

SunVault "Apocalypse" Lithium Ion Battery

LiFePO4 Powered Energy Storage Solution

User Manual V1.1



Read the instruction manual before installation and operation.

The information include in this manual is accurate at the time of publication. However, this manual is subject to change without prior notice. In addition, the illustrations in this manual are meant only to help explain system configuration concepts and installation instructions. Please note the image shown is for illustration purposes only.

Warning: Read this entire document before installing or using this product. Failure to do so or to follow any of the instructions or warning in this document can result in electrical shock, serious injury, or death, or can damage this product, potentially rendering it inoperable.

After installation, the installer must explain the manual to the end-user and keep this manual nearby the product for future reference.

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1 Safety Information

1.1 Symbols



Caution, risk of electric shock



Do not place or install near flammable or explosive materials



Install the product out of reach of children.



Read the instruction manual before starting installation and operation.



Heavy weight may cause serious injury to the back.



Do not dispose of the product with household wastes.



Recyclable



Disconnect the equipment before carrying out maintenance or repair.

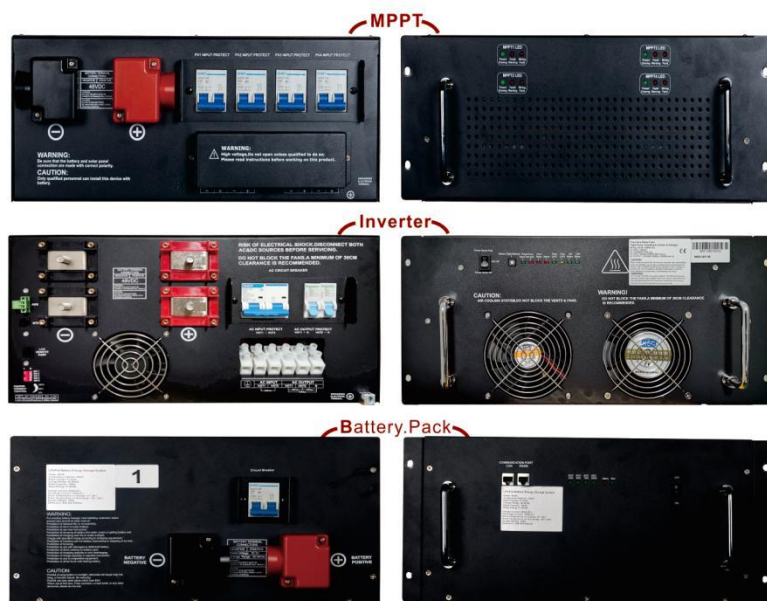
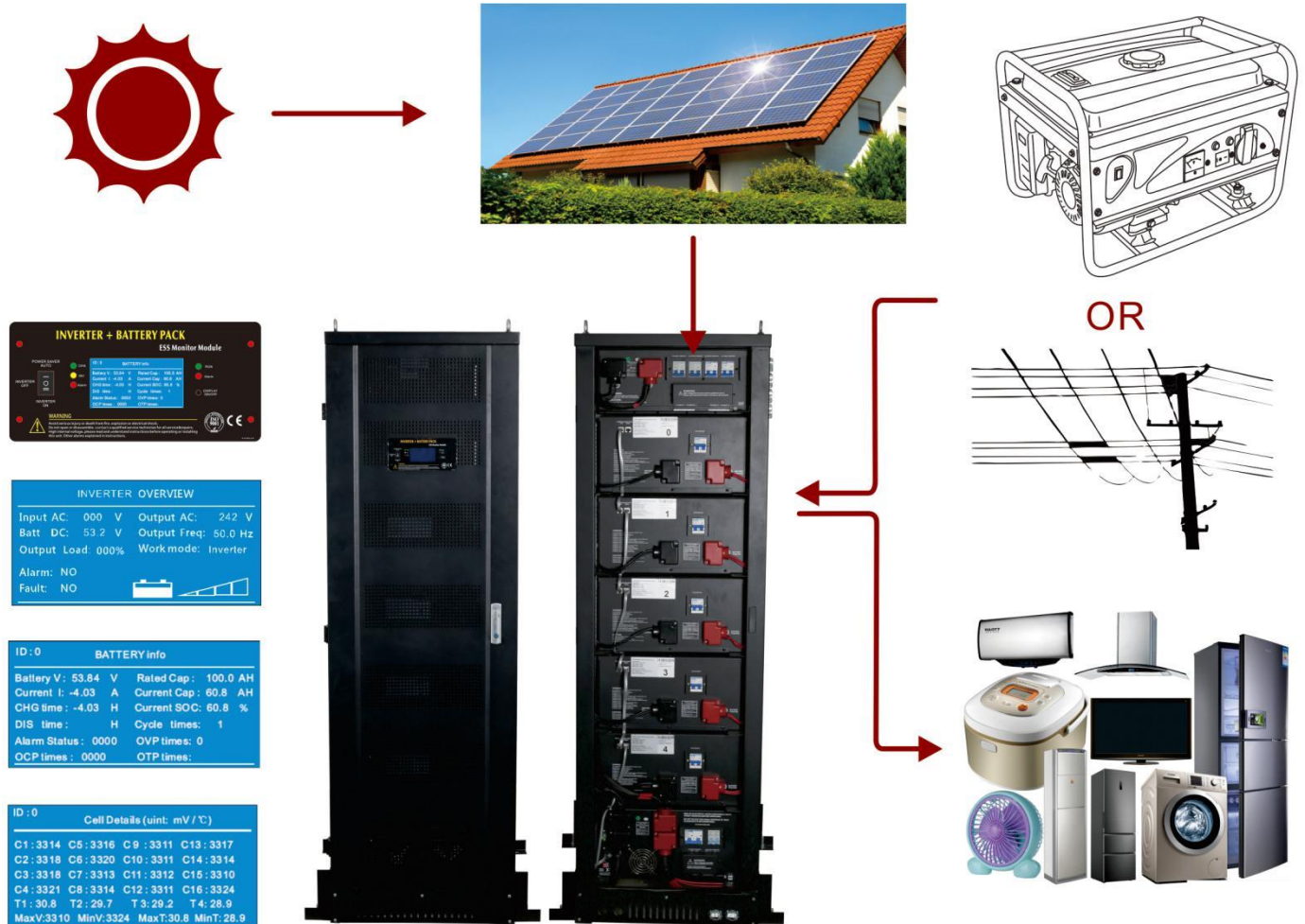


Observe precautions for handling electrostatic discharge sensitive devices.

1.2 Introduction

1.2.1 System Introduction

Our Lithium ESS works both in off grid and AC coupled systems to help users to achieve energy independence. It optimizes integration of solar, utility, generator-off grid and protects your home and mission critical business functions from power outages and brownouts.



Loads Power Source

Day-time(battery priority mode):

PV power > loads power: PV → MPPT → inverter → loads
 battery

PV power = loads power: PV → MPPT → inverter → loads

PV power < loads power: PV → MPPT → inverter → loads
 Battery → inverter → loads

Night-time(battery priority mode):

Battery Full: battery → inverter → loads

Battery Low alarm: City power → inverter → loads
 battery charging

OR

City power → inverter → loads

1.2.2 Safety Instructions

For safety reasons, installers are responsible for familiarizing themselves with the contents of this document and all warnings before performing installation.

1.2.3 General Safety Precautions

DANGER!!

Danger to life due to high voltages of the PV array and electric shock.

When exposed to sunlight, the PV array generates dangerous DC voltage which will be present in the DC conductors. Touching the DC conductors or the live components can lead to lethal electric shocks. If you disconnect the DC connectors from the system under load, an electric arc may occur leading to electric shock and burns.

Do not touch uninsulated cable ends.

Do not touch the DC conductors.

Do not open the inverter and battery.

Do not wipe the system with damp cloth.

Have the system installed and commissioned by qualified people with the appropriate skills best.

Prior to performing any work on the inverter or the battery pack, disconnect the inverter from all voltage sources as described in this document.

WARNING!!

Risk of chemical burns from electrolyte or toxic gases.

During standard operation, no electrolyte shall leak from the battery pack and no toxic gases shall form. Despite careful construction, if the Battery Pack is damaged or a fault occurs, it is possible that electrolyte may be leaked or toxic gases formed.

Do not install the system in any environment of temperature below -10°C or over 50°C and in which humidity is over 85%.

Do not touch the system with wet hands.

Do not put any heavy objects on top of the system.

Do not damage the system with sharp objects.

Do not install or operate the system in potentially explosive atmospheres or areas of high humidity.

Do not install or operate the system in areas containing highly flammable materials or gases.

Do not expose or place near water sources like downspouts or sprinklers.

Do not store this product in a place exposed to direct sunlight.

A ventilated area is strongly recommended for handling the product.

Store at cool and dry place. (Do not store in greenhouses and storage areas for hay, straw, chaff, animal feed, fertilizers, vegetables or fruit products.)

Store the product on a flat surface.

Store the product out of reach of children and animals.

Store the product where it should be minimal dust and dirt in the area.

Do not disconnect, disassemble or repair by unqualified personnel. Service must be made by qualified personnel only.

Do not step on the product or the product package. The product may be damaged.

Do not place any foreign objects on the top of the Battery Pack.

The system only be installed indoors

If moisture has penetrated the system (e.g. due to a damaged enclosure), do not install or operate the system.

Do not move the system when it is working.

Secure the system to prevent tipping with restraining straps in your vehicle.

In case of contact with electrolyte, rinse the affected areas immediately with water and consult a doctor without delay.

1.2.4 Response to Emergency Situations

The system comprises multiple batteries and Sophisticated BMS that are designed to prevent hazards resulting from failures. However, we cannot guarantee their absolute safety if battery is mishandled. If a user happens to be exposed to internal materials of the battery cell due to damage on the outer casing, the following actions are recommended.

Inhalation: Leave the contaminated area immediately and seek medical attention.

Eye contact: Rinse eyes with running water for 15 minutes and seek medical attention.

Contact with skin: Wash the contacted area with soap thoroughly and seek medical attention

Ingestion: Induce vomiting and seek medical attention.

If a fire breaks out in the place where the battery pack is installed, perform the following countermeasures:

Fire extinguishing media

Respirator is not required during normal operations.

Use FM-200 or CO2 extinguisher for battery fire.

Use an ABC fire extinguisher, if the fire is not from battery and not spread to it yet.

Firefighting instructions

If fire occurs when charging batteries, if it is safe to do so, power off the switch.

If the battery pack is not on fire yet, extinguish the fire before the battery pack catches fire.

If the battery pack is on fire, do not try to extinguish but evacuate people immediately

Effective ways to deal with accidents

On land: Place damaged battery into a segregated place and call local fire department or service engineer.

In water: Stay out of the water and do not touch anything if any part of the battery, inverter, or wiring is submerged.

Do not use submerged battery again and contact the service engineer.

1.3 Qualified Personnel

This guide and the tasks and procedures described herein are intended for use by skilled workers only. A skilled worker is defined as a trained and qualified electrician or installer who has all of the following skills and experience:

Knowledge of the functional principles and operation of on-grid and off-grid (backup) systems.

Knowledge of the dangers and risks associated with installing and using electrical devices and acceptable mitigation methods.

Knowledge of the installation of electrical devices

Knowledge of and adherence to this guide and all safety precautions and best practice



Make sure all power is off and wires are disconnected when maintaining/servicing the battery

2 Product Introduction

2.1 General Information

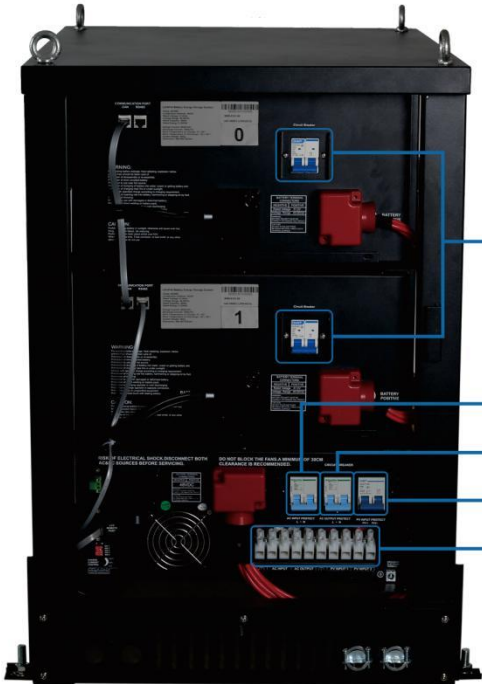

Our "apocalypse" system is a high-tech product researched and developed. With its integration, miniaturization, light-weight, intelligent centralized monitoring, battery maintenance and management, unattended, energy conservation and environmental protection, are widely applied in remote access network equipment, remote switch unit, mobile communication, transmission equipment, home storage and other areas as a backup power supply.


2.2 Product Features

- Truly Plug & Play/ ALL -In- One Design Make the system performance best
- 19" Standard Rack Design for all module
- Long Cycle Life LFP Battery energy from 10Kwh——46Kwh optional
- 60-145Vdc PV range MPPT Built-in, Solar energy input from 6Kw——14Kw optional
- 6Kw——15Kw Low Frequency Pure Sinewave Inverter & Charger Built-in
- Central LCD displays all module working information and status

2.3 System Appearance

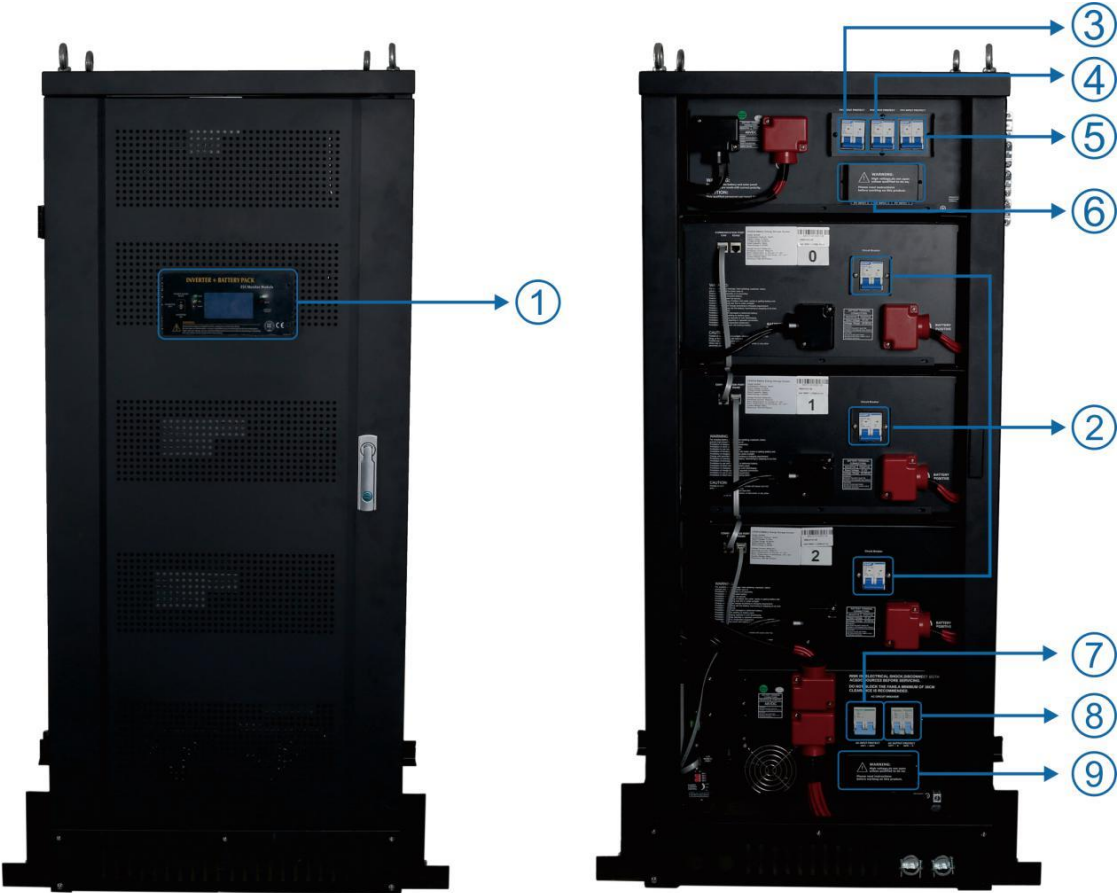
Model	Configuration			
ESS6048E200100	MPPT	INVERTER	BATTERY	ENERGY
	100A(50A*2)	6KW	200AH(100AH*2)	10.24kwh





①	LCD module
②	Battery breaker
③	AC input breaker
④	AC output breaker
⑤	PV input breaker
⑥	Wiring terminal
⑦	Battery pack ID 0
⑧	Battery pack ID 1
⑨	Inverter with MPPT

Model	Configuration			
ESS 8048E300150	MPPT	INVERTER	BATTERY	ENERGY
	150A(50A*3)	8KW	300AH(100AH*3)	15.36kwh



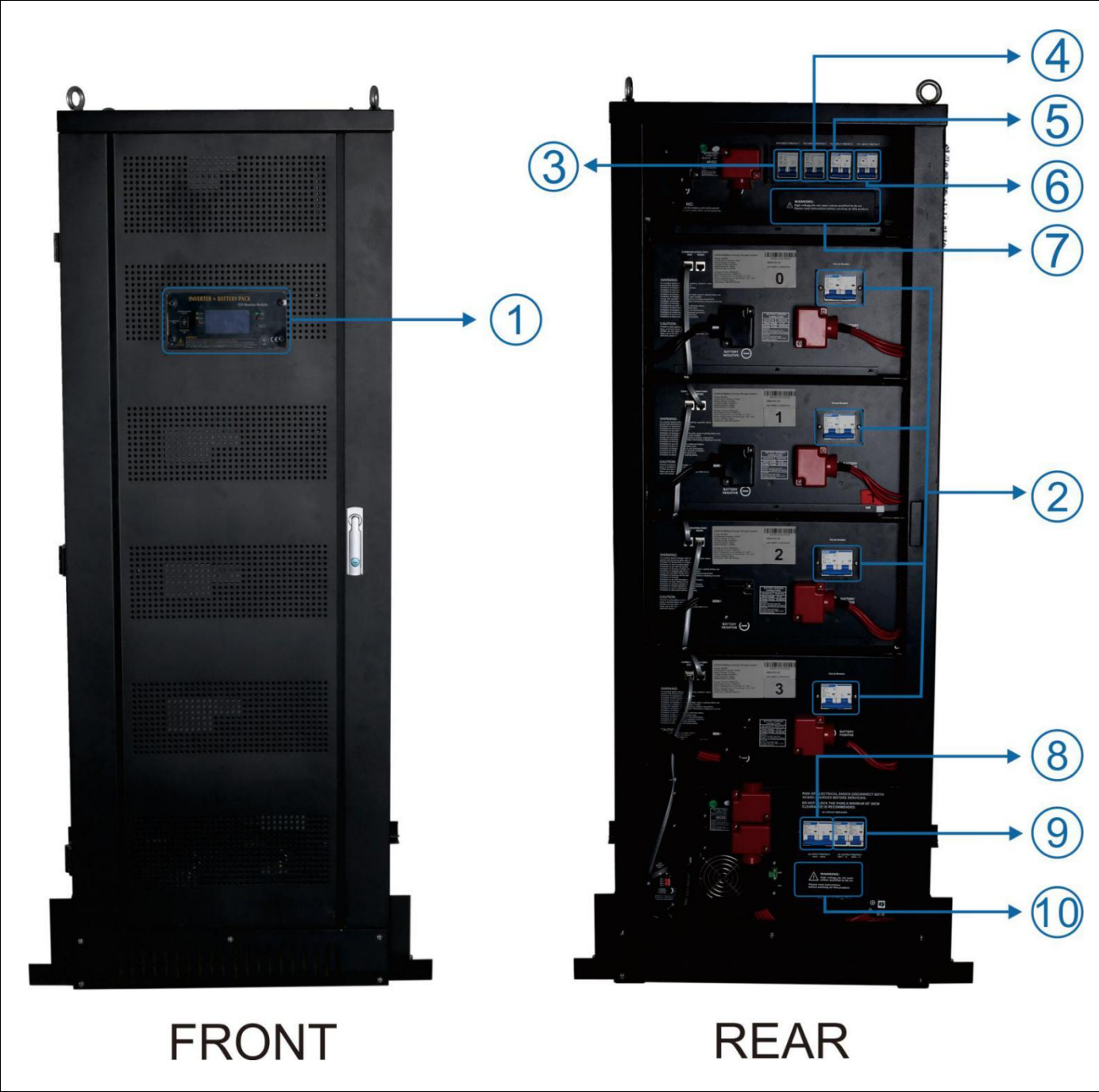
FRONT

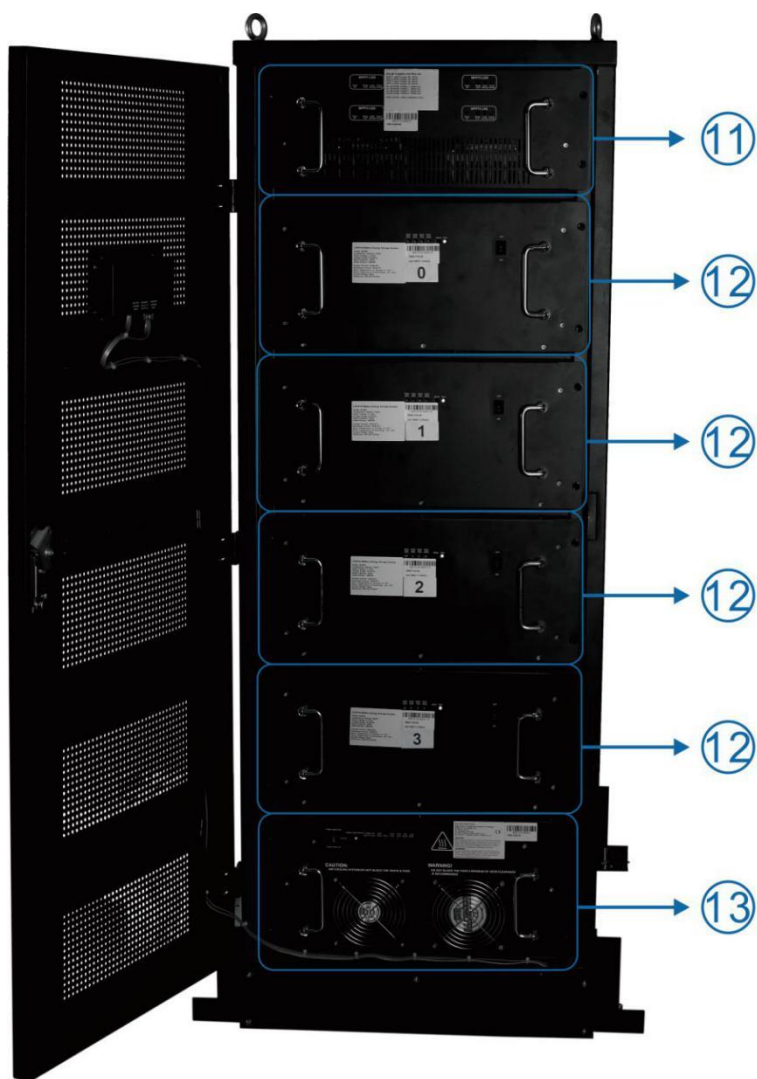
REAR



①	LCD module
②	Battery breaker
③	PV3 input breaker
④	PV2 input breaker
⑤	PV1 input breaker
⑥	PV input terminal
⑦	AC input breaker
⑧	AC output breaker
⑨	AC terminal
⑩	MPPT module
⑪	Battery pack 0 1 2
⑫	Inverter module

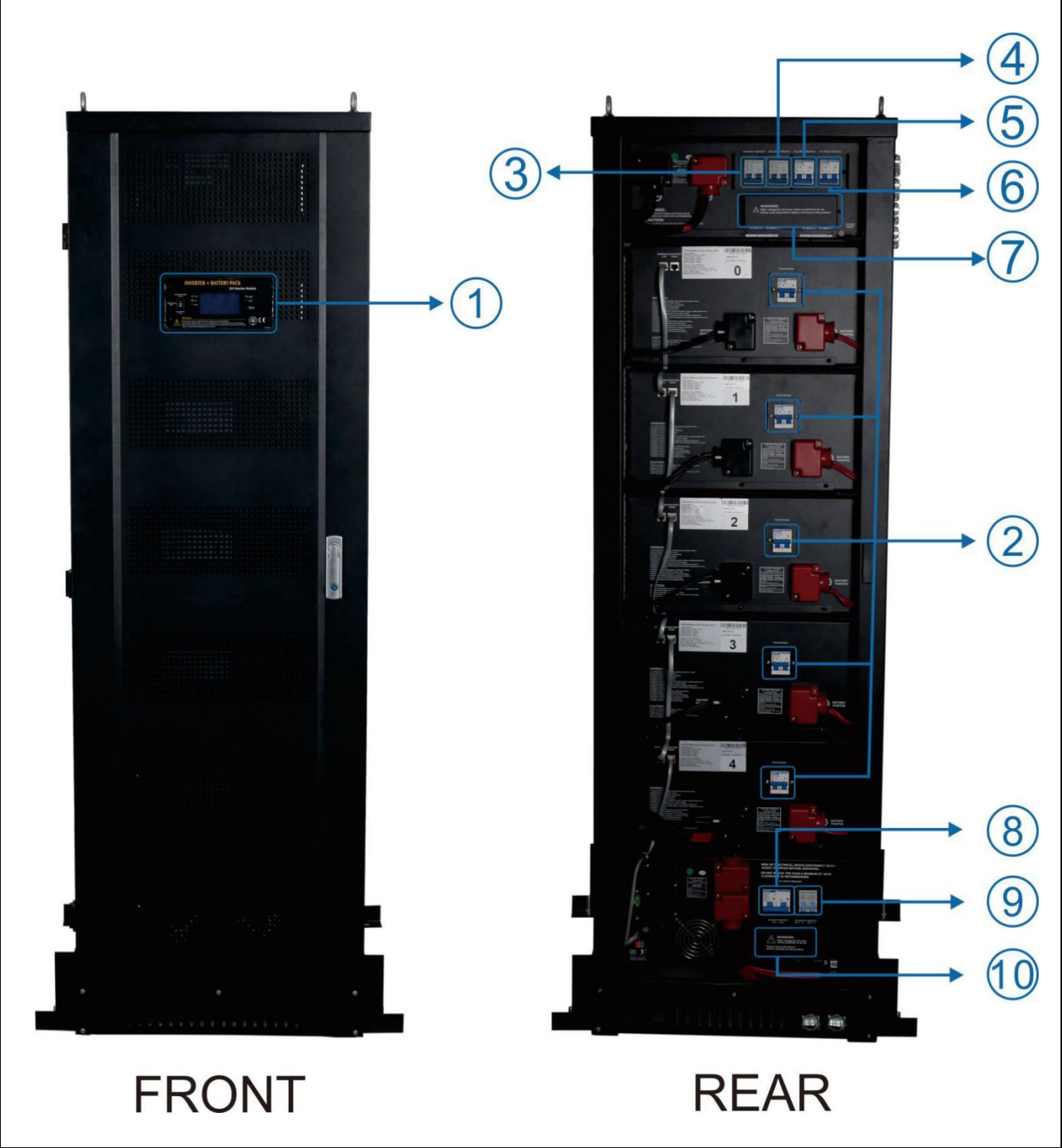
Model	Configuration			
ESS 10048E400200	MPPT	INVERTER	BATTERY	ENERGY
	200A(50A*4)	10KW	400AH(100AH*4)	20.48kwh
ESS 12048E640240	240A(60A*4)	12KW	640AH(160AH*4)	32.77kwh
ESS 15048E720240	240A(60A*4)	15KW	720AH(180AH*4)	36.86kwh

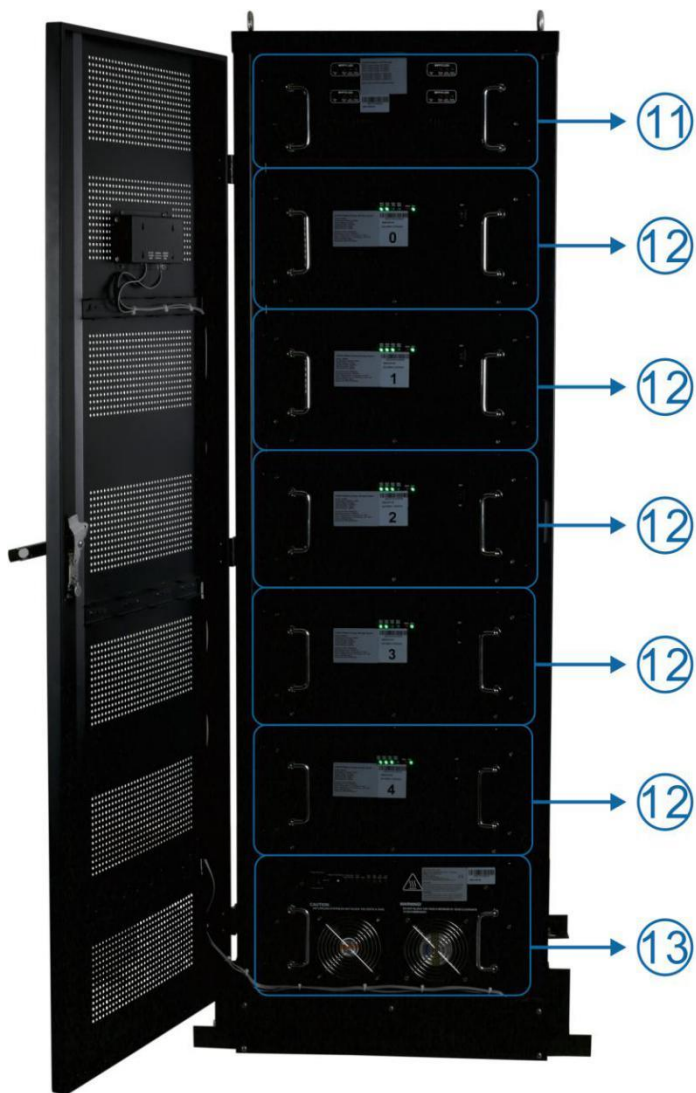




①	LCD module
②	Battery breaker
③	Pv4 input breaker
④	PV3 input breaker
⑤	PV2 input breaker
⑥	PV1 input breaker
⑦	PV input terminal
⑧	AC input breaker
⑨	AC output breaker
⑩	AC terminal
⑪	MPPT module
⑫	Battery pack 0 1 2 3
⑬	Inverter module

Model	Configuration			
ESS 12048E500240	MPPT	INVERTER	BATTERY	Energy
	240A(60A*4)	12KW	500AH(100AH*5)	25.6kwh
ESS 15048E800240	240A(60A*4)	15KW	800AH(160AH*5)	40.96kwh
ESS 15048E900240	240A(60A*4)	15KW	900AH(180AH*5)	46.08kwh





①	LCD module
②	Battery breaker
③	Pv4 input breaker
④	PV3 input breaker
⑤	PV2 input breaker
⑥	PV1 input breaker
⑦	PV input terminal
⑧	AC input breaker
⑨	AC output breaker
⑩	AC terminal
⑪	MPPT module
⑫	Battery pack 0 1 2 3 4
⑬	Inverter module

2.4 System specification

ESS Basic Specification									
NO	Model	ESS 6048E 200100	ESS 8048E 300150	ESS 10048E 400200	ESS 12048E 500240	ESS 12048E 640240	ESS 15048E 720240	ESS 15048E 800240	ESS 15048E 900240
1	Battery Rated Voltage	51.2Vdc							
2	Battery Rated Capacity	200Ah	300Ah	400Ah	500Ah	640Ah	720Ah	800Ah	900Ah
3	Battery Rated Energy	10.24KWH	15.36KWH	20.48KWH	25.6KWH	32.77KWH	36.86KWH	40.96KWH	46.08KWH
4	Battery Configuration	5.12*2PCS	5.12*3PCS	5.12*4PCS	5.12*5PCS	8.2*4PCS	9.22*4PCS	8.2*5PCS	9.22*5PCS
5	Battery Cell Quantities	3.2V50AH 64PCS	3.2V50AH 96PCS	3.2V50AH 128PCS	3.2V50AH 160PCS	3.2V80AH 128PCS	3.2V90AH 128PCS	3.2V80AH 160PCS	3.2V90AH 160PCS
6	Rated Charge Voltage	56.0Vdc							
7	Max Charge Voltage	56.8Vdc							
8	Overcharge Protection	58.4Vdc							
9	Rated Charge Current(total)	100A	150A	200A	250A	300A	360A	375A	450A
10	Max Charge Current(total)	120A	180A	240A	300A	360A	432A	450A	540A
11	Over Charge Protection Release	Restart or Discharge Battery							

12	Charge Temp Range	0~45°C							
13	Output Voltage Range	40~56Vdc (46Vdc or 48Vdc inverter cut off by SW1 setting)							
14	Rated Discharge Current(total)	200A	300A	400A	500A	600A	720A	750A	900A
15	Max Discharge Current(total)	240A	360A	480A	600A	720A	864A	900A	1080A
16	Over Discharge Protection Release	Charging or Cut off loads and Restart							
17	Discharge Temp Range	-20~60°C							
18	Communication	RS485 for LCD / CAN for PC monitor							
Inverter (built-in)		HP6048R	HP8048R	HP10048R	HP12048R	HP12048R	HP15048R	HP15048R	HP15048R
1	INV Rated power	6KW	8KW	10KW	12KW	12KW	15KW	15KW	15KW
2	Output Waveform	Pure Sine Wave/Same as input (Bypass Mode)							
3	Efficiency	>88%(Peak) Inverter mode / >95% Line mode							
4	Power Factor	0.9-1.0							
5	Inverter Output Voltage	220Vac or 230Vac or 240Vac or 110Vac or 120Vac (L-N) & 240Vac(H-H)/120Vac(H-N) ±10% RMS							
6	Inverter Output Frequency	50 or 60± 0.3Hz (Inverter mode by sw4 setting)							
7	Typical Transfer Time	4-6ms typical,10ms(Max)							

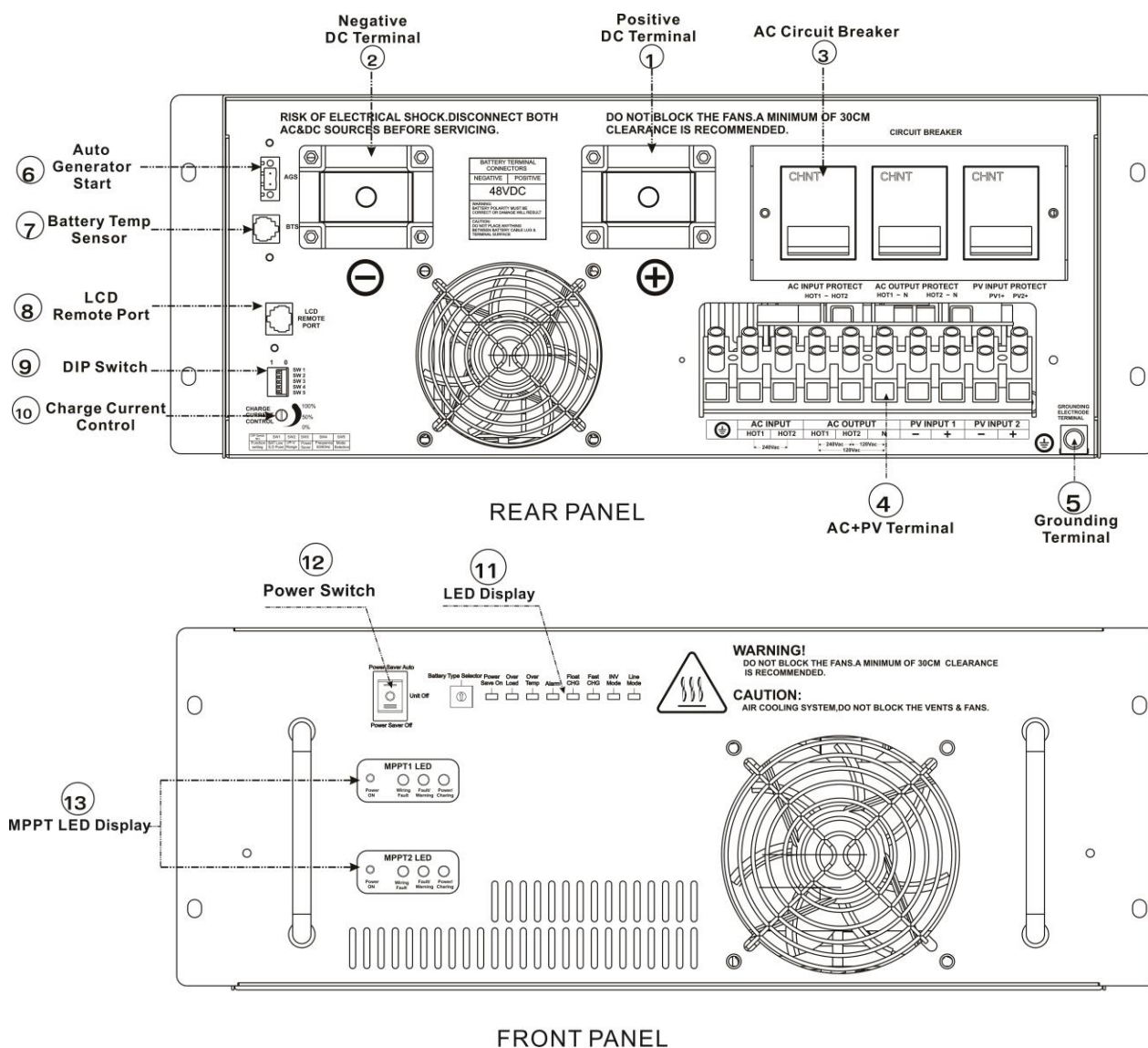
8	THD	< 3%(Rated voltage full R load)							
9	AC Input Range	184-253Vac (UPS mode) or 140-270Vac (GEN mode) / 96-135(UPS mode) or 80-135Vac (GEN mode)							
10	Customized AC Charger	Battery type selector position 9, special design for LFP, make the battery cycle life Maximization							
11	MAX AC Charge Current	60A	80A	100A	120A	120A	140A	140A	140A
12	Battery priority Function	setting by SW5 on position 1 (inverter mode valid), AC automatic come in when battery voltage low alarm at 48Vdc or 50Vdc							
13	AC Bypass without charging	Battery type selector position 0							
MPPT (built-in)		50A*2	50A*3	50A*4	60A*4	60A*4	60A*4	60A*4	60A*4
1	PV power	3KW*2	3KW*3	3KW*4	3.5KW*4	3.5KW*4	3.5KW*4	3.5KW*4	3.5KW*4
2	PV Input groups	2	3	4	4	4	4	4	4
3	PV Input range	60-145Vdc							
4	MPPT Charging Voltage	56.0Vdc (Fast charging)/54Vdc (Float charging)							
Mechanical Characteristics		ESS 6048E 200100	ESS 8048E 300150	ESS 10048E 400200	ESS 12048E 500240	ESS 12048E 640240	ESS 15048E 720240	ESS 15048E 800240	ESS 15048E 900240
1	Dimension (H*W*D)	730*560 *935mm	1280*560 *935mm	1520*560 *935mm	1760*560 *935mm	1520*560 *935mm	1520*560 *935mm	1760*560 *935mm	1760*560 *935mm
2	Shipping (H*W*D)	980*690 *1005mm	1460*690 *1005mm	1700*690 *1005mm	1940*690 *1005mm	1700*690 *1005mm	1700*690 *1005mm	1940*690 *1005mm	1940*690 *1005mm
3	Weight(N.W.)	200Kg	350Kg	430Kg	550Kg	550Kg	600Kg	650Kg	700Kg
4	Weight(G.W.)	220Kg	380Kg	460Kg	600Kg	600Kg	650Kg	700Kg	750Kg

3 Module Introduction

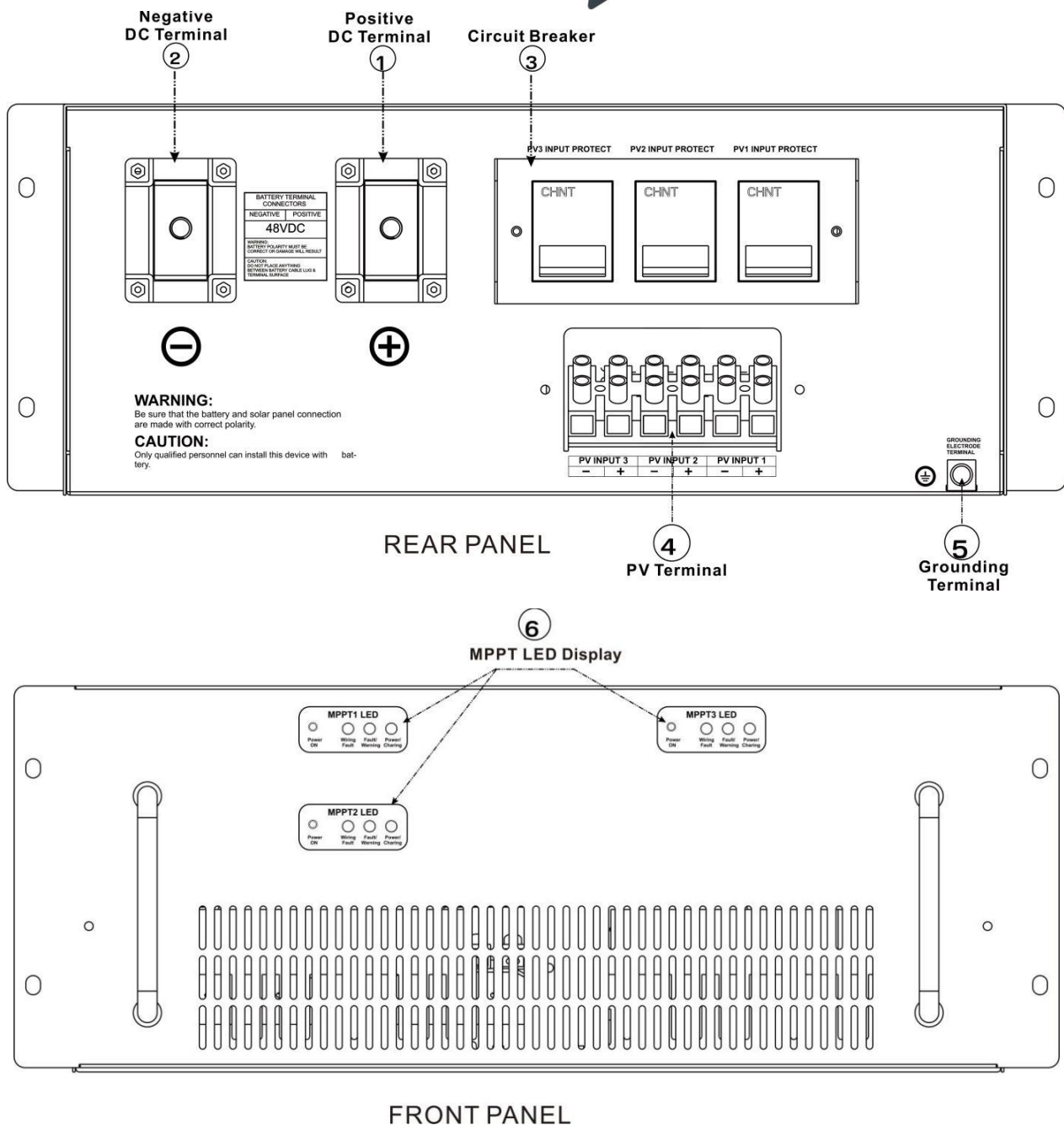
3.1 MPPT solar charge controller

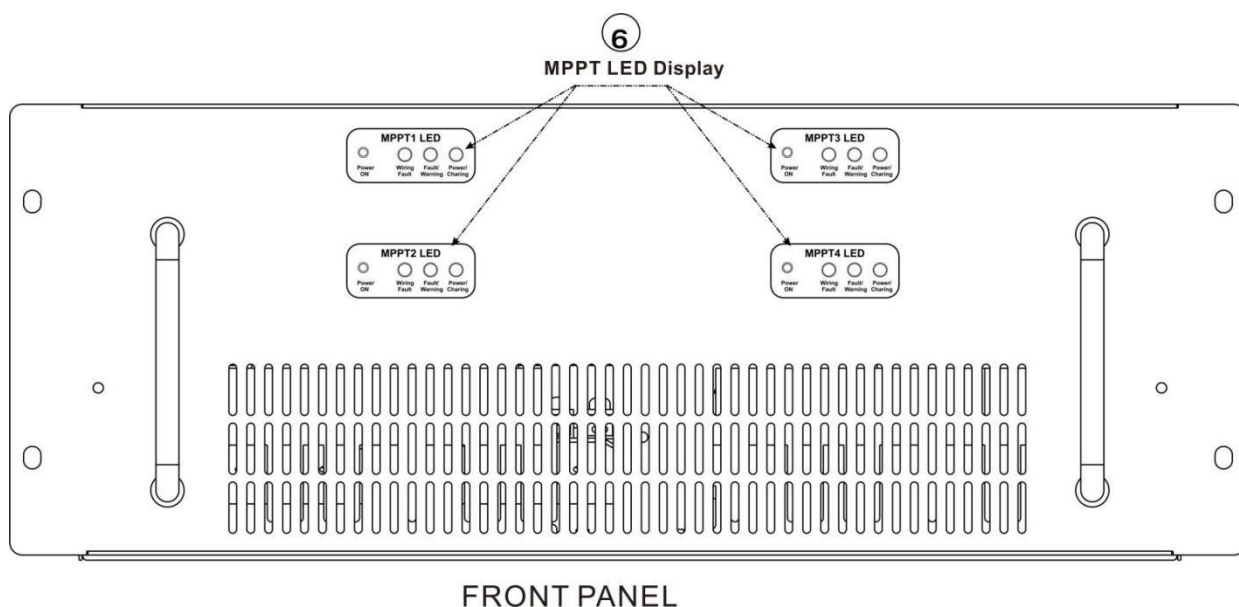
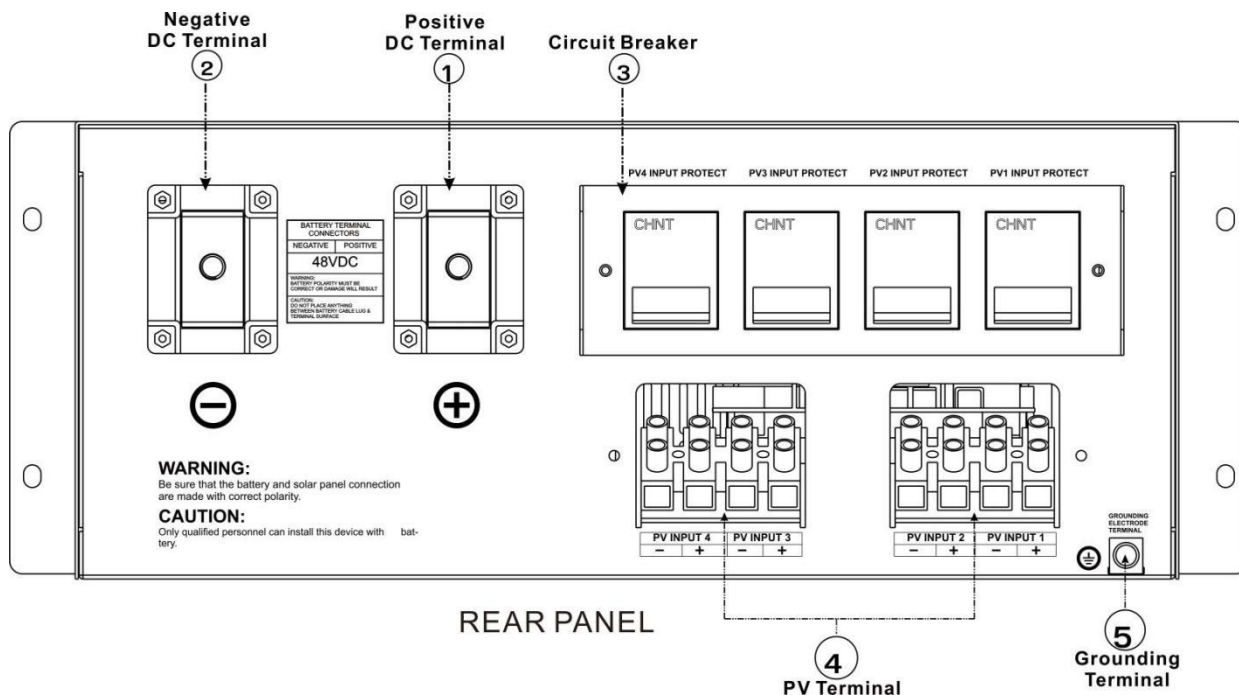
3.1.1 Appearance

Type A: SCM100 built-in inverter chassis



Type B: SCM150 & SCM200 & SCM240

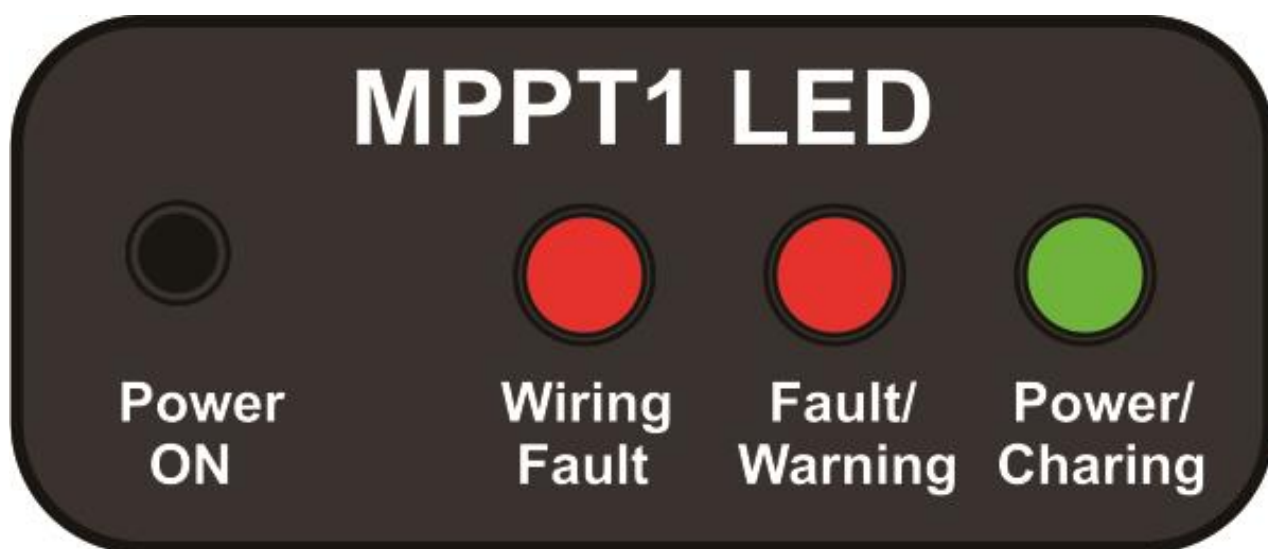




Input & Output simple introductions

Model	Output current	PV range	PV groups	PV power	PV wire spec
SCM100	100A(50A*2)	60-145Vdc	2	6Kw(3Kw*2)	Copper 6AWG (90°C wire)
SCM150	150A(50A*3)	60-145Vdc	3	9Kw(3Kw*3)	
SCM200	200A(50A*4)	60-145Vdc	4	12Kw(3Kw*4)	
SCM240	240A(60A*4)	60-145Vdc	4	14Kw(3.5Kw*4)	

3.1.2 LED Indicator



LED Indicator			Messages
POWER ON/CHARGING	Green	Solid On	The controller is on.
		Flashing	The controller is charging.
FAULT/ WARNING	Red	Solid On	Fault occurs.
		Flashing	Warning situation occurs.
WIRING FAULT	Red	Solid On	Battery polarities are not connected correctly.

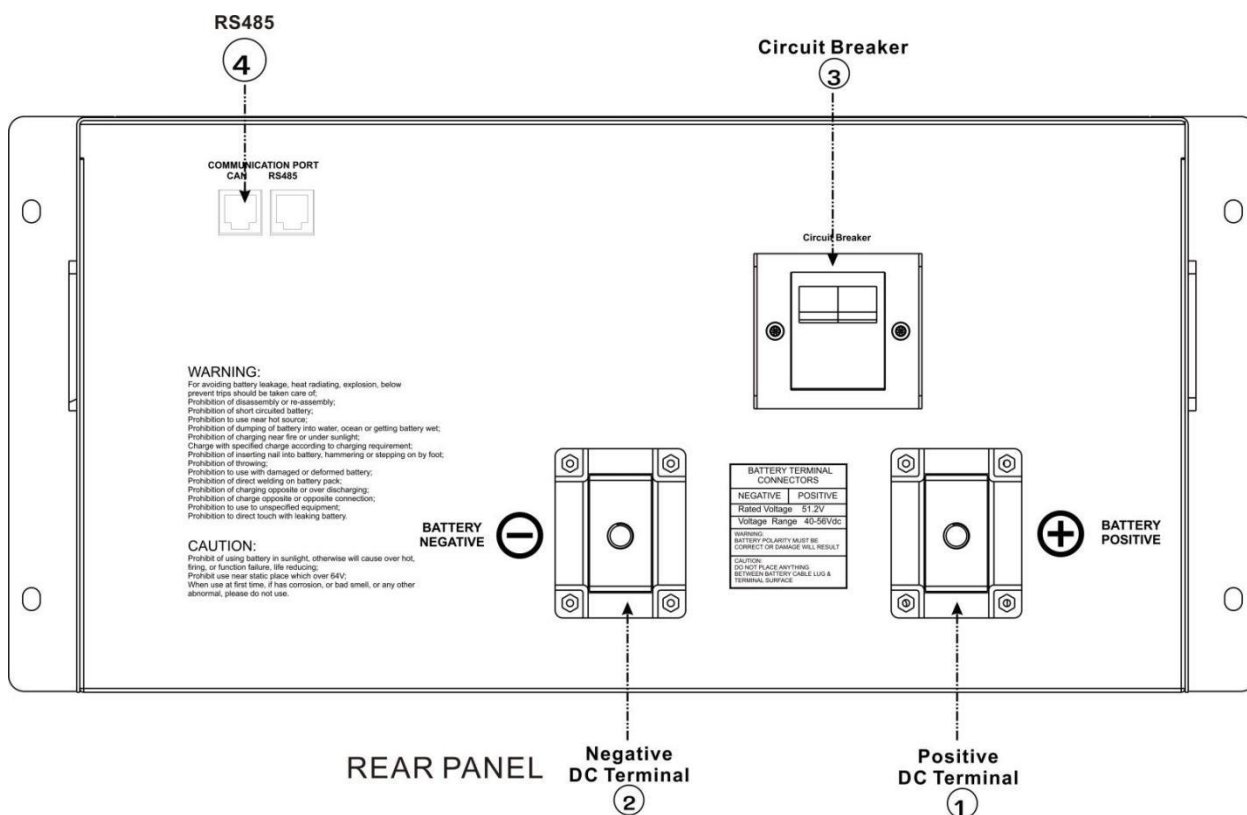
3.1.3 TROUBLE SHOOTING

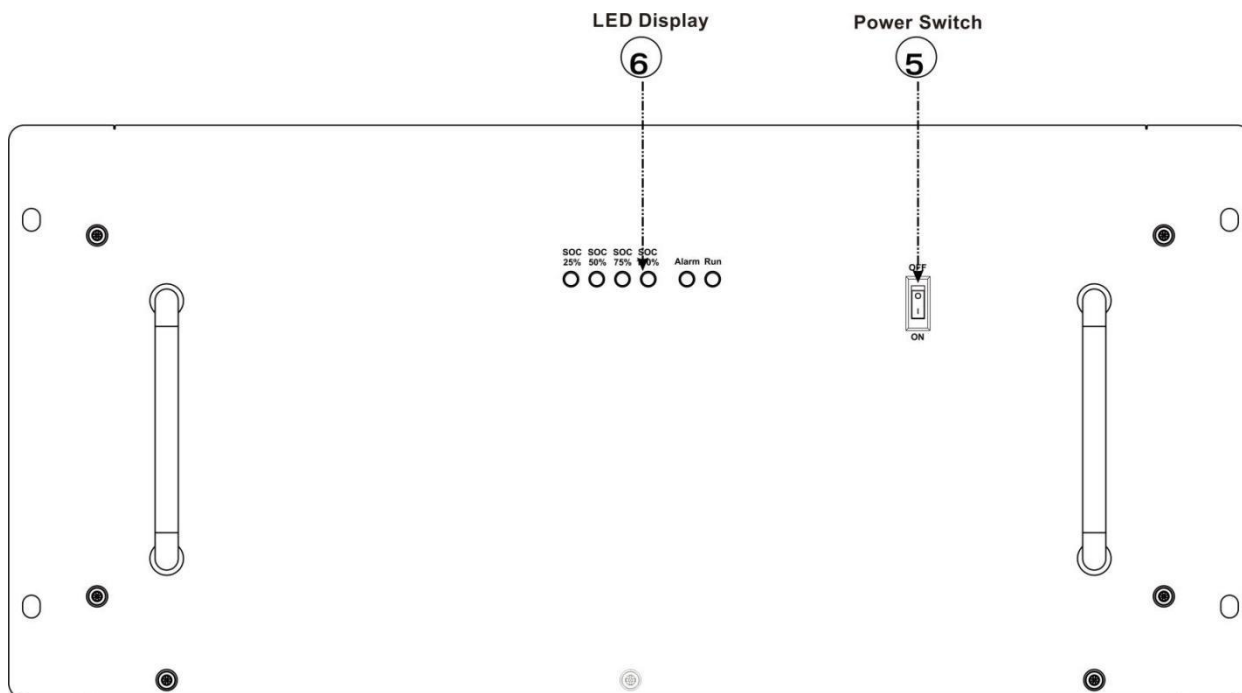
Situation	Solution
Fault Event	
Over charge current	<ol style="list-style-type: none"> 1. Restart the charger. 2. If the problem remains, please contact your installer.
Over temperature	<ol style="list-style-type: none"> 1. Keep the charger in the cool environment. 2. If the problem remains, please contact your installer.
Battery voltage under	<ol style="list-style-type: none"> 1. Check the battery wire connection. 2. If the wire connection is ok, please contact your installer.
Battery voltage high	<ol style="list-style-type: none"> 1. Reconnect the battery to the charger. 2. If the problem remains, please contact your installer.
PV high loss	<ol style="list-style-type: none"> 1. Please check the voltage of the solar panel, it should be less than 140V. 2. If the voltage is ok, please contact your installer.

3.2 Battery pack

3.2.1 Appearance

LFP48100R & LFP48160R & LFP48180R





FRONT PANEL

Model	Voltage	Capacity	Power	Rated CHG.A	Rated DIS.A
LFP48100R	51.2Vdc	100Ah	5.12Kwh	50A(0.5C)	100A(1C)
LFP48160R	51.2Vdc	160Ah	8.2Kwh	75A(0.5C)	150A(1C)
LFP48180R	51.2Vdc	180Ah	9.22Kwh	90A(0.5C)	180A(1C)

3.2.2 BMS

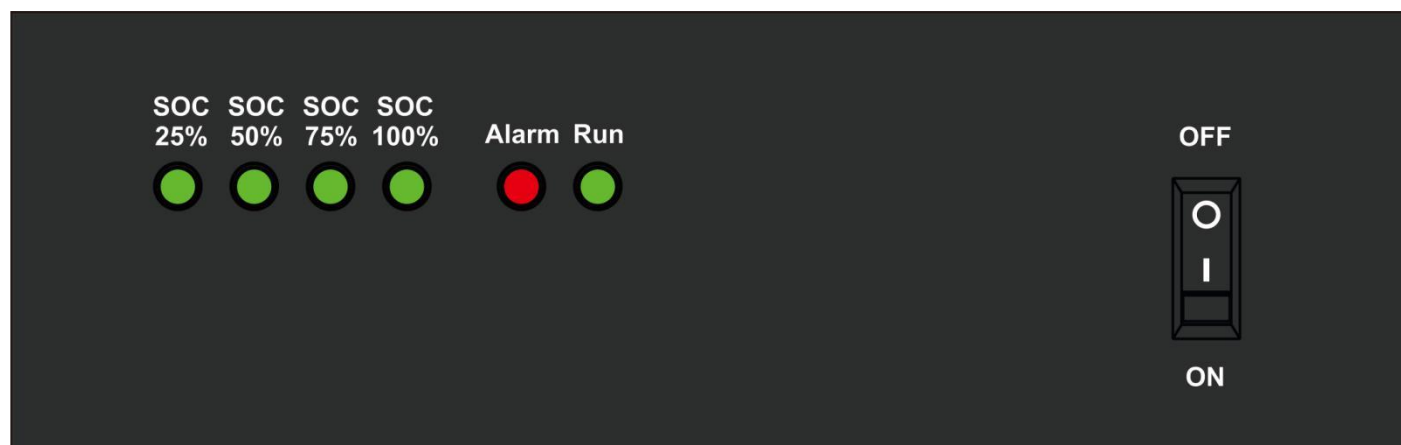
The batteries are supplied with a LiFePO4 Battery Management System (BMS) that can monitor and optimized each single prismatic cell during charge & discharge, to protect the battery pack overcharge, over discharge, short circuit. Overall, the BMS helps to ensure safe and accurate running.

Items	Content (for each cell)	Criterion	Alarm LED(red)
Over charge	Over-charge warning	3700mv	once/3s flash, keep output
	Over-charge protection	3750mv	once/1s flash, relay cut off
	Over-charge warning release	3400mv	
	Over-charge protection release	3350mv	
	Over-charge release method	Restart and Discharge	
Over discharge	Over-discharge warning	2700mv	once/3s flash, keep output
	Over-discharge protection	2500mv	once/1s flash, relay cut off
	Over-discharge warning release	2900mv	
	Over-discharge protection release	2800mv	
	Over-discharge release method	Charging	
Over current (CHG&DISCHG)	Over current warning	110% rated	once/1s flash, delay 30S relay cut off
	Over current protection(PEAK)	120% rated	Lightning, delay 10s relay cut off
	Over current release method(CHG)	Restart	
	Over current release method(DISCHG)	Cut off loads and Restart	
Over & Lower Temp (Discharging)	Over temperature	Warning @55°C	once/3s flash, keep output
		Protection @60°C	once/1s flash, relay cut off
		WarningRelease @50°C	
		Protection Release @55°C	
	Lower temperature	Warning @-20°C	once/3s flash, keep output
		Protection @-25°C	once/1s flash, relay cut off
		WarningRelease @-15°C	
		Protection Release @-20°C	
Over & Lower Temp (Charging)	Over temperature	Warning @45°C	once/3s flash, keep output
		Protection @50°C	once/1s flash, relay cut off
		WarningRelease @40°C	
		Protection Release @45°C	
	Lower temperature	Warning @0°C	once/3s flash, keep output
		Protection @-5°C	once/1s flash, relay cut off
		WarningRelease @5°C	
		Protection Release @0°C	

Battery Management System. The built in BMS is a central hub inside the battery that maintains constant voltage, current and temperature. The BMS allows for maximum charging capacity for faster charging and efficient discharging. It also communicates with the desktop monitoring software via the RS485 or CAN port.

3.2.3 LED Indicators

The LED indicators on the front of the battery pack show its operational state as follows:

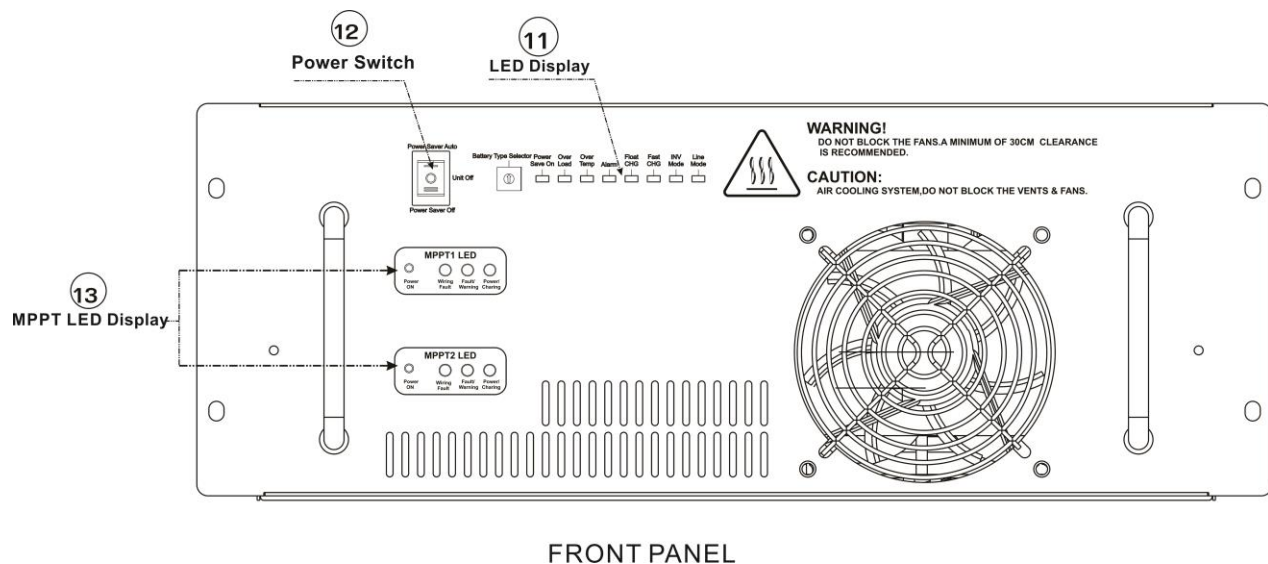
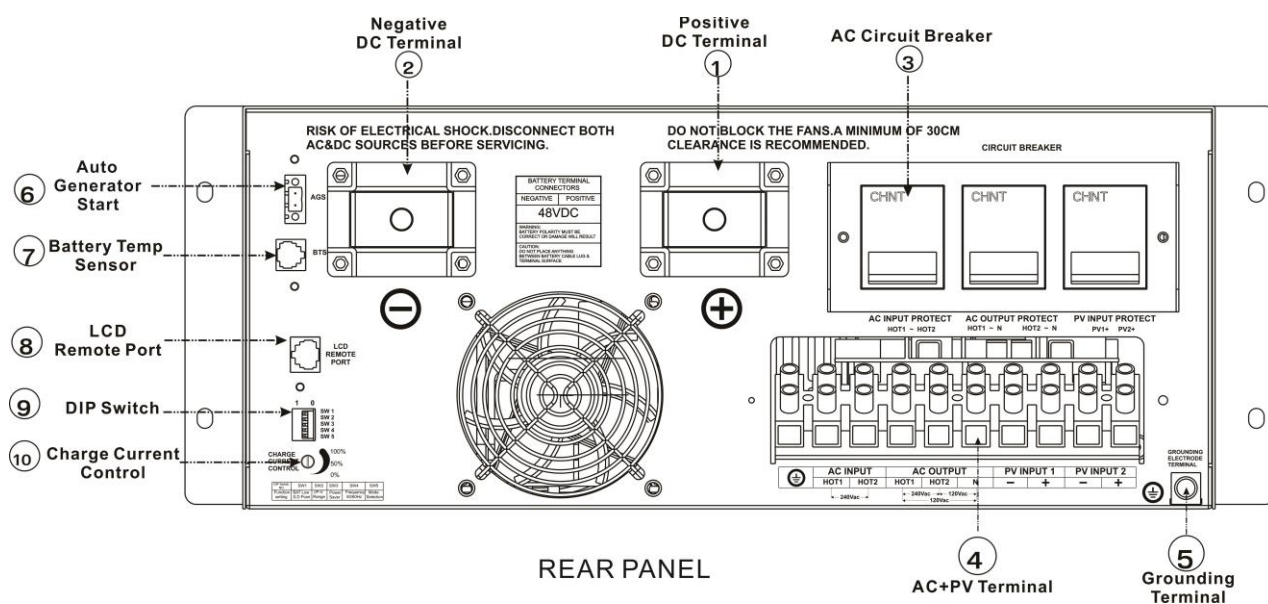


SWITCH	Power ON/OFF
RUN LED(green)	Lighting: System working normal
Alarm LED(red)	once/3S Flash: system warning
	once/1S Flash: system protection
	Lighting: system fault
SOC LEDs (4 green)	<p>In Charging Mode</p> <p>SOC<25%, LED1, LED2, LED3, LED4 flash in turn</p> <p>25%<SOC <50%, LED1 lighting, LED2, LED3, LED4 flash in turn</p> <p>50%<SOC<75%, LED1, LED2 lighting, LED3, LED4 flash in turn</p> <p>75%<SOC<95%, LED1, LED2, LED3 lighting, LED4 flash</p> <p>SOC>95%, LED1, LED2, LED3, LED4 lighting</p> <p>In Discharging Mode</p> <p>SOC< 10%, LED1, LED2, LED3, LED4 off</p> <p>10%<SOC<25%, LED1 flash, LED2, LED3, LED4 off</p> <p>25% <SOC<50%, LED1 lighting, LED2 flash, LED3, LED4 off</p> <p>50% <SOC <75%, LED1, LED2 lighting, LED3 flash, LED4 off</p> <p>SOC>75%, LED1, LED2, LED3 lighting, LED4 flash</p>

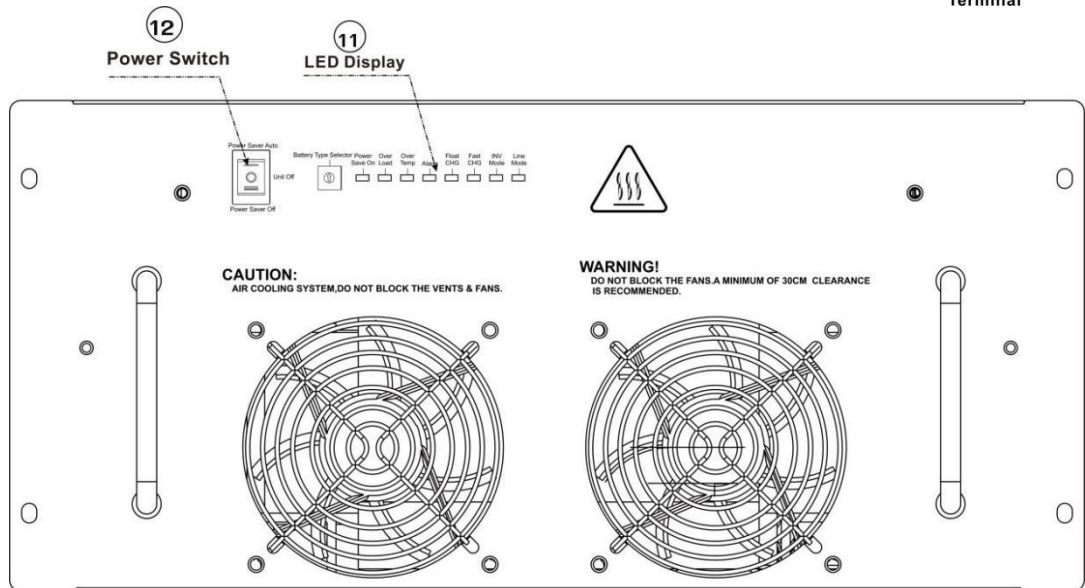
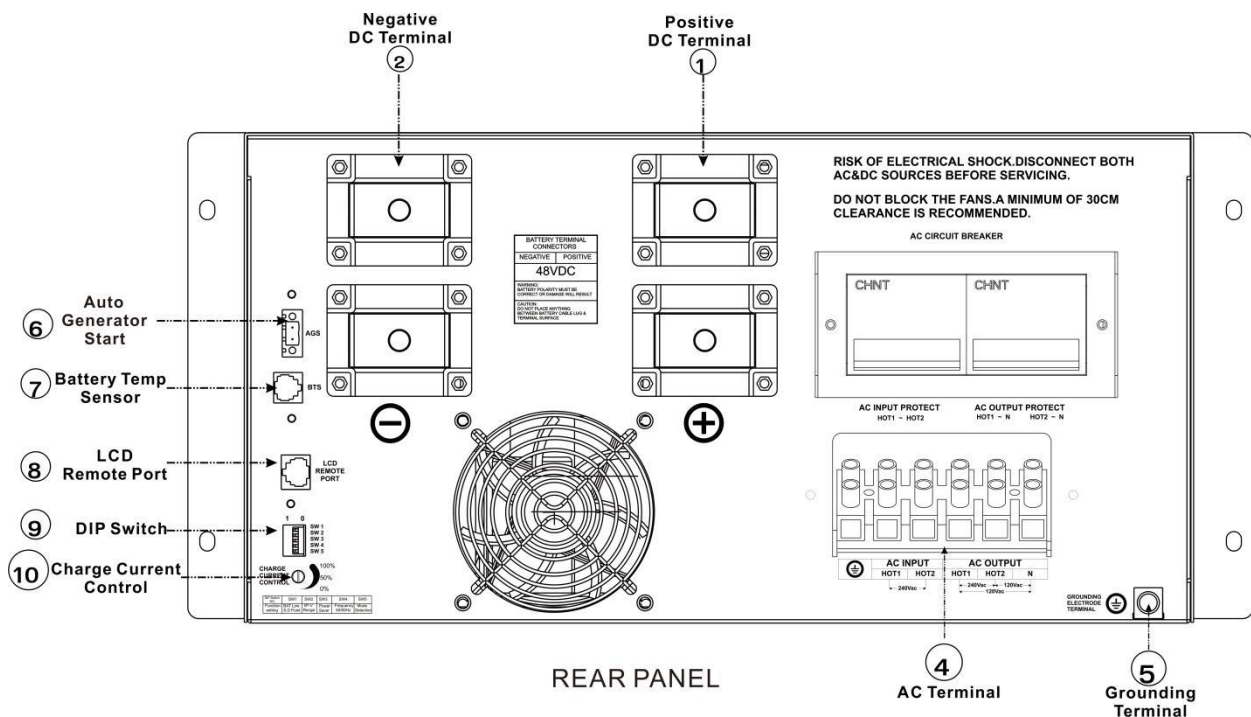
3.3 INVERTER

3.3.1 Appearance

HPV6K rack



HP8K-15K rack



Input & Output simple introductions				
Model	Power	AC output	AC input	AC wire spec
HP6048R	6Kw	110/120Vac	80-135/96-135Vac	Copper 6AWG
HP6048RE	6Kw	220/230/240Vac	184-253(230)/140-270Vac	Copper 10AWG
HP6048RD	6Kw	120/240Vac	194-263/140-270Vac	Copper 10AWG
HP8048RE	8Kw	220/230/240Vac	184-253(230)/140-270Vac	Copper 8AWG
HP8048RD	8Kw	120/240Vac	194-263/140-270Vac	Copper 8AWG
HP10048RE	10Kw	220/230/240Vac	184-253(230)/140-270Vac	Copper 6AWG
HP10048RD	10Kw	120/240Vac	194-263/140-270Vac	Copper 6AWG
HP12048RE	12Kw	220/230/240Vac	184-253(230)/140-270Vac	Copper 4AWG
HP12048RD	12Kw	120/240Vac	194-263/140-270Vac	Copper 4AWG
HP15048RE	15Kw	220/230/240Vac	184-253(230)/140-270Vac	Copper 4AWG
HP15048RD	15Kw	120/240Vac	194-263/140-270Vac	Copper 4AWG

3.3.2 DIP Switches

On the rear panel of inverter, there are five DIP switches which enable users to customize the performance of the device.

Switch #	Switch Function	Position: 0	Position: 1
SW1 (Battery type 9)	Low Battery Cut Off	46VDC(100%DOD)	48VDC(90%DOD)
	Low Battery Alarm point	48VDC(90%DOD)	50VDC(80%DOD)
SW2(230Vac)	AC Input Range	184-253Vac \pm 4%	140-270Vac(40Hz+) \pm 4%
SW2(120Vac)	AC Input Range	100-135Vac \pm 4%	90-135Vac(40Hz+) \pm 4%
SW3	Power Saver ON/OFF	Inverter Off	Power Saver On(3 sec)
SW4	Frequency Switch	50Hz	60Hz
SW5	Battery/AC Priority	AC Priority	Battery Priority

About AC/Battery Priority (SW5):

The inverter chargers are designed with AC/Battery priority switch (DIP switch #5).

Switch the battery priority selector to Position “0” for AC priority mode, Position “1” for battery priority mode. In AC priority mode, when AC input is present, the battery will be charged first, and the inverter will transfer the input AC to power the load. Only when the AC input is stable for a continuous period of 15 days will the inverter start a battery inverting cycle to protect the battery. After 1 normal charging cycle ac through put will be restored.

When you choose battery priority, the inverter will invert from battery despite the AC input.

When the battery voltage reaches the low voltage alarm point which is higher than “**Low Battery Cut Off Point**”, the inverter will transfer to AC input, charge battery, and switch back to battery when the battery is fully charged. This function is mainly for solar systems using utility power or generator as back up.

In battery priority mode, when setting SW1 to 0, the battery will be discharged despite the AC input until battery voltage to 48Vdc(90% DOD), then the inverter will transfer to AC input, charge battery, take load

and switch back to battery mode when the battery is fully charged.

In battery priority mode, when setting SW1 to 1, the battery will be discharged despite the AC input until battery voltage to 50Vdc(80% DOD), then the inverter will transfer to AC input, charge battery, take load and switch back to battery mode when the battery is fully charged.

Note: In battery priority mode, when qualified AC inputs for the first time and the battery voltage is below 50Vdc, the inverter will first carry out a cycle of bulk charging and absorb charging, the inverter will not go into float charging mode.

3.3.3 Battery type selector

Position 0——AC bypass to the load without charging.

Choosing the battery type selector to “0” will disable the built-in battery charger while still allow transfer through. When battery charger is disabled, if the battery is charged by external DC power to 54Vdc, the inverter will go to battery priority mode automatically.

Position 9——Special design for the LiFePo4 battery, make the battery cycle life maximization.

3.3.4 Auto Generator Start

The inverter can start up generator when battery voltage goes low.

When the inverter goes to low battery alarm, it can send a signal to start a generator and turn the generator off after battery charging is finished.

The auto gen start feature will only work with generators which have automatic starting capability. The generator must have start and stop controls [i.e., an electric starter and electric choke (for gasoline units)], and the safety sensors to be able to start and stop automatically.

There is an open/close relay (constant open) that will close and short circuit the positive and negative cables from a generator start control. The input DC voltage can vary, but the max current the relay can carry is 16Amp.

The Auto Generator Start terminal pins are not polarized.

In addition, these two pins can also be used as dry contacts to send out “Low Battery Voltage” signal to an external alarm device.

This AGS relay can also carry AC voltage within its capacity.

This inverter will skip the float charging when it is set at battery priority mode, so that the generator will no longer be kept running to maintain a small charge on the batteries.

3.3.5 FAN Operation

For 6KW model, there are two DC fans.

For 8-15KW models, there are two multiple controlled DC fans and one AC fan.

The AC fan will work once there is AC output from the inverter. So when the inverter is in power saver mode, the AC fan will work from time to time in response to the pulse sent by the inverter in power saver mode.

The DC fans are designed to operate according to the following logic:

Condition	Enter Condition	Leave condition	Speed
HEAT SINK TEMPERATURE	$T \leq 60^{\circ}\text{C}(140^{\circ}\text{F})$	$T > 65^{\circ}\text{C}(149^{\circ}\text{F})$	OFF
	$65^{\circ}\text{C}(149^{\circ}\text{F}) \leq T < 85^{\circ}\text{C}(185^{\circ}\text{F})$	$T \leq 60^{\circ}\text{C}(140^{\circ}\text{F})$ or $T \geq 85^{\circ}\text{C}(185^{\circ}\text{F})$	50%
	$T > 85^{\circ}\text{C}(185^{\circ}\text{F})$	$T \leq 80^{\circ}\text{C}(176^{\circ}\text{F})$	100%
CHARGER CURRENT	$I \leq 15\%$	$I \geq 20\%$	OFF
	$20\% < I \leq 50\%\text{Max}$	$I \leq 15\%$ or $I > 50\%\text{Max}$	50%
	$I > 50\%\text{Max}$	$I \leq 40\%\text{Max}$	100%

LOAD Percentage (INV MODE)	Load < 30%	Load \geq 30%	OFF
	$30\% \leq \text{Load} < 50\%$	Load $\leq 20\%$ or Load $\geq 50\%$	50%
	Load $\geq 50\%$	Load $\leq 40\%$	100%

Allow at least 30CM of clearance around the inverter for air flow. Make sure that the air can circulate freely around the unit.

Fan noise level <60db at a distance of 1m

3.3.6 Low Battery Voltage Recovery Start

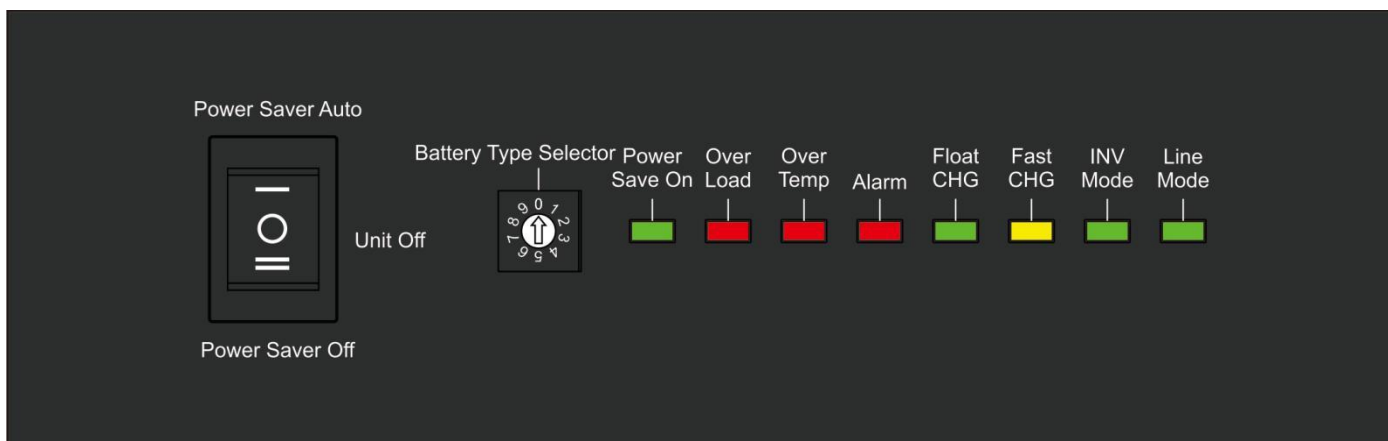
After low battery voltage cut off at 46Vdc (SW1 at 0) or 48Vdc(SW1 at 1), the inverter is able to restore to work after the battery voltage recovers to 52V(with power switch still in “On” position). This function helps to save the users extra labor to reactivate the inverter when the low battery voltage returns to acceptable range in renewable energy systems.

WARNING!!

Never leave the loads unattended, some loads (like a Heater) may cause accidents in such cases.

It is better to shut everything off after low voltage trip than to leave your load in the risk of fire. Nobody wants to return home, finding house surrounded by fire trucks and naughty neighborhood kids toasting hot dogs against his house.

3.3.7 LED indicator



LINE MODE	GREEN LED lit in Line Mode
INV MODE	GREEN LED lit in Inverter Mode
FAST CHG	YELLOW LED lit in Fast Charging Mode
FLOAT CHG	GREEN LED lit in Float Charging Mode
ALARM	RED LED lit in Alarm
OVER TEMP	RED LED lit in Over Temperature
OVER LOAD	RED LED lit in Over Load
POWER SAVER ON	GREEN LED lit in Power Saver Mode

Please refer to ‘Indicator and Buzzer’ for the detailed information.

3.3.8 Audible Alarm

The inverter also gives audible alarms when the following situations occur.

Battery Voltage Low	Inverter green LED Lighting, and the buzzer beep 0.5s every 5s.
Battery Voltage High	Inverter green LED Lighting, and the buzzer beep 0.5s every 1s, and Fault after 60s.
Invert Mode Over-Load	(1) $110\% < \text{load} < 125\% (\pm 10\%)$, No audible alarm in 14 minutes, Beeps 0.5s every 1s in 15 th minute and Fault after 15 minutes; (2) $125\% < \text{load} < 150\% (\pm 10\%)$, Beeps 0.5s every 1s and Fault after 60s; (3) $\text{Load} > 150\% (\pm 10\%)$, Beeps 0.5s every 1s and Fault after 20s;
Over Temperature	Heat sink temp. $\geq 105^{\circ}\text{C} (221^{\circ}\text{F})$, Over temp red LED Lighting, beeps 0.5s every 1s;

Please refer to ‘Indicator and Buzzer’ for the detailed information.

3.3.9 Maintenance & Troubleshooting

This troubleshooting guide contains information about how to troubleshoot possible error conditions while using the Inverter/Charger. The following chart is designed to help you quickly pinpoint the most common inverter failures.

		LED Indicator and Buzzer							
Status	Item	SHORE POWER ON	INVERTER ON	FAST CHG	FLOAT CHG	OVER TEMP TRIP	OVER LOAD TRIP	POWER SAVER ON	Buzzer
Line Mode	CC	√		√					
	CV	√		√, blink					
	Float	√			√				
	Standby	√							
Inverter Mode	Inverter On		√						
	Power Saver							√	
Inverter Mode	Battery Low		√						Beep 0.5s every 5s
	Battery High		√						Beep 0.5s every 1s
	Overload On Invert Mode		√				√		Refer to “Audible alarm”
	Over-Temp On Invert Mode		√			√			Beep 0.5s every 1s
	Over-Temp On Line Mode	√		√		√			Beep 0.5s every 1s
	Over Charge	√		√					Beep 0.5s every 1s
Fault Mode	Fan Lock								Beep continuous
	Battery High		√						Beep continuous
	Inverter Mode Overload						√		Beep continuous
	Output Short						√		Beep continuous
	Over-Temp					√			Beep continuous
	Over Charge			√					Beep continuous
	Back Feed Short								Beep continuous

4 Installation

4.1 Transportation and Storage

4.1.1 Transportation

Due to the characteristic of cells, proper environment for transportation of LiFePO₄ battery pack is needed to protect the battery. Battery should be stayed in the ware house -20°C~35°C where it's dry, clean, shade, and well-ventilated. The battery should be stored in 45~55% SOC during transportation.

Product is adapted to the truck, boat, transport. When in transport, it should be covered to avoid the sunlight, and with civilized loading and unloading. With product packaging box allows using any kinds of transport, battery in loading and unloading process should be light moving gently to prevent throwing, rolling, pressing. Direct rain and mechanical impact of rain and snow should be avoided in transportation.

4.1.2 Storage

Product storage should be kept in dry warehouse, not sun and rain. The harmful gases are not allowed in the warehouse, as well as flammable and explosive products and corrosive chemicals. To avoid mechanical impact, stress and strong magnetic field effect, avoid direct sunlight and away from heat source not be less than 2m, the packing box should pad off the ground at least 20 cm high, away from the wall, window, or the air inlet at least 50cm. Under the provisions of the conditions of storage period of more than 3 months of products should charge once, storage period of more than 6 months products must check and test the capacity, store for more than 1 years of products must be re-examined, only can be used when is qualified.

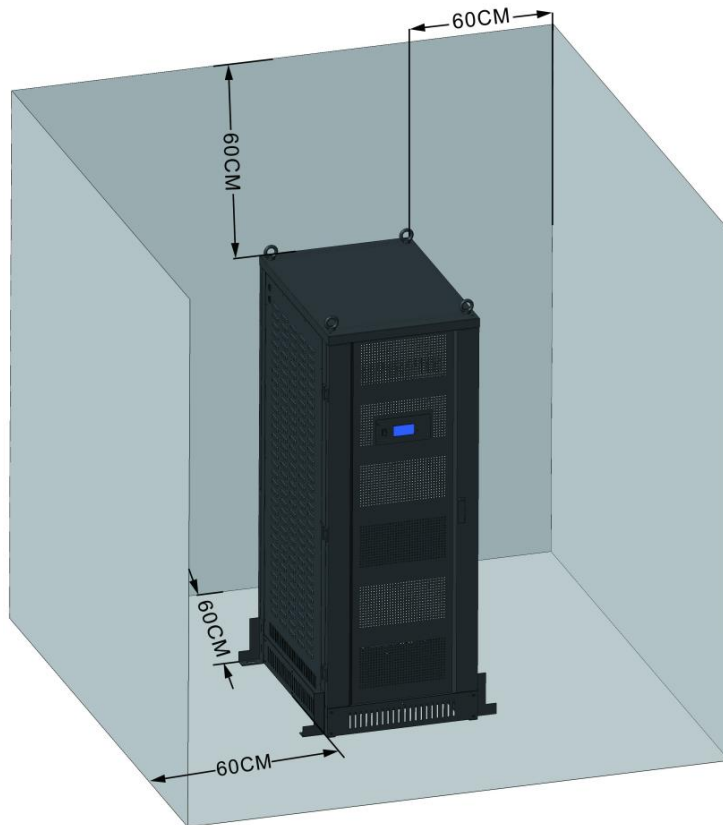
1	Storage Temperature	Less than 1 month	-20~35°C
		Less than 6 months	-10~30°C
2	Storage humidity	45~75%RH	

4.2 System Installation

4.2.1 Clearance

Observe the specified minimum distances to neighboring objects. The minimum distances ensure that:

- There is sufficient heat dissipation,
- The storage system door can be opened easily,
- There is sufficient space for carrying out maintenance work.



NOTED: Minimum clearances(600mm) for the left、right、Top and rear of the product is shown in the figure. For the proper ventilation and installer convenience

4.2.2 Installation Site and Environment

The following sites are not allowed for installation:

Sites where the freezing point is reached, like garages, carports or other places.

Sites with humidity and condensation over 85%.

Sites which are salty and where humid air can penetrate.

Flooded areas.

Earthquake areas –additional security measures are required here.

Sites with ammonia containing environment.

Sites that are higher than 2000 meters above the sea level.

Sites with explosive atmosphere.

Sites with direct sunlight.

Sites with extreme change of ambient temperature.

Wet rooms.

Sites with highly flammable materials or gases.

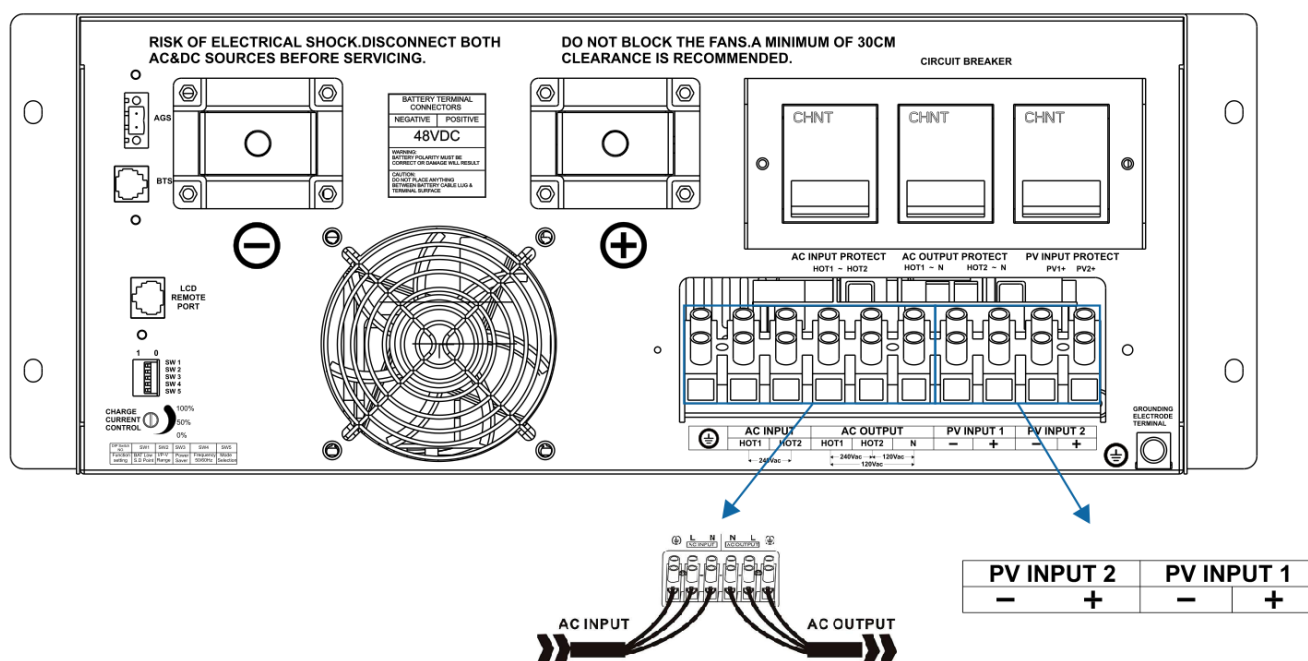
Sites with a potentially explosive atmosphere.

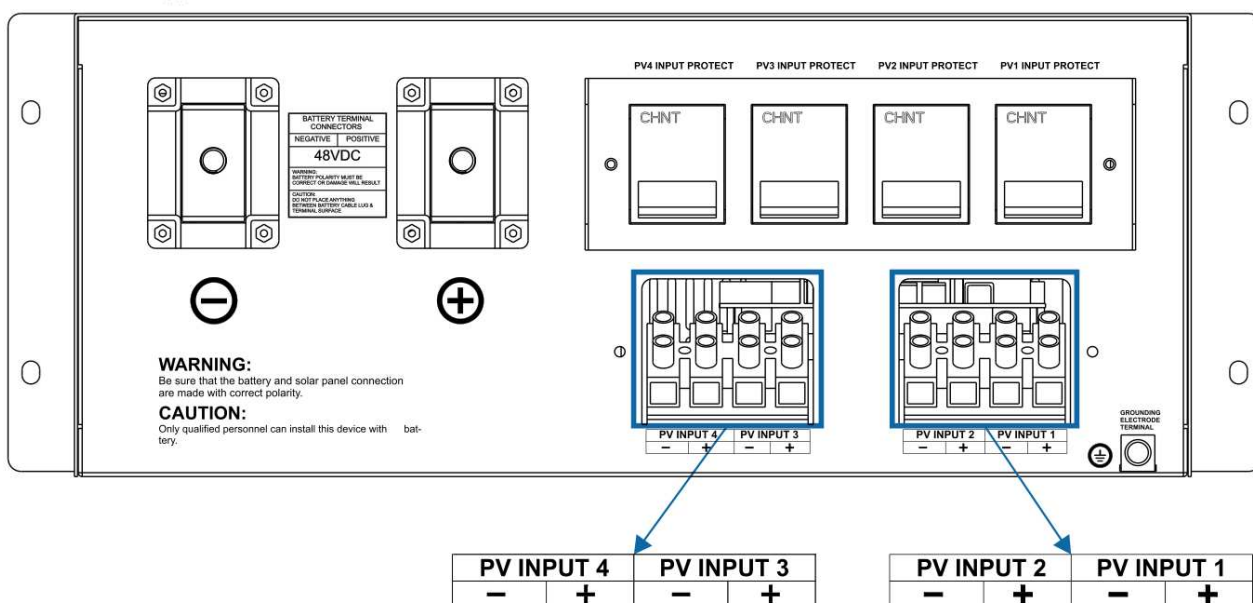
4.3 System wiring

After system installation, open the rear panel by the key (be fixed on the top of cabinet)

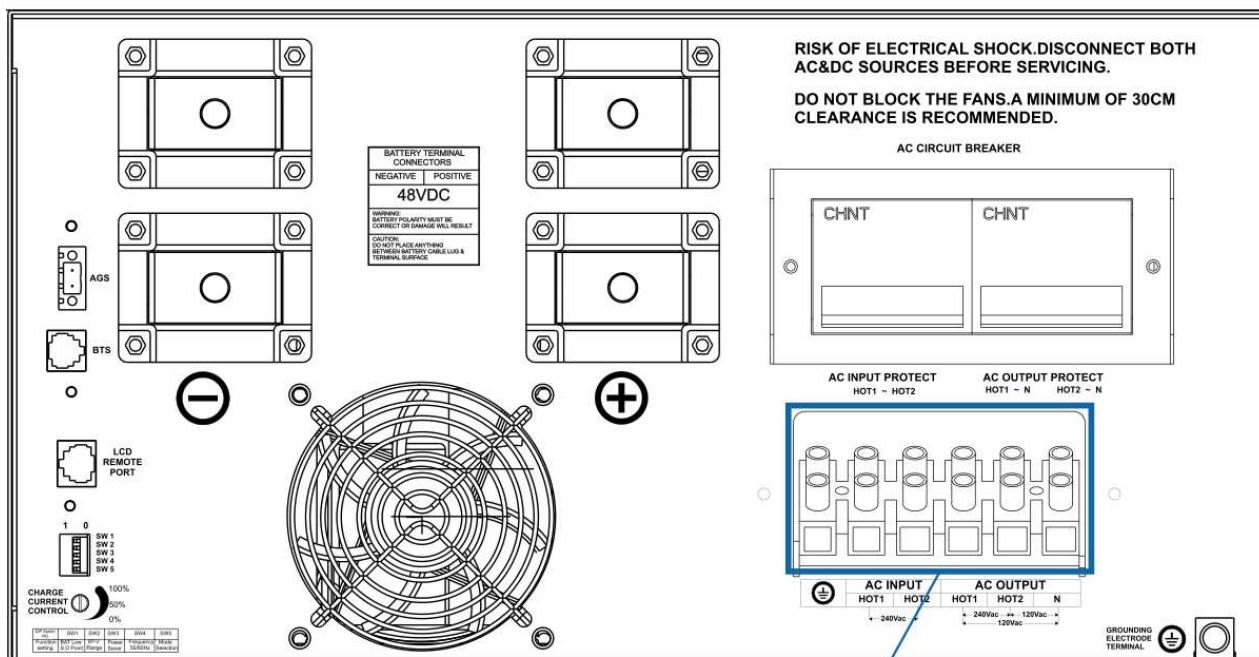


Remove the protection cover on the module, you will find the wiring terminal





PV Wiring terminal	
ESS8048E300150	ESS10048E400240
ESS12048E500240	ESS12048E640240
ESS15048E720240	ESS15048E800240
ESS15048E900240	



	AC INPUT		AC OUTPUT		
	HOT1	HOT2	HOT1	HOT2	N

AC Wiring terminal	
ESS8048E300150	ESS10048E400240
ESS12048E500240	ESS12048E640240
ESS15048E720240	ESS15048E800240
ESS15048E900240	

4.3.1 PV Wiring & Recommended Configuration

Wire size

The terminals are sized for 12 - 4 AWG (3.5 - 25mm²) wire. The terminals are rated for copper conductors. Use UL-listed Class B 300 Volt stranded wire only. Good system design generally requires large conductor wires for solar module connections that limit voltage drop losses to 2% or less.

Minimum Wire Size

The table below provides the recommended minimum wire size allowed for the charger. Wire types rated for 75°C and 90°C are listed.

Recommended wire size:

Typical Amperage	Wire Type	75°C Wire	90°C Wire
60A	Copper	4 AWG (25 mm ²)	6 AWG (16 mm ²)

Connect the Power Wires

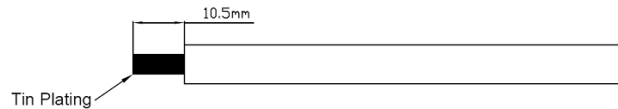
WARNING: Shock Hazard

The solar modules can produce open-circuit voltages in excess of 100 Vdc when in sunlight. Verify if solar input breaker has been turned off (disconnected) before connecting system wires.

Connect terminals by following below steps (Refer to diagram above):

1. Make sure that the system input breaker are turned off before connecting power wires to the charger. There are no disconnecting switches inside the charger.

Make power wires first. Remove insulation sleeve 10.5mm and the conductor should be plated Tin. Refer to the chart below.



WARNING: Risk of Damage

Be sure that solar connection is made with correct polarity. Turn on the solar breaker/disconnect and measure the voltage on the open wires BEFORE connecting to the controller. Disconnect solar breaker/disconnect before wiring to the controller.

Connect positive wire (+) of solar module to the solar positive terminal (+) on the controller.

Connect negative wire (-) of solar module to the solar Negative terminals (-) on the controller.

Screw power terminals tightly with 50 in-lbs torque. (5.65 Nm)

Recommended Panel Configuration Ref

Recommended Panel Configuration 1				
MPPT Model	Charge Current	Solar Panel Spec	Solar Panel Configuration	Total PV Input Power
SCM100	100A(50A*2)	250Wp*12PCS *2groups	3S4P*2groups (24PCS total)	6KW (3KW*2)
SCM150	150A(50A*3)	250Wp*12PCS *3groups	3S4P*3groups (36PCS total)	9KW (3KW*3)
SCM200	200A(50A*4)	250Wp*12PCS *4groups	3S4P*4groups (48PCS total)	12KW (3KW*4)
SCM240	240A(60A*4)	290Wp*12PCS *4groups	3S4P*4groups (48PCS total)	13.92kW (3.48KW*4)

Recommended Panel Configuration 2				
MPPT Model	Charge Current	Solar Panel Spec	Solar Panel Configuration	PV Input Power
SCM100	100A(50A*2)	330Wp*9PCS *2groups	3S3P*2groups (18PCS total)	5.94KW (2.97KW*2)
SCM150	150A(50A*3)	330Wp*9PCS *3groups	3S3P*3groups (27PCS total)	8.91KW (2.97KW*3)
SCM200	200A(50A*4)	330Wp*9PCS *4groups	3S3P*4groups (36PCS total)	11.88KW (2.97KW*4)
SCM240	240A(60A*4)	380Wp*9PCS *4groups	3S3P*4groups (36PCS total)	13.68KW (3.42KW*4)

4.3.2 AC Wiring

We recommend using 10 to 4Awg wire to connect to the ac terminal block.

Wiring Option 1

230V single phase/120V single phase

Input: Hot line +Neutral
+Ground

Output: Hot line
+Neutral+Ground

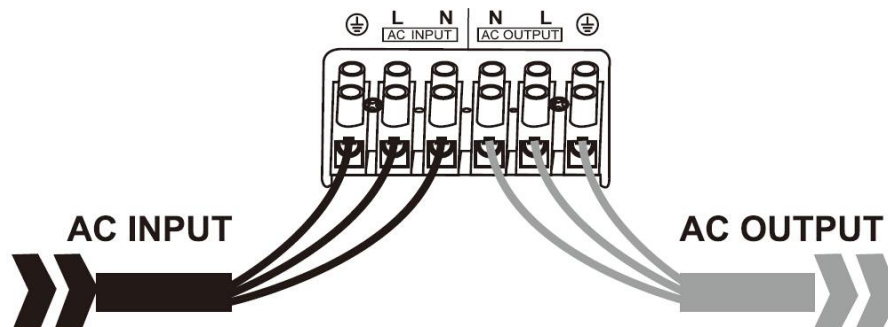


Figure 15

Wiring Option 2

230V split phase

Input: Hot line+ Hot line
+Ground

Output: Hot line+ Hot line
+Neutral

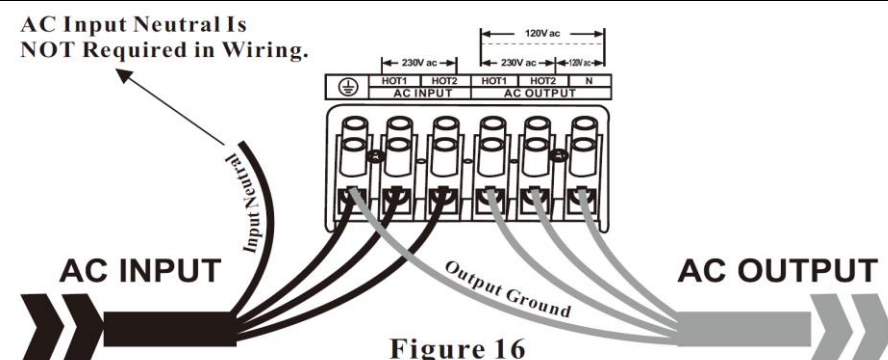


Figure 16

Wiring Option 3

230V split phase

Input: Hot line+ Hot line
+Ground

Output: Hot line +Neutral

Remark: In such case, each output hotline can only carry a max of half the rated capacity.

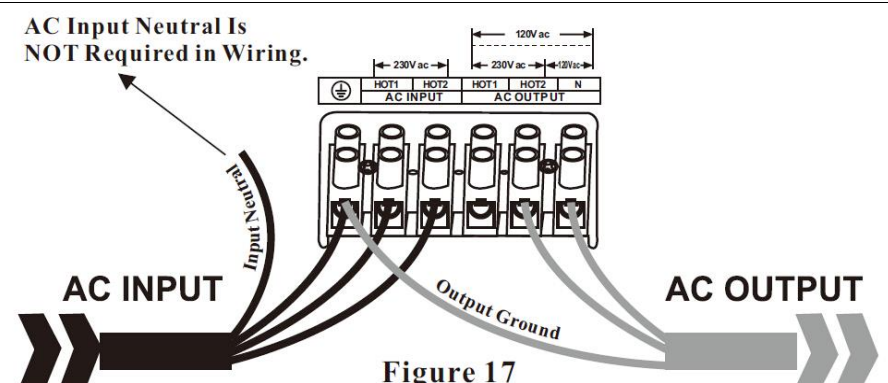


Figure 17

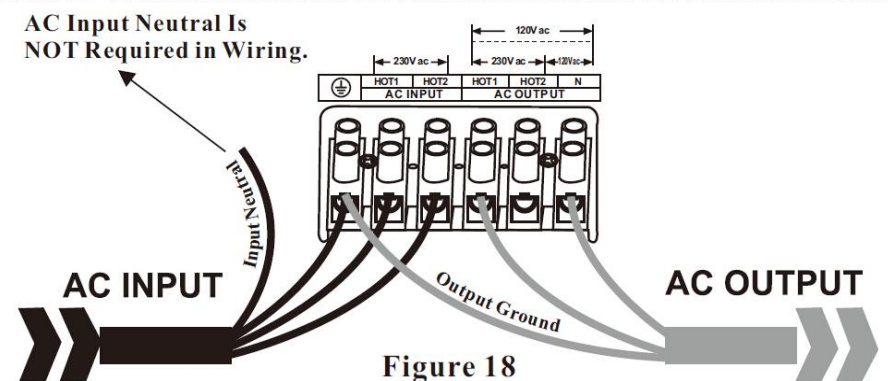


Figure 18

When in AC mode the AC input power will supply both the loads and AC charger, a thicker wire gauge for AC Input is required. Please consult a qualified electrician about the specific wire gauge required in terms of wire material and inverter power.

There are 3 different ways of connecting to the terminal block depending on the model.

Caution:

Wiring Option 2 and Wiring Option 3 are only allowed for split phase models.

Please wire all the other models according to Wiring Option 1.

WARNING	<p>For split phase models, AC input neutral is not required in wiring. Never Connect Input Neutral to Ground or to Output Neutral. Damage will result which is not covered under warranty.</p> <p>The output voltage of this unit must never be connected in its input AC terminal, overload or damage may result.</p> <p>Always switch on the inverter before plugging in any appliance.</p> <p>Damages caused by AC wiring mistakes are not covered under warranty.</p>
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Preventing Paralleling of the AC Output

The AC output of the unit should never be connected to the utility power / generator.

Such a connection may result in parallel operation of the different power sources and AC power from the utility / generator will be fed back into the unit which will instantly damage the inverter and may also pose a fire and safety hazard.

4.3.3 Grounding

Connect an AWG 8 gauge or greater copper wire between the grounding terminal on the inverter and the earth grounding system or the vehicle chassis.

5 Operation the system

5.1 Power on

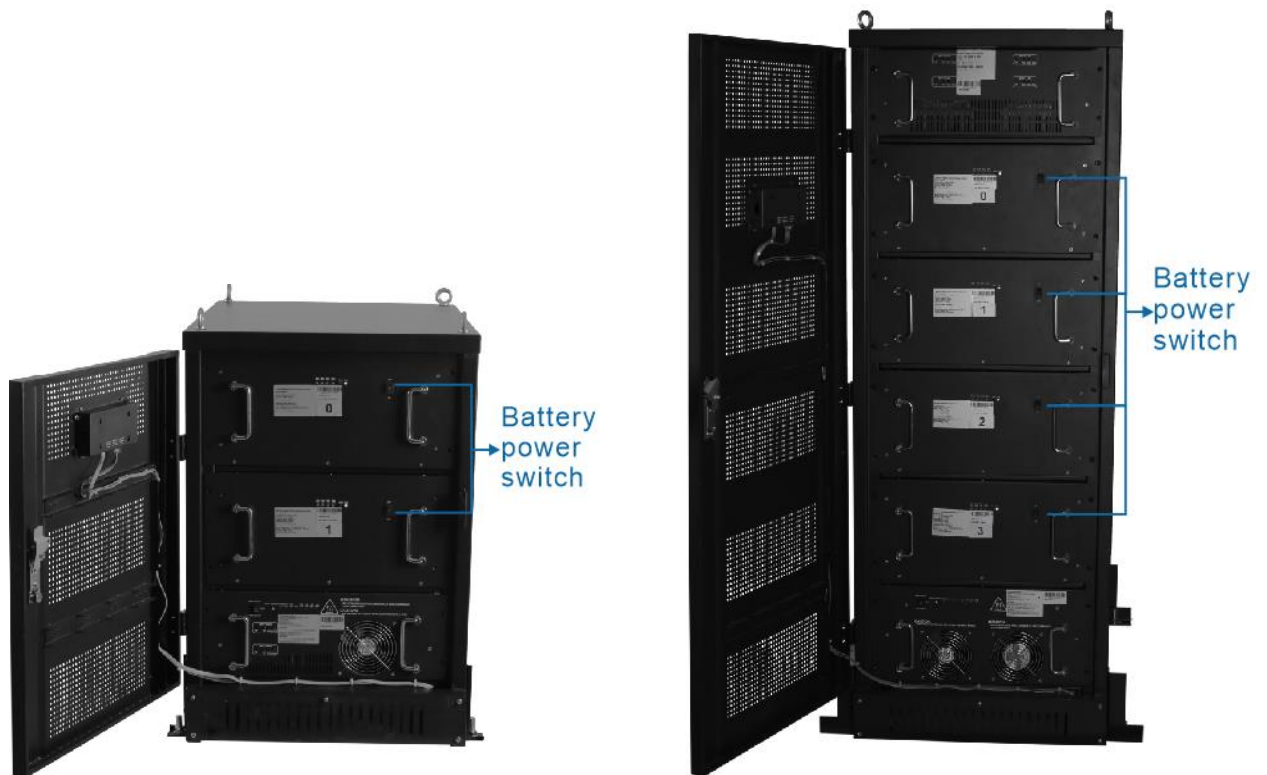
Check all the wiring tightly, make sure the PV input voltage and AC input voltage are right and at the range. System shall be turned on in the correct sequence to avoid any damage.

5.1.1 Battery pack turn on

Step 1, Open the rear panel of the cabinet, turn on all the breaker of battery pack (ID:0、 1、 2...) one by one

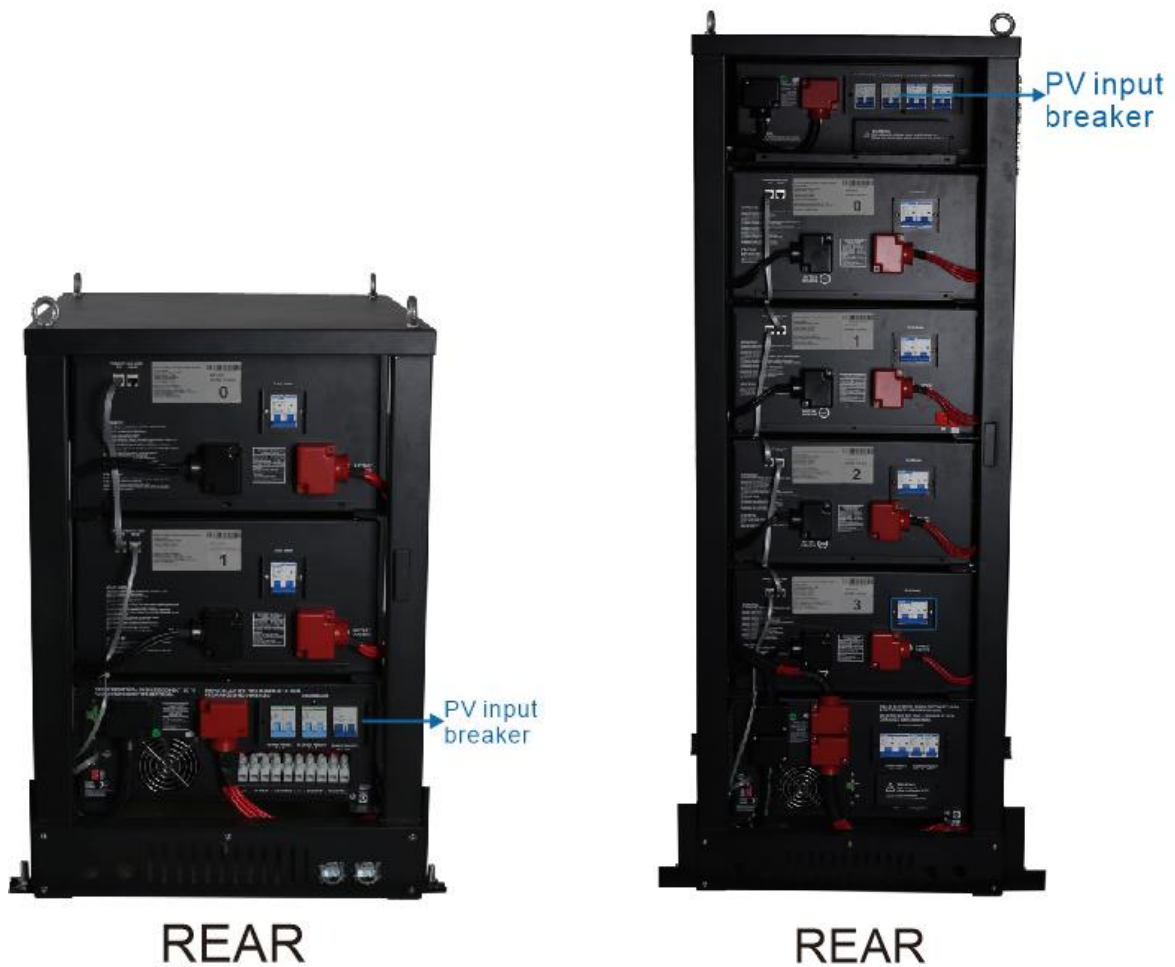


Step 2, Open the front panel, turn on all the switch of battery pack(ID:0、1、2...)one by one , then the SOC and RUN LEDs on the battery panel will lighting, battery pack working, LCD will light and display the battery information



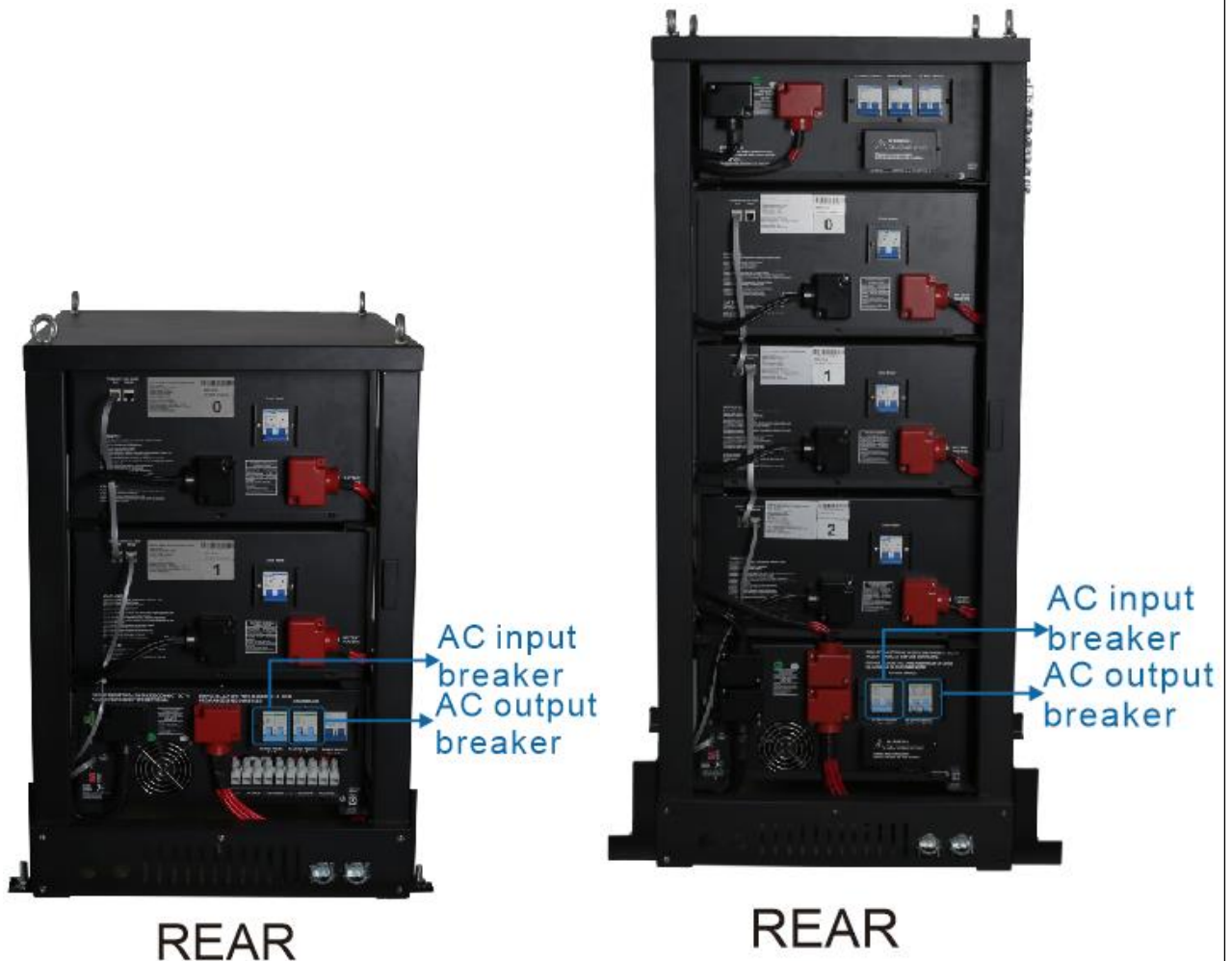
5.1.2 MPPT turn on

Step 3, Open the rear panel of the cabinet, turn on the PV(1、2、3、4) input breaker one by one, MPPT will work, the GREEN charging LED on the MPPT module panel will flash.



5.1.3 Inverter turn on

Step 4, Turn on the power switch on the LCD panel, inverter will working, then turn on the AC output breaker, the load will get AC output and working.
If you want charging the battery by AC, turn on the AC input breaker.



5.2 Power off

Step1, turn off the power switch on the LCD panel

Step2, turn off the AC input and output breaker on inverter

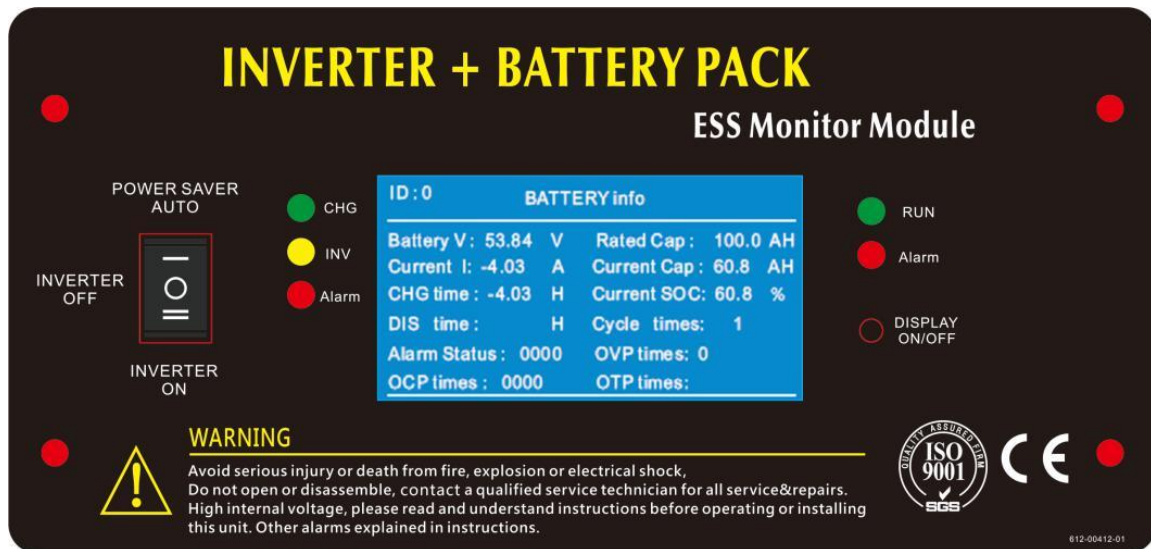
Step3, turn off the PV input breaker one by one

Step4, turn off the battery power switch one by one

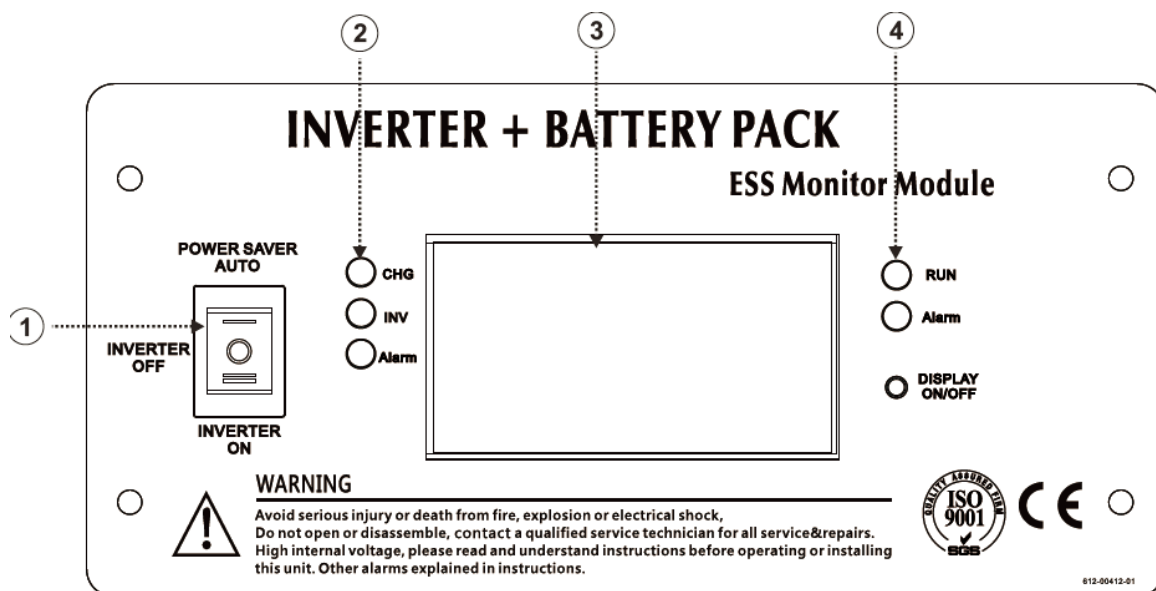
Step5, turn off the battery breaker one by one

5.3 LCD Module Introduction

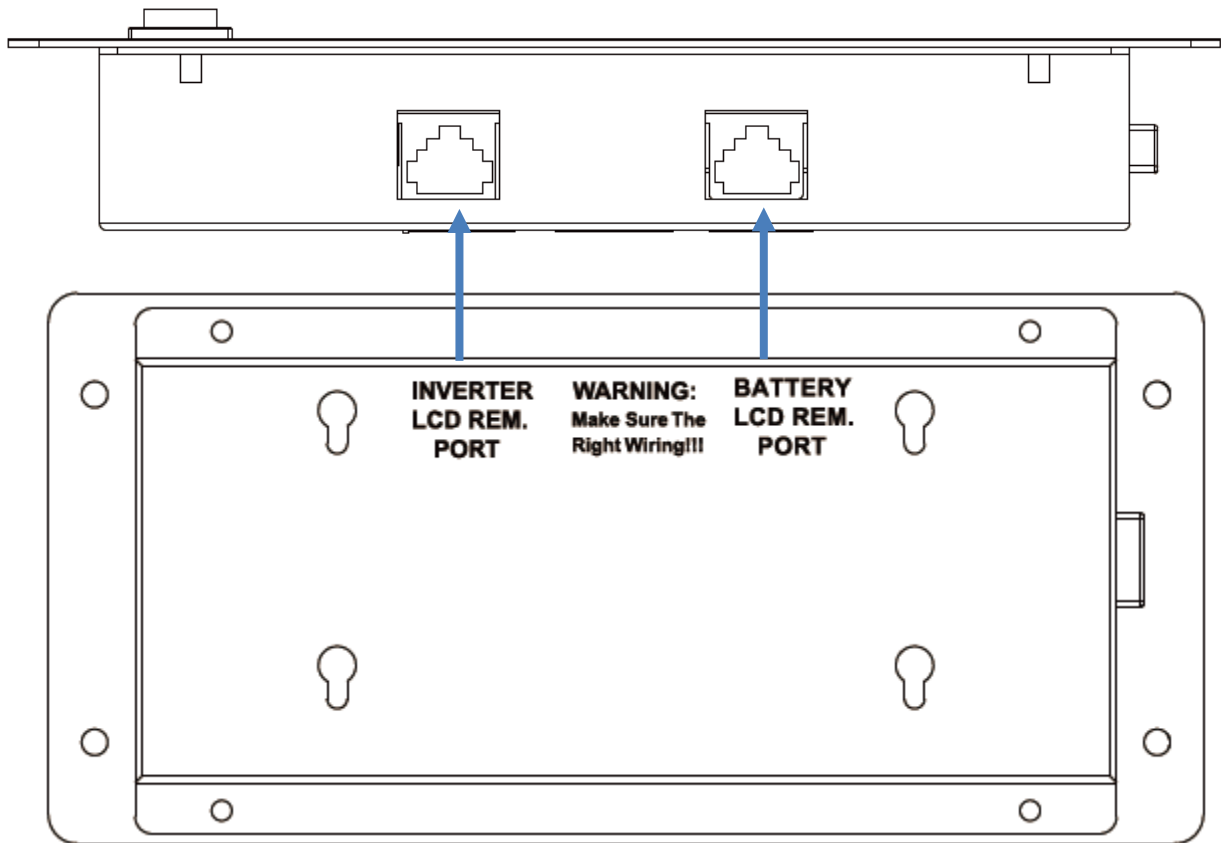
The LCD display battery and inverter working information in the cabinet



5.3.1 function description



Item	Name	Description
1	switch	Power saver auto: inverter work in saver mode
		Inverter OFF: inverter power off
		Inverter ON: inverter work in normal mode
2	Inverter indicator LED	CHG: inverter working in battery charge mode
		INV: inverter working in battery discharge mode
		Alarm: inverter warning or fault
3	LCD Screen	Display inverter and battery working information
4	Battery indicator LED	RUN: battery working normal
		Alarm: battery warning or fault
		Display ON/OFF

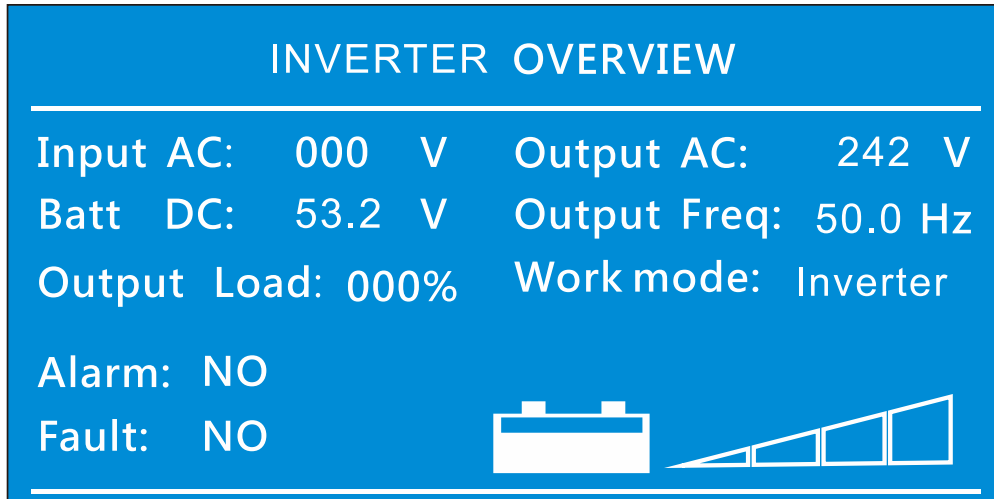


Note:

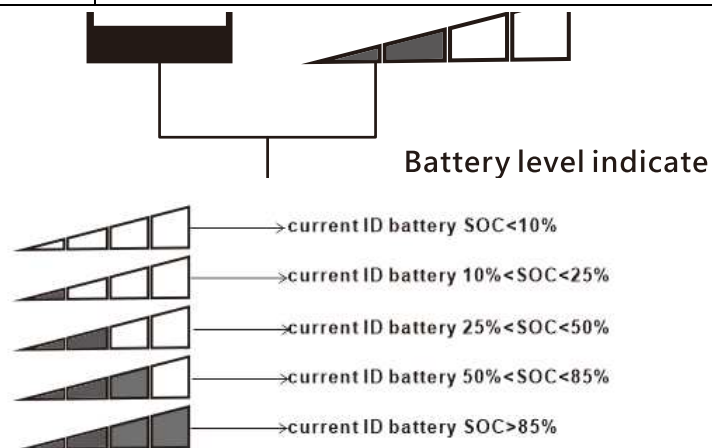
1. The connector of Inverter port is RJ45 type, connector of Battery is RJ11 type, never insert the wrong position or damage will happen and invalid warranty.
2. DISPLAY ON/OFF: touch the button lighting the LCD, keep press the button, the current screen will hold for checking information

5.3.2 Display introduction

INVERTER display



Input AC:	Current utility or generator AC voltage
Output AC:	Inverter output AC voltage
Batt DC:	Current battery voltage
Output Freq:	Inverter output AC frequency
Output Load:	Current AC loads percentage inverter take
Work mode:	Charging or Inverter
Alarm:	Ref inverter 3.3.9
Fault:	Ref inverter 3.3.9



BATTERY PACK display

ID : 0		BATTERY info	
Battery V :	53.84 V	Rated Cap :	100.0 AH
Current I :	-4.03 A	Current Cap :	60.8 AH
CHG time :	-4.03 H	Current SOC :	60.8 %
DIS time :	H	Cycle times :	1
Alarm Status :	0000	OVP times :	0
OCP times :	0000	OTP times :	

first battery info window

Battery V:	Current ID battery voltage
Rated Cap:	Battery rated capacity of current ID
Current I:	Positive means charge, Negative means discharge
Current Cap:	Remain capacity of current ID battery
CHG time:	Estimated time to charging battery full
Current SOC:	Remain SOC of current ID battery
DIS time:	Estimated time to discharge battery empty
Cycle times:	Battery cycle times of current ID
ID:	Current battery identity number
Alarm status:	Ref the battery pack alarm code table
OVP times	Number of battery voltage alarm times
OCP times	Number of battery current alarm times
OTP times	Number of battery temperature alarm times

Battery pack alarm code table

0000	normal
0100	Cell Over-voltage Warning
0200	Cell Over-voltage Protection
0400	Cell Low-voltage Warning

0800	Cell Low-voltage Protection
0010	Cell Over-temp Warning
0020	Cell Over-temp Protection
0040	Cell Low-temp Warning
0080	Cell Low-temp Protection
0001	Discharge Over-current Warning
0002	Discharge Over-current Protection
0004	Charge Over-current Warning
0008	Charge Over-current Protection

ID : 0		Cell Details (uint: mV / °C)	
C1:3314	C5:3316	C9:3311	C13:3317
C2:3318	C6:3320	C10:3311	C14:3314
C3:3318	C7:3313	C11:3312	C15:3310
C4:3321	C8:3314	C12:3311	C16:3324
T1:30.8	T2:29.7	T3:29.2	T4:28.9
MaxV:3310	MinV:3324	MaxT:30.8	MinT:28.9

second battery info window

ID	Current battery identity number
C1——C16	Internal cells voltage
T1——T4	Internal temperature detecting value
Max V	Maximum cell voltage
Min V	Minimum cell voltage
Max T	Maximum internal temperature detecting value
Min T	Minimum internal temperature detecting value

5.4 Battery Communication with PC(optional)

Connect the CAN communication card from the battery pack to the computer, after installing the ESS monitor, the information displays on 7 different tabs:

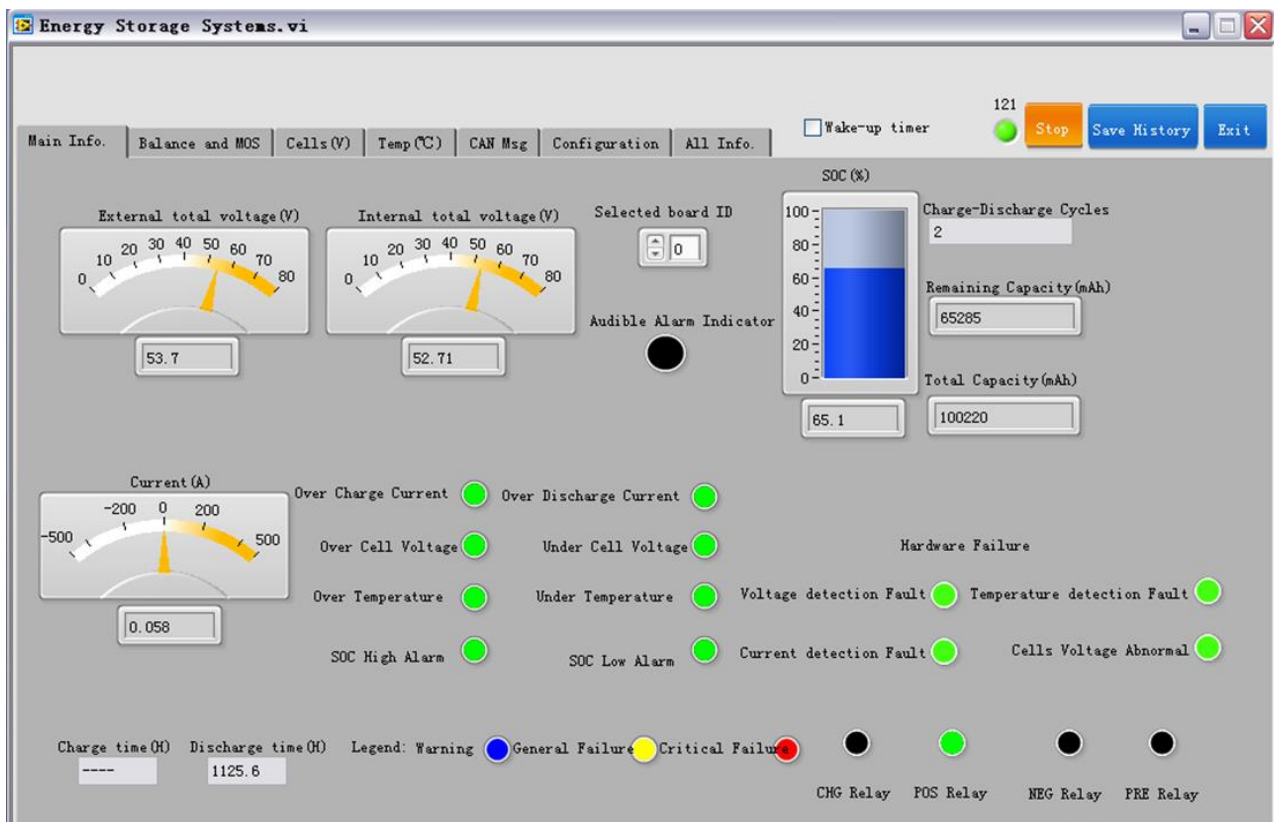
1. Main Info tab: SOC%, voltage, current, cycles, capacity and running status
2. Balance & MOS tab: cell balancing
3. Cells tab: cell voltage
4. Temp tab: internal cell temperature
5. CAN Transmission Message
6. Configuration tab:
 - Bus
 - Diagnostics - displays voltage, temp and current
 - Data storage
7. All Info tab: summary of all info per battery if more than one battery is being used (max 10 batteries in parallel)

NOTE: The CAN communication card need to buy independent

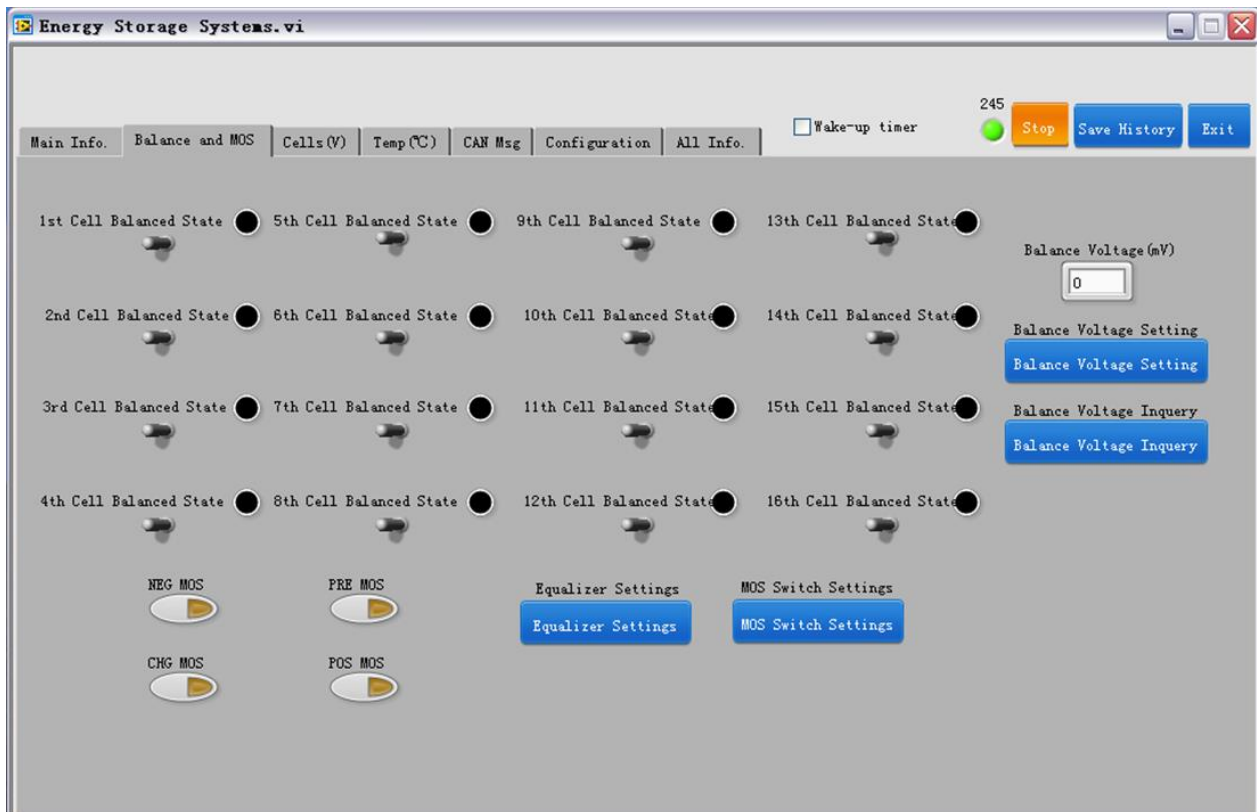




Example for ESS6048E200P2



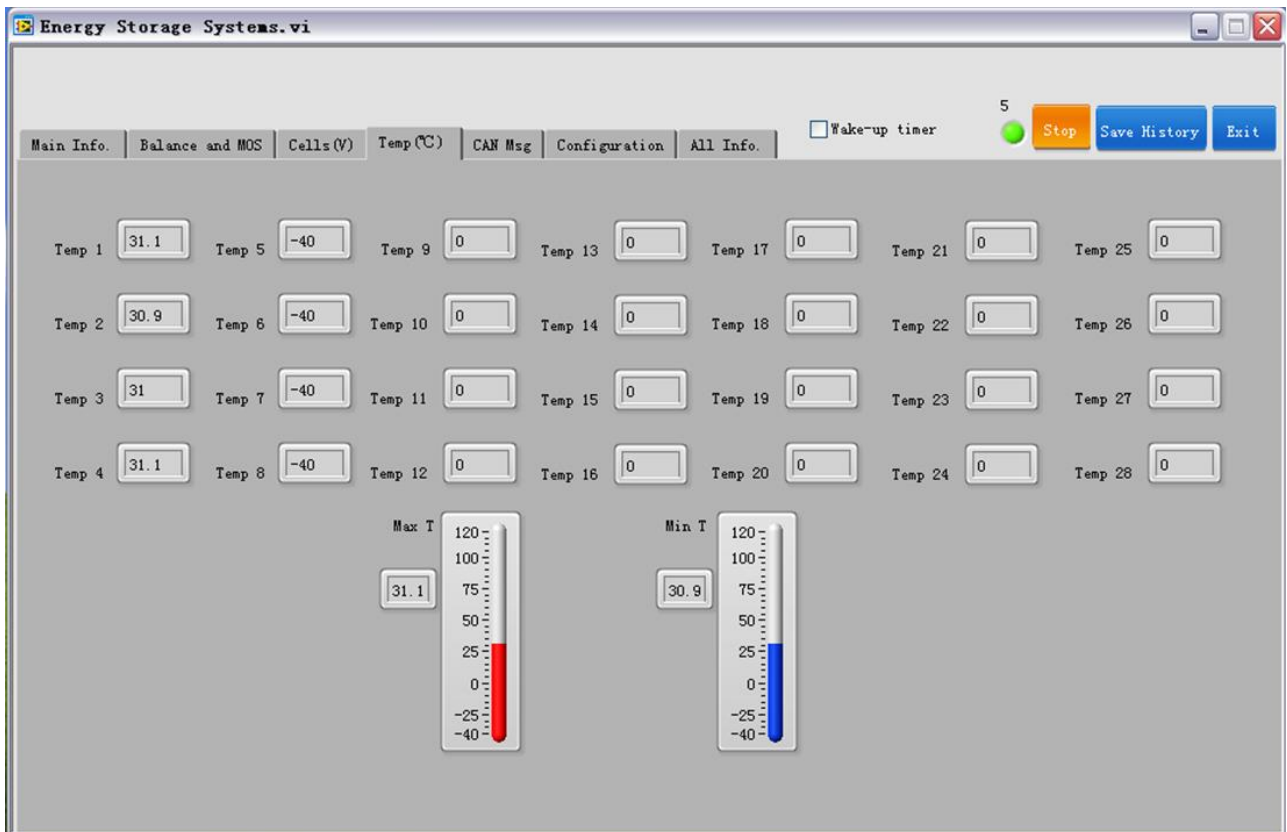
1、Main Info tab: SOC%, voltage, current, cycles, capacity and running status



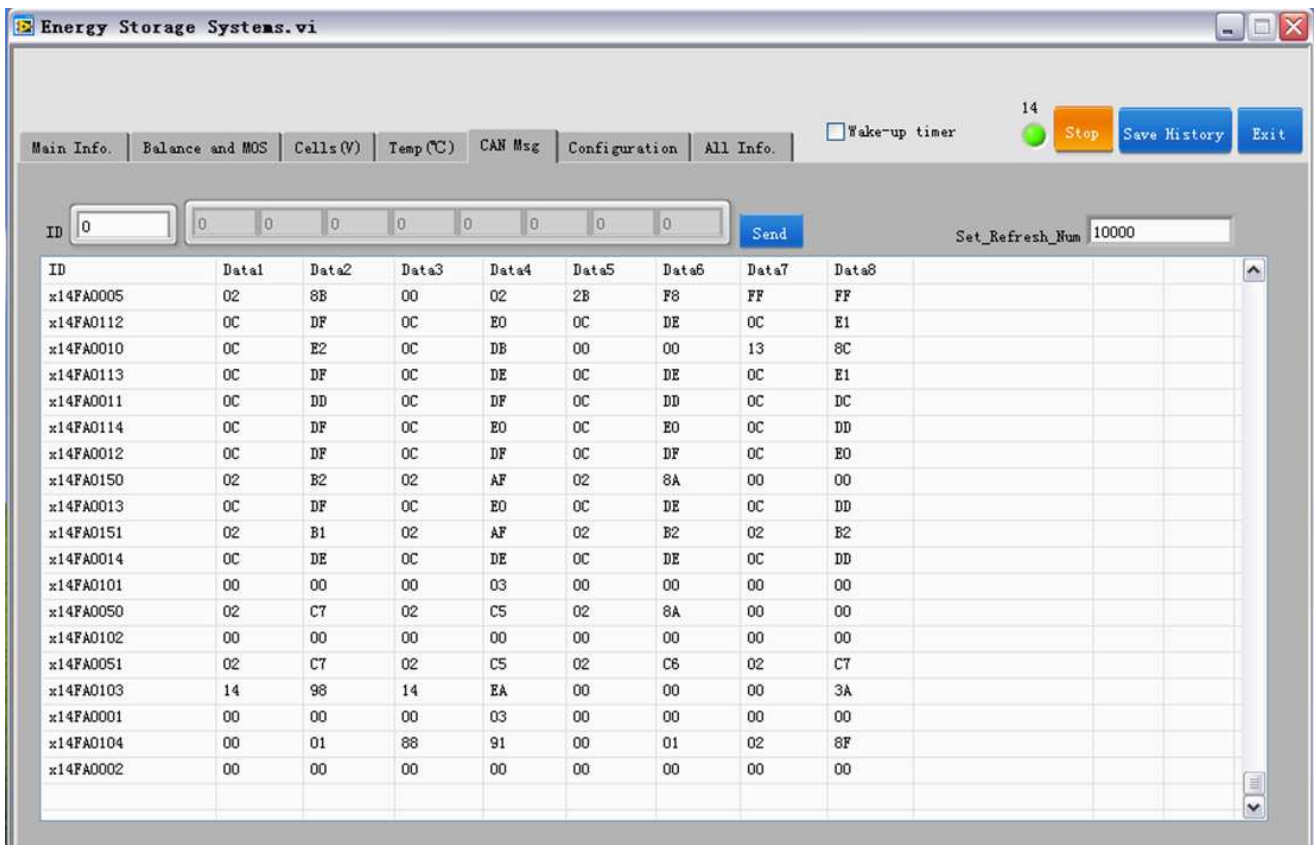
2、Balance & MOS tab: cell balancing



3、Cells tab: cell voltage



4、Temp tab: internal cell temperature



5、CAN Transmission Message

Energy Storage Systems.vi

Wake-up timer 209 Stop Save History Exit

Main Info. Balance and MOS Cells(V) Temp(°C) CAN Msg Configuration All Info.

Bus Diagnostics Data Storage

Total Capacity Setting(mAh) 100220 Board ID 0 Board No. 3 Serial Number 16512104 Send

Import Config Export Config Board Setting

Over Voltage Lv1 (mV)	Restore (mV)	Over Temperature Lv1 (°C)	Restore (°C)	Over Discharge Current Lv1 (A)	SN Setting Parameter Inquiry CAN to RS485 RS485 to CAN Power Off
3600	3400	50	45	100	
Over Voltage Lv2 (mV)	Restore (mV)	Over Temperature Lv2 (°C)	Restore (°C)	Over Discharge Current Lv2 (A)	
3650	3350	55	50	110	
Under Voltage Lv1 (mV)	Restore (mV)	Under Temperature Lv1 (°C)	Restore (°C)	Over Charge Current Lv1 (A)	
2700	2900	0	5	50	
Under Voltage Lv2 (mV)	Restore (mV)	Under Temperature Lv2 (°C)	Restore (°C)	Over Charge Current Lv2 (A)	
2500	2800	-5	0	55	

6、Configuration tab: Bus Diagnostics - displays voltage, temp and current Data storage

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Wake-up timer 143 Stop Save History Exit

Main Info. Balance and MOS Cells(V) Temp(°C) CAN Msg Configuration All Info.

ID	ExTV	InTV	Cur	Soc	Cap	Cyc	MaxV	MinV	MaxT	MinT	State
0	53.67	52.7	0.038	65.1	65287	2	3.297	3.291	31.1	30.9	0
1	53.55	52.71	0.07	65.8	66192	2	3.297	3.292	29	28.6	0
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0

7、All Info tab: summary of all info per battery if more than one battery is being used (max 10 batteries in parallel)

5.5 Troubleshooting of battery

Check the indicators on the front of the battery to determine the status of the battery pack. A warning state is triggered when a condition, such as voltage or temperature, is outside battery's rating. When the battery pack status falls outside of set limits, it enters a warning state. When a warning is reported, turn off the DC source immediately.

Use the monitoring software to identify the cause of the warning.

Warning Alarms

Battery Over Voltage

Battery Under Voltage

Battery Over Temperature

Battery Under Temperature

Battery Discharge Over Current

Battery Charge Over Current

The fault state is cleared when the battery pack recovers to normal operation. If battery pack is not working correctly and the issue persists, contact a qualified technician or your distributor.

If the battery pack or the inverter indicates FAULT or fails to operate, contact your distributor immediately.

6 Liability Limitation

Any product damage or property loss caused by the following conditions does not assume any direct or indirect liability.

Product modified, design changed or parts replaced without authorization;

Changes, or attempted repairs and erasing of series number or seals by non technician;

System design and installation are not in compliance with standards and regulations;

Failure to comply with the local safety regulations;

Transport damage (including painting scratch caused by rubbing inside packaging during shipping). A claim should be made directly to shipping or insurance company in this case as soon as the container/packaging is unloaded and such damage is identified;

Failure to follow any/all of the user manual, the installation guide and the maintenance regulations;

Improper use or misuse of the device;

Insufficient ventilation of the device;

The maintenance procedures relating to the product have not been followed to an acceptable standard;

Force majeure (violent or stormy weather, lightning, overvoltage, fire etc);

Damages caused by any external factors.

