party, please include all of the documentation that came with this unit. This is to ensure that the unit is used in line with the conditions described in the included documentation.
This manual contains important safety-related information. Please read and understand the contents of the manual before beginning operation.
If you discover any omissions or errors in the manual, please contact the shop of purchase.

Legal Notices

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This product confirms to environmental protection and personal security. Product storage, using and disposal should be in accordance with product manuals, relevant contract and national laws.

When required product updates or technical changes, you can visit website of Polinovel (<https://polinovel.com/> or <https://lithiumionlifepo4battery.com/>) for the latest information, without notice if the product improvements or technical change in other way.

Information Version: V1.0

Information Number: EX220-01

Revise History

Revision NO.	Revision Date	Revision Reason
1.0	2020.3.10	First Release

Safety Instructions

This BESS is designed and tested in strict accordance with relevant international safety standards. As electrical and electronic equipment, they must strictly abide by relevant safety regulations during their installation, operation, and maintenance. Improper use or misuse may cause:

- Hurt the life and personal safety of the operator or third party.
- Damage to the BESS or other property belonging to the operator / third party.

The content of this chapter mainly explains the warning signs used in this manual, and provides safety guidance on the entire use of the energy storage machine.

And, in any of the following situations, the company has the right not to perform quality assurance.





- Transport damage.
- Damage caused by storage conditions not meeting product documentation requirements.
- Incorrect equipment storage, installation and use.
- Unqualified personnel for equipment installation and use.
- Failure to follow the operating instructions and safety warnings in the product and documentation.
- Operate in harsh environments beyond the product and documentation.
- Operate beyond the parameters specified in the applicable technical specifications.
- Unauthorized dis-assembly, modification of the product or modification of the software code.
- Equipment damage caused by abnormal natural environment (force majeure, such as lightning, earthquake, fire, storm, etc.).
- The warranty period has been exceeded and the warranty service has not been extended.
- The task exceeds the installation and operating environment specified in the relevant international standards.

1. Save the safety instructions




This manual contains important instructions for BESS5 that should be followed when using the BESS and batteries.





2. Symbol

Warnings are used to warn of situations that could cause serious personal injury or death, or damage to the equipment, and give advice to avoid danger. The following warning signs are used in this manual.

Symbol	Name	Explanation of symbols
 Danger	Dangerous	Failure to follow relevant requirements may result in personal injury.
 Caution	Caution	Failure to follow relevant requirements may result in personal injury or equipment damage.
 Forbidden	Static sensitive	Failure to follow relevant requirements may result in damage.
 High Temperature	Watch out for high temperature	High temperature on the back and sides of the BESS. Do not touch.
NOTE	Note	Steps taken to ensure proper operation.

3. Safety instructions

	<ul style="list-style-type: none"> After receiving this product, please confirm that the product packaging is intact. If you have any questions, please contact the shipping company or your local dealer immediately. The installation and operation of the BESS must be completed by specialized technicians who have read and are familiar with all the contents of this manual and are familiar with the safety requirements of electrical systems. It is forbidden to perform operations such as connection and disconnection, unpacking inspection and replacement of components under power. Before performing wiring and inspection, you must first confirm that the DC and AC circuit breakers of the BESS have been cut off and wait at least 5 minutes.
	<ul style="list-style-type: none"> Make sure that no other electronic or electrical equipment generates strong electromagnetic interference around the installation site. Unauthorized modification of the BESS is strictly prohibited. All electrical installations must comply with local and national electrical standards.
	When the BESS is running, the casing or heat sink may generate high temperature. Do not touch it to avoid burns.

	<p>Must be reliably grounded before operation.</p>
	<p>Do not open the BESS housing without authorization. The internal electronic components of the BESS are electrostatic sensitive devices, anti-static measures must be taken when authorizing operations.</p>
	<p>Grounding identification. The BESS should be reliably grounded.</p>
	<p>Discharge identification. Before performing wiring and inspection, you must first confirm that the DC and AC circuit breakers of the BESS have been cut off and wait at least 5 minutes.</p>

4. Moving and installation precautions



- During storage and transportation, ensure that the packaging of the BESS and the case itself are complete, dry, and clean.
- The BESS is heavy. Moving and installation must be completed by two or more people.
- Choose appropriate handling and installation tools to ensure the normal and safe operation of the BESS and avoid personal injury. Installers must take mechanical protection measures to protect their personal safety, such as wearing anti-smashing shoes and working clothes.
- The installation of the BESS must be completed by professional technicians.
- Do not store, approach, or install the BESS on flammable or explosive objects.
- It is prohibited to install the BESS in a place where children and other members of the public can easily touch it.
- Before installing equipment and electrical connections, remove metal accessories such as rings, bracelets, etc. that are worn on your hands to avoid the risk of electric shock by accidentally touching conductive parts.
- PV modules exposed to sunlight can generate dangerous voltages. Be sure to cover the panels with a completely light-shielding material before making electrical connections.
- The input voltage of PV, battery, and commercial power of the BESS cannot exceed the maximum input voltage, otherwise the BESS may be damaged.
- The BESS is not suitable for the positive or negative grounding system of PV modules.
- Make sure that the BESS is installed firmly and the electrical wiring is reliable.

5. Grid operation precautions



- It must be approved by the local power department and be operated by a professional technician.
- All electrical connections must meet the national electrical standards.
- Before the BESS runs, please ensure that it is installed firmly and the electrical wiring is reliable.
- Do not open the housing of the BESS while it is working or under power.

6. Maintenance and repair precautions



- Maintenance, inspection and repair of the BESS must be performed by trained and qualified professional and technical personnel.
- Please contact the dealer or manufacturer for maintenance of the BESS.
- During the maintenance process, to prevent unrelated personnel from entering the maintenance area, temporary warning signs must be placed to warn non-professionals to enter or be fenced off.
- Before carrying out any maintenance operations, you must disconnect all input power to the BESS, be sure to wait at least 5 minutes until the internal capacitors of the BESS are discharged before performing maintenance work.
- Most of the internal are electrostatic sensitive circuits and devices. Please observe the electrostatic protection regulations and take anti-static measures.
- Maintenance of the BESS, the use of components not provided by the company is prohibited.
- After ensuring that any faults affecting the safety performance of the BESS have been eliminated, you can turn on the BESS again.
- It is forbidden to approach or touch any live metal conductor parts of the mains and running BESS, otherwise it may cause electric shock or death or fire. Please pay attention to any safety signs and instructions like “Danger of Live” .

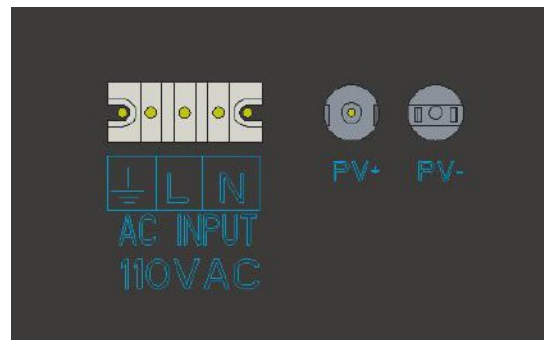
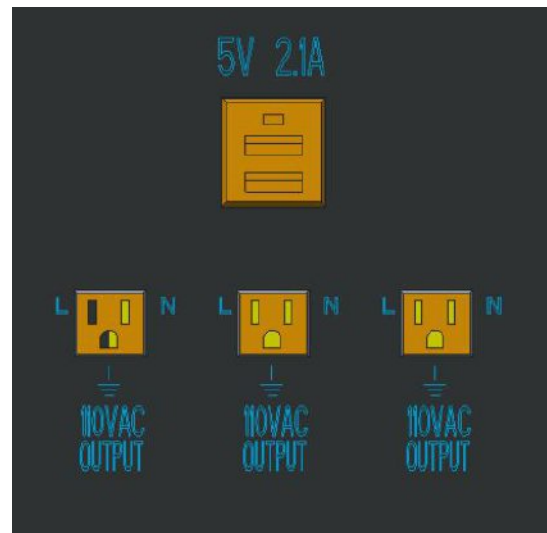
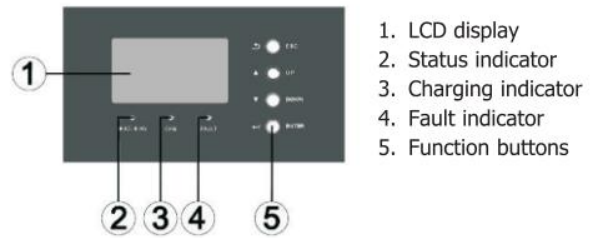
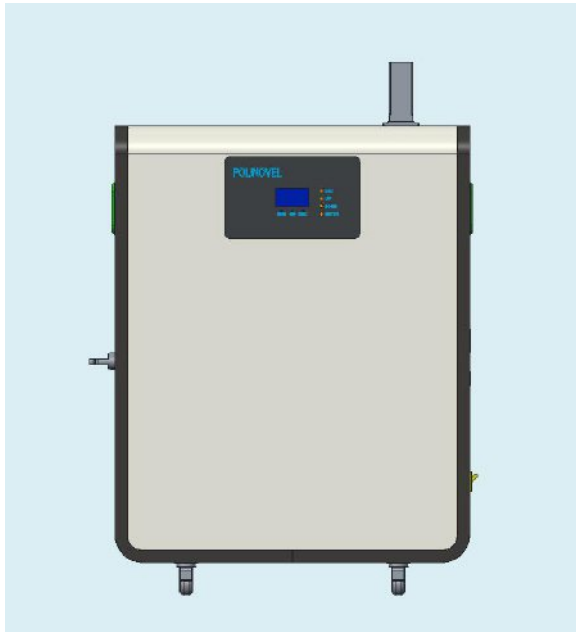
7. Scrap treatment precautions



- It is not allowed to discard the BESS with domestic waste. The user has the

responsibility and obligation to send it to the designated agency for recycling and disposal.

Product Overview



Preparation

1. Unpacking the product

Caution !

The approximate masses of the product is 85kg.
Unpack/transport this product considering this weight.

- Dropping may cause injury.



Open the package box and take out the BESS and accessories.

2. Checking the contents

Check whether all the package contents are included and there is no damage found on their appearance.

If you should notice defects or anything wrong, please contact the dealer immediately.





Accessories Checking List:

Name	Quantity
BESS	1 pc
MC4 connector	1 pair
CubeWiFi module	1 pc
BESS Instruction Manual (English)	1 pc
WiFi Monitoring Instruction Manual (English)	1 pc





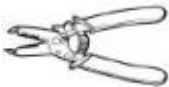











Installation and Connection

1. Preparation

1.1 Tools for personnel safety

			
Safety Gloves	Safety Glasses	Dust Mask	Safety Shoes

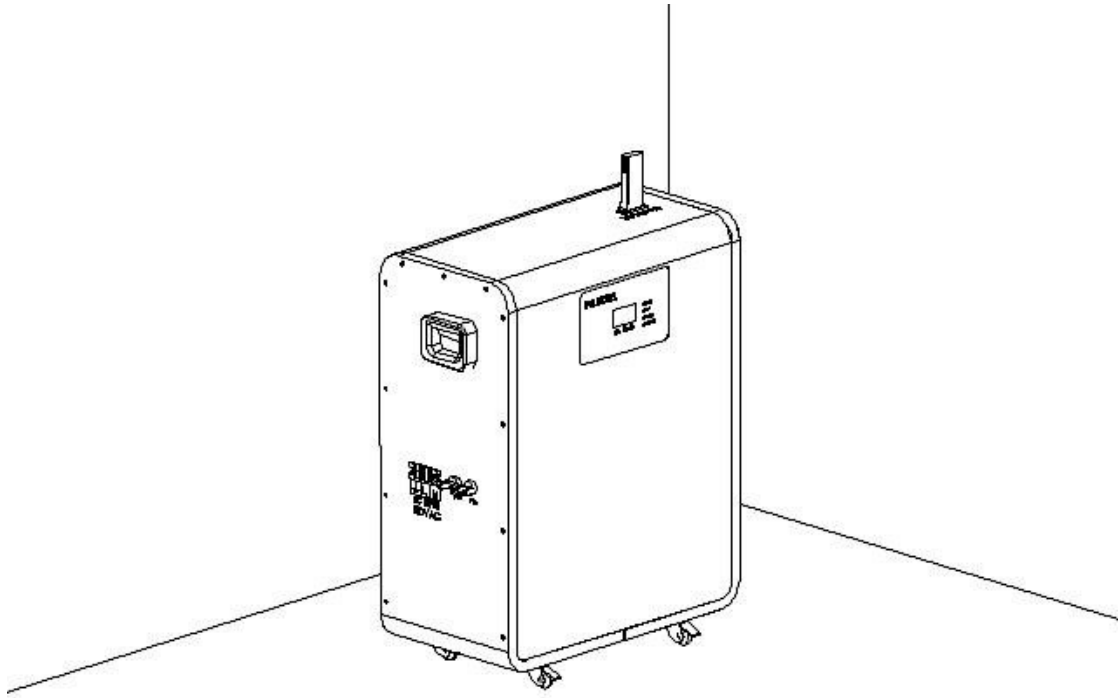
1.2 Tools for installation

 Torque socket wrench (13mm, suitable for M8 bolt, torque range: 0~15 N*m)	 Torque wrench (13mm/33mm, torque range: 0~1.5N*m)	 Torque screwdriver (M4/M6, torque range: 0~5N*m)	 Diagonal pliers
 Wire stripper	 Crimping tool	 Wire cutter	 Open-end wrench
 Knife	 Rubber hammer	 Cable tie	 Multimeter (DC voltage range $\geq 600V$ DC)
 Marker	 steel tape measure	 Heat-shrink tube	 Hot air gun

2. Installation and connection

The BESS permits the following position.

Do not use this unit in any position other than the “correct position” indicated in the illustration below.



Note

Before installing this device, make a record of the serial number of this device. The product serial number is required when contacting us about the device. The serial number (S/N) is on the left side of the product.

Caution !




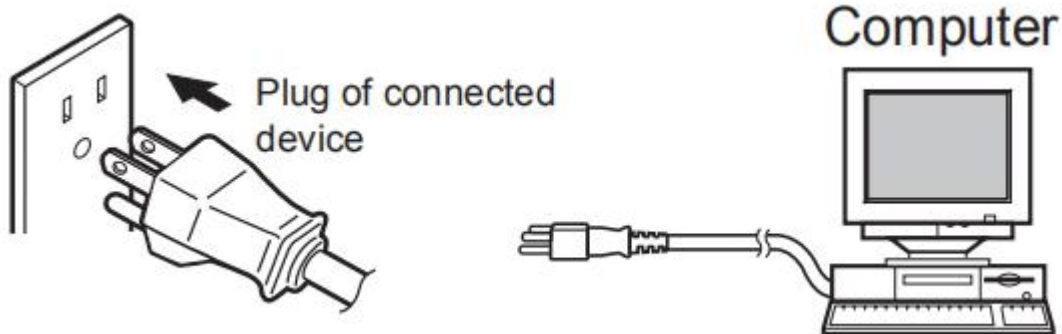
Make sure the BESS is switched off before you do any installation and connection.




2.1 Connecting a device to the power supply output

Connect devices (computer, server, peripherals, etc.) that require backup to the power supply output receptacle on the right side of the BESS.


Caution !	
<p>Do not connect devices with rated voltage over 100~120 VAC.</p> <ul style="list-style-type: none">● The rated output voltage of this BESS is 100~120VAC.● Over current may damage the connected devices.	



-  Make sure that the total power of devices connected to the output receptacle does not exceed the output power rating of this BESS. If the overload indicator appears, reduce the number of connected devices.

2.2 Connecting the AC input

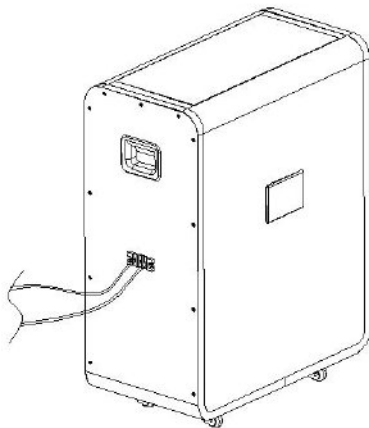
Connect the BESS AC input to a grid power source.


Caution !	
<p>Make sure to connect the AC input power source (grid power) with rated input voltage (100V to 120V AC).</p> <ul style="list-style-type: none">● Connecting to grid power of a different rated voltage may result in fire.● The unit may fail. <p>Before connecting to AC input power source, please make sure a separate AC breaker between the BESS and AC power source. This will ensure the BESS can be securely disconnected during maintenance and fully protected from over current of AC input. The recommended AC breaker is 32A.</p> <p>It is very important for system safety and efficient operation to use appropriate cable for AC input connection. To reduce risk of injury, please use the proper recommended cable size as below.</p> <p>Be sure that AC power source is disconnected before attempting to hardwire it to</p>	

the unit.

Recommended cable requirement for AC wires :

Model	Wire Size	Torque Value
BESS5	8AWG	1.4~1.6Nm



Please insert AC input wires according to polarities indicated on terminal block and tighten the terminal screws. Be sure to connect the PE protective conductor  first.



Ground (yellow or green)



LINE (brown or black)



Neutral (blue)

Double check and make sure the wires are securely connected.

The unit was charged before shipment, but it may have self-discharged during shipment, resulting in a reduced backup time. We recommend charging the unit before use. When all installation is finished, AC input is connected to grid power, switching on the BESS, the battery automatically starts charging.

2.3 Connecting the PV input

Caution !

Before connecting to PV modules, please install separately a DC circuit breaker between BESS and PV modules.



It is very important for system safety and efficient operation to use appropriate cable for PV module connection. To reduce risk of injury,

please use the proper recommended cable size as below.

Recommended cable and terminal size:

Model	Typical Amperage	Cable Size	Torque Value
BESS5	80A	6AWG	1.4~1.6Nm

PV Module Selection:

When selecting proper PV modules, please be sure to consider below parameters:

1. Open circuit Voltage (Voc) of PV modules not exceeds max. PV array open circuit voltage of the unit.
2. Open circuit Voltage (Voc) of PV modules should be higher than min. battery voltage.

Solar Charging Mode:	
BESS Model	BESS5
Max. PV Array Open Circuit Voltage	145Vdc
PV Array MPPT Voltage Range	60~115Vdc
Min. battery voltage for PV charge	34Vdc

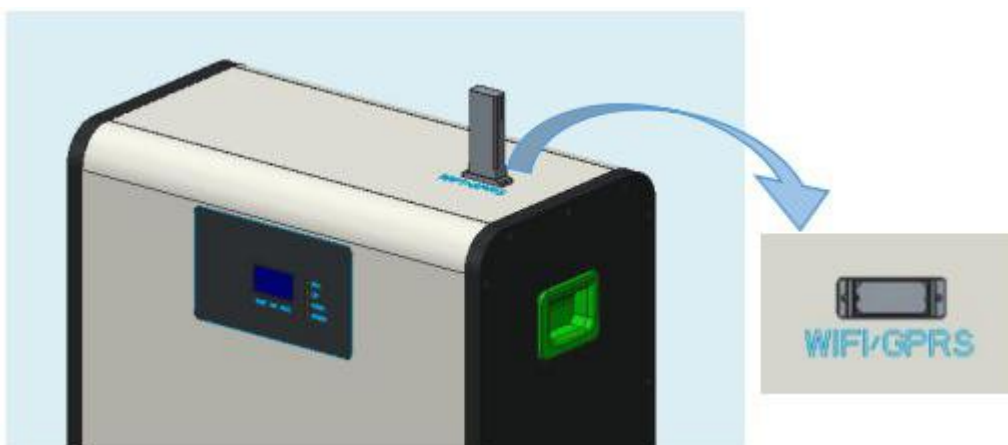
Please follow below steps to implement PV module connection:

1. Check if the PV module is with MC4 connector. If no, modify your PV modules with MC4 connectors;
2. Check correct polarity of connection cable from PV modules and PV input connectors. Then, connect positive pole (+) of connection cable to positive pole (+) of PV input connector. Connect negative pole (-) of connection cable to negative pole (-) of PV input connector.
3. Make sure the wires are securely connected.

2.4 Communication Connection

This BESS adopt WIFI/GPRS communication, connection of the communication is the same as it for the built-in inverter of this BESS.

Step 1: Plug CubeWiFi module into the WiFi/GPRS port.



Turn on the BESS, red LED flashing indicates the BESS and CubeWiFi module communication is normal.

Step 2: Download PVbutler APP

Re-connect your cellphone to your own WLAN WiFi, scan the QR code as below to download PVbutler APP, or go to the website: <http://server.pvbutler.com> download and install it.

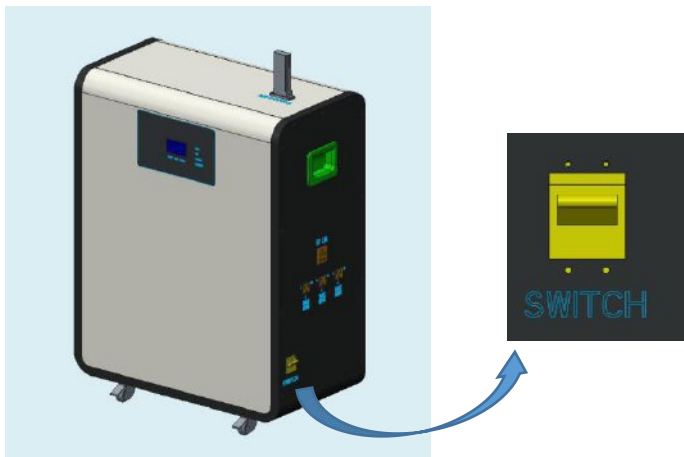


Android & iOS

Please follow the other steps on the instruction of “Wifi Monitoring Instruction (PVbutler)” .

Operation

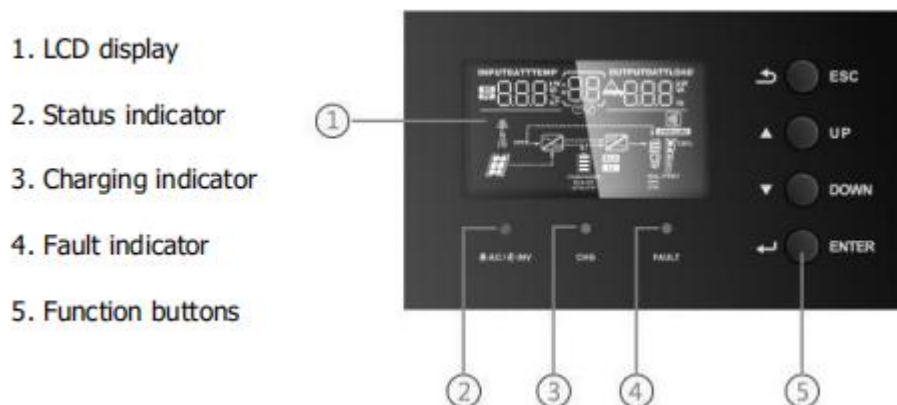
1. Power ON/OFF



Once the unit has been properly installed, simply press On/Off switch (located on the button of the front side) to turn on the unit.

2. Operation and Display Panel

The operation and display panel, shown in below chart, is on the front panel of the BESS. It includes three indicators, four function keys and a LCD display, indicating the operating status and input/output power information.



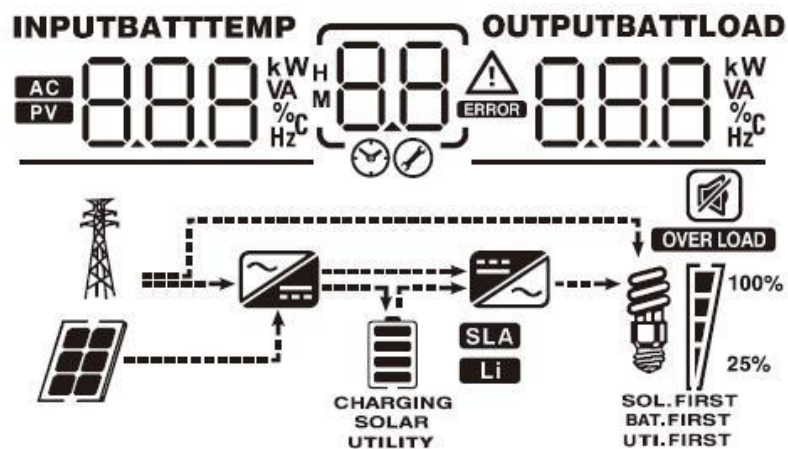
LED Indicator

LED Indicator		Messages	
☀️ AC / 🔌 INV	Green	Solid On	Output is powered by utility in Line mode.
		Flashing	Output is powered by battery or PV in battery mode.
☀️ CHG	Green	Solid On	Battery is fully charged.
		Flashing	Battery is charging.
⚠️ FAULT	Red	Solid On	Fault occurs in the inverter.
		Flashing	Warning condition occurs in the inverter.





Function Buttons

Button	Description
ESC	To exit setting mode
UP	To go to previous selection
DOWN	To go to next selection
ENTER	To confirm the selection in setting mode or enter setting mode


3. LCD Display Icons




Icon	Function Description
Input Source Information	
AC	Indicates the AC input.
PV	Indicates the PV input
INPUTBATT 888 kW VA %C Hz	Indicate input voltage, input frequency, PV voltage, battery voltage and charger current.
Configuration Program and Fault Information	


	Indicates the setting programs.
	<p>Indicates the warning and fault codes.</p> <p> Warning: flashing with warning code.</p> <p> Fault: lighting with fault code</p>

Output Information

<p>OUTPUTBATTLOAD</p> 	Indicate output voltage, output frequency, load percent, load in VA, load in Watt and discharging current.
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Battery Information





	Indicates battery level by 0-24%, 25-49%, 50-74% and 75-100% in battery mode and charging status in line mode.
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	These two signs indicate the charge priority. SOLAR indicates solar first. UTILITY indicate utility first. SOLAR blinking indicates solar only; SOLAR and UTILITY both on indicates combined charging.
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In AC mode, it will present battery charging status.

Status	Battery voltage	LCD Display
	<2V/cell	4 bars will flash in turns.
Constant Current mode / Constant	2 ~ 2.083V/cell	Bottom bar will be on and the other three bars will flash in turns.
	2.083 ~ 2.167V/cell	Bottom two bars will be on and the other two bars will flash in turns.
Voltage mode	> 2.167 V/cell	Bottom three bars will be on and the top bar will flash.
Floating mode. Batteries are fully charged.		4 bars will be on.

In battery mode, it will present battery capacity.

Load Percentage	Battery Voltage	LCD Display
Load >50%	< 1.717V/cell	
	1.717V/cell ~ 1.8V/cell	
	1.8 ~ 1.883V/cell	
	> 1.883 V/cell	

50% > Load > 20%	< 1.817V/cell	
	1.817V/cell ~ 1.9V/cell	
	1.9 ~ 1.983V/cell	
	> 1.983	
Load < 20%	< 1.867V/cell	
	1.867V/cell ~ 1.95V/cell	
	1.95 ~ 2.033V/cell	
	> 2.033	

Load Information

	Indicates overload.			
	Indicates the load level by 0-24%, 25-49%, 50-74% and 75-100%.			
	0%~24%	25%~49%	50%~74%	75%~100%

Mode Operation Information

	Indicates unit connects to the mains.
	Indicates unit connects to the PV panel.
	Indicates load is supplied by utility power.
	Indicates the utility charger circuit is working.
	Indicates the DC/AC inverter circuit is working.
SOL.FIRST BAT.FIRST UTI.FIRST	These three signs indicate the output priority. SOL.FIRST indicates solar first. BAT.FIRST indicates battery first. UTI.FIRST indicates utility first.

Mute Operation

	Indicates unit alarm is disabled.
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Specification

NO.	Item	General Parameter	Remark
Battery Specification			
1	Cell Model	IFR 32700-5Ah	Single cell capacity 5Ah
2	Casing Material for Single Cell	Nickel plated steel	
3	Nominal Capacity (0.2C ₅ A)	100Ah	Battery pack capacity
4	Nominal Voltage	51.2V	Single cell voltage: 3.2V
5	Nominal Energy	5.12KWh	
6	Max Charge Voltage	58.4V	
7	Discharge Cut-off Voltage	44V	
8	Allowed Max Constant Charge Current	80A	
9	Allowed Max Discharge Power	3KW	
10	Allowed Max Cont. Discharge Current	100A	
11	Allowed Max Pulse Discharge Current	130A	< 1 second
PV Input (DC)			
12	MPPT Voltage Range	60~115Vdc	
13	Max Charging Current	60A	
14	MPPT Tracker	1	
15	Input Terminal	1	
AC Input (AC)			

16	AC Input Voltage	100/110/120Vac	
17	Grid Voltage Range	120 ($\pm 2\%$) Vac	
18	Nominal Frequency	50/60Hz	
19	Max Input Current	20A \pm 5A	
AC Output (AC)			
20	Nominal Output Voltage	100/110/120Vac	
21	Nominal Output Frequency	50/60 (± 0.3) Hz	
22	Rated Output Power	3KW	(Overload: 110% rated, 10s)
23	Type of Phase	Single Phase	
Efficiency			
24	Inverter Efficiency	93%	
25	Lithium Battery Efficiency	100%	
26	System Efficiency	95%	
Environmental Conditions			
27	Working Temperature & Humidity Range	0~60°C, $\leq 75\%$ RH	
28	Storage Temperature & Humidity Range	0~45°C, 45%~75%RH	
29	Installation Altitude (above sea level)	<2000m	
Safety Protection			
30	IP Level	IP54	
31	BMS Protection	Yes	Refer to the BMS specifications
32	Inverter Short Circuit Protection	440A	10S
33	Master Switch	Yes	
Others			
34	DC Output	2 x USB DC 5V 2.1A	
35	Communication	WIFI/GPRS	
36	Certification (Battery Cell)	CE-EMC, UN38.3, MSDS	
37	Product Size (HxWxD)	861x706x355 (± 3) mm	
38	Product Weight	116 kg	

39	Plywood Packing Size (HxWxD)	940x750x545 (±5) mm	
40	Gross Weight	137 kg	

Built-in LiFePo4 Battery BMS Protection Parameters		
Function	Item	Technical Parameters
Over-voltage Protection	Single cell over-voltage protection	3.8V
	Single cell over-voltage protection recover	3.4V
	Battery pack over-voltage protection	58.4V
	Battery pack over-voltage protection recover	50.6V
Low-voltage Protection	Single cell low-voltage protection	2.65V
	Single cell low-voltage protection recover	3.0V
	Battery pack low-voltage protection	44V
	Battery pack low-voltage protection recover	45V
Temperature Protection	Charge over-temperature protection	60°C
	Charge over-temperature protection recover	50°C
	Charge low-temperature protection	0°C
	Charge low-temperature protection recover	5°C
	Discharge over-temperature protection	60°C
	Discharge over-temperature protection recover	55°C
	Discharge low-temperature protection	-20°C
	Discharge low-temperature protection recover	-10°C
Over-current Protection	Charge/Discharge over-current protection	130A, 1S
	Short circuit protection	440A, 400uS
	Recover method	Restart

Storage & Transportation

Storage

If the BESS is not put into use immediately, the storage must meet the following requirements:

- Do not remove the outer packaging of the BESS.
- The BESS needs to be stored in a clean and dry place, protected from dust and moisture.
- Storage temperature should be maintained at 0 °C ~ +45 °C , relative humidity should be maintained at 45% RH ~ 75% RH.
- Avoid chemically corrosive substances, otherwise the BESS may be corroded.
- During storage, regular inspection is required. If there is any bite or damage to the package, it is necessary to replace the packaging materials in time.
- After long-term storage, the BESS needs to be inspected and tested by professionals before being put into use.

Transportation

Based on the character of battery cell, proper environment for transportation of LiFePO4 battery pack need to be created to protect the battery.

- The BESS should be packed in boxes for delivery, and well prevented from vibration, shock, extrusion, sun-scorched and rain-drenched.
- The BESS should be delivered under the state of half charged (50% SOC).
- During the transportation, the BESS should be well prevented from short circuit.
- During loading of the BESS, handle lightly, do not drop, throw, turn over the BESS, or stack heavy goods on the BESS.

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