

SAJ



GUANGZHOU SANJING ELECTRIC CO.,LTD

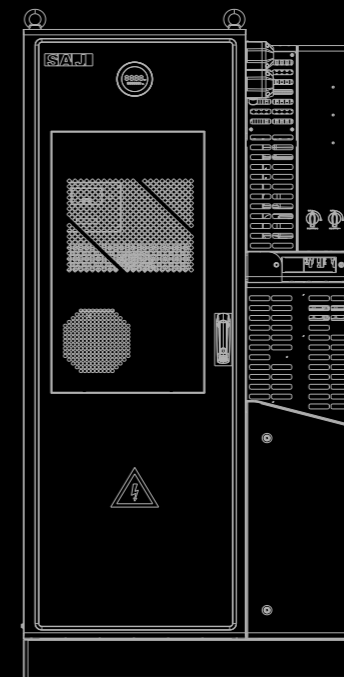


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V0.0

SAJ



CHS2 Series

C&I ENERGY STORAGE SYSTEM

CHS2-(29.9K-63K)-(T4,T5,T6)-X

(X=204.8V/280Ah/51.5kWh,256.0V/280Ah/64.4kWh,307.2V/280Ah/77.3kWh,358.4V/280Ah/90.2kWh)

Preface

Thank you for choosing SAJ product. We are pleased to provide you first-class products and exceptional service.

This manual includes information for installation, operation, maintenance, trouble shooting and safety. Please follow the instructions of this manual so that we can ensure delivery of our professional guidance and wholehearted service.

Customer-orientation is our forever commitment. We hope this document proves to be of great assistance in your journey for a cleaner, greener world.

Please check for the latest version at www.saj-electric.com

Guangzhou Sanjing Electric Co., Ltd.



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1.1 Scope of Application

This User Manual describes instructions and detailed procedures for installing, operating, maintaining, and troubleshooting of the following SAJ products:

CHS2-29.9K-T4-X; CHS2-30K-T4-X; CHS2-40K-T5-X; CHS2-50K-T6-X; CHS2-63K-T6-X;

1.2 Safety Instructions



DANGER

· DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.



WARNING

· WARNING indicates a hazardous situation which, if not avoided, can result in death or serious injury or moderate injury.



CAUTION

· CAUTION indicates a hazardous condition which, if not avoided, can result in minor or moderate injury.

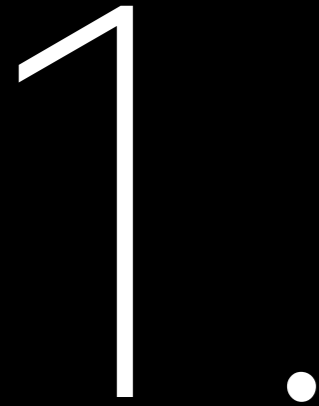


NOTICE

· NOTICE indicates a situation that can result in potential damage, if not avoided.

1.3 Target Group

Only qualified electricians who have read and fully understood all safety regulations contained in this manual can install, maintain and repair the device. Operators must be aware of the high-voltage device.



SAFETY PRECAUTIONS



2.

PREPARATION



2.1 Safety Instructions

For safety, be sure to read all the safety instructions carefully prior to any works, and please observe the appropriate rules and regulations of the country or region where you installed C&I energy storage system.

DANGER

- There is possibility of dying due to electrical shock and high voltage.
- Do not touch the operating component of the inverter; it might result in burning or death.
- To prevent risk of electric shock during installation and maintenance, please make sure that all AC and DC terminals are plugged out.
- Do not touch the surface of the equipment while the housing is wet, otherwise, it might cause electrical shock.
- Do not stay close to the equipment while there are severe weather conditions including storm, lightning, etc.
- Before opening the housing, the SAJ inverter must be disconnected from the grid and PV generator; you must wait for at least five minutes to let the energy storage capacitors completely discharged after disconnecting from power source.
- Please keep the power off prior to any operations
- Do not expose the battery to temperatures in excess of 50°C.
- Do not subject the battery to any strong force.
- Keep inflammable and explosive dangerous items or flames away from the battery.
- Do not soak the battery in water or expose it to moisture or liquids.
- Do not use the battery in areas where the ammonia content of the air exceeds 20ppm.

WARNING

- Only qualified personnel who has full knowledge of local safety regulations and local standards on battery can install, maintain, retrieve and process this product.
- SAJ electric shall not be liable for any loss or warranty claims arising from any unauthorized change of product which may cause fatal injury to the operator, third party or equipment performance.
- For personal and property safety, do not short-circuit the positive (+) and negative (-) electrode terminals.










CAUTION



- Risk of damage due to improper modification
- Use professional tools when operating the products.
- The inverter will become hot during operation. Please do not touch the heat sink or peripheral surface during or shortly after operation.

NOTICE

- During installation of the battery, circuit breaker must be disconnected from the battery pack wiring.

2.2 Explanations of Symbols

Symbol	Description
	Dangerous electrical voltage This device is directly connected to public grid, thus all work to the battery shall only be carried out by qualified personnel.
	No open flames Do not place or install near flammable or explosive materials.
	Danger of hot surface The components inside the battery will release a lot of heat during operation. Do not touch metal plate housing during operating.
	Attention Install the product out of reach of children
	An error has occurred Please go to Chapter 7 "Troubleshooting" to remedy the error.
	This device shall NOT be disposed of in residential waste
	This battery module shall NOT be disposed of in residential waste
	CE Mark Equipment with the CE mark fulfills the requirements of the Low Voltage Directive and Electro Magnetic Compatibility.
	Recyclable

Danger to life due to high electrical voltage!
There might be residual currents in inverter because of large capacitors. Wait 5 MINUTES before you remove the front lid.

2.3 Battery Handling

Operate and use the battery properly according to user manual, any attempt to modify battery without the permission from SAJ will void the limit warranty for the battery.

- The battery must be installed at a suitable location with sufficient ventilation
- Do not use the battery if it is defective, damaged or broken.
- Only use the battery with compatible inverter.
- Do not use the battery with other type of battery.
- Make sure the battery is grounded prior to use.
- Do not pull out any cables or open the battery enclosure when the battery is powered on.
- Only use the battery as intended and designed.

2.4 Emergency Situation

Despite of its careful and professional protection design against any hazards, damage of the battery may still possible. If a small amount of battery electrolyte is released due to a serious damage of the outer casing; or if the battery explodes due to not being treated timely after a fire breaks out nearby, and leaks out poisonous gases such as carbon monoxide, carbon dioxide and etc., the following actions are recommended:

- 1) Eye contact: Rinse eyes with a large amount of running water and seek medical advice
- 2) Contact with skin: Wash the contacted area with soap thoroughly and seek medical advice
- 3) Inhalation: If you feel discomfort, dizziness or vomiting, seek medical advice immediately.
- 4) Use a FM-200 or Carbon Dioxide (CO₂) fire extinguishers to extinguish the fire if there is a fire in the area where the battery pack is installed. Wear a gas mask and avoid inhaling toxic gases and harmful substances produced by the fire.
- 5) Use an ABC fire extinguisher, if the fire is not caused by battery and not spread to it yet.

⚠ WARNING

- If a fire has just occurred, try to disconnect the battery circuit breaker and cut off the power supply first, but only if you can do so without endangering yourself.
- If the battery is on fire, do not attempt to extinguish the fire but evacuate the crowd immediately.

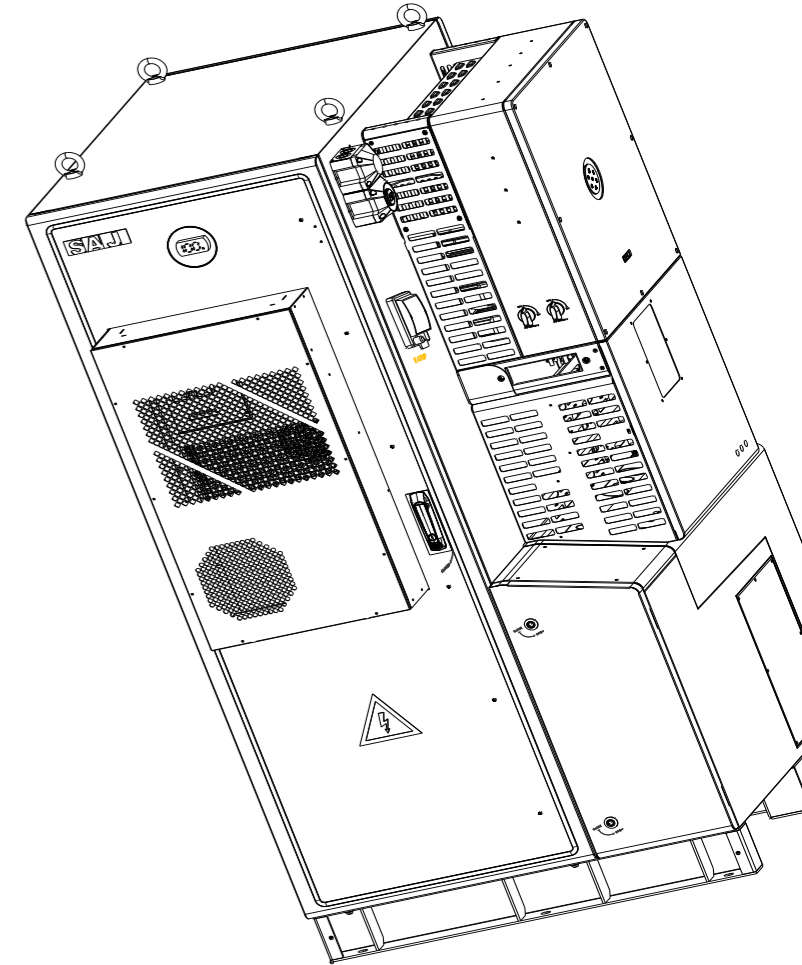
Potential danger of damaged battery:

Chemical Hazard: Despite of its careful and professional protection design against any hazard results, rupture of battery may still occur due to mechanical damage, internal pressure etc., and may result in a leakage of battery electrolyte. The electrolyte is corrosive and flammable. When there is fire, the toxic gases produced will cause skin and eyes irritation, and discomfort after inhalation. Therefore:

- 1) Do not open damaged batteries;
- 2) Do not damage the battery again (shock, fall, trample, etc.);
- 3) Keep damaged batteries away from water (except to prevent an energy storage system from catching fire);
- 4) Do not expose the damaged battery to the sun to prevent internal heating of the battery.

Electrical hazard: The reason of fire and explosion accidents in lithium batteries is battery explosion. Here are the main factors of battery explosion:

- 1) Short circuit of battery. Short circuit will generate high heat inside battery, resulting in partial electrolyte gasification, which will stretch the battery shell. The temperature reaching ignition point of internal material will lead to explosive combustion.
- 2) Overcharge of battery. Overcharge of battery may precipitate lithium metal. If the shell is broken, it will come into direct contact with the air, resulting in combustion. The electrolyte will be ignited at the same time, resulting in strong flame, rapid expansion of gas and explosion.



3.

PRODUCT INFORMATION



3.1 Application Scope of Products

The product is C&I energy storage system with battery and it is suitable for large residential or small industrial and commercial scenarios. The energy storage system is able to store the energy for future use. It is built internally with a battery management system (BMS), which is used to ensure efficiency of the battery and protect the battery from operating outside its specified limitations.

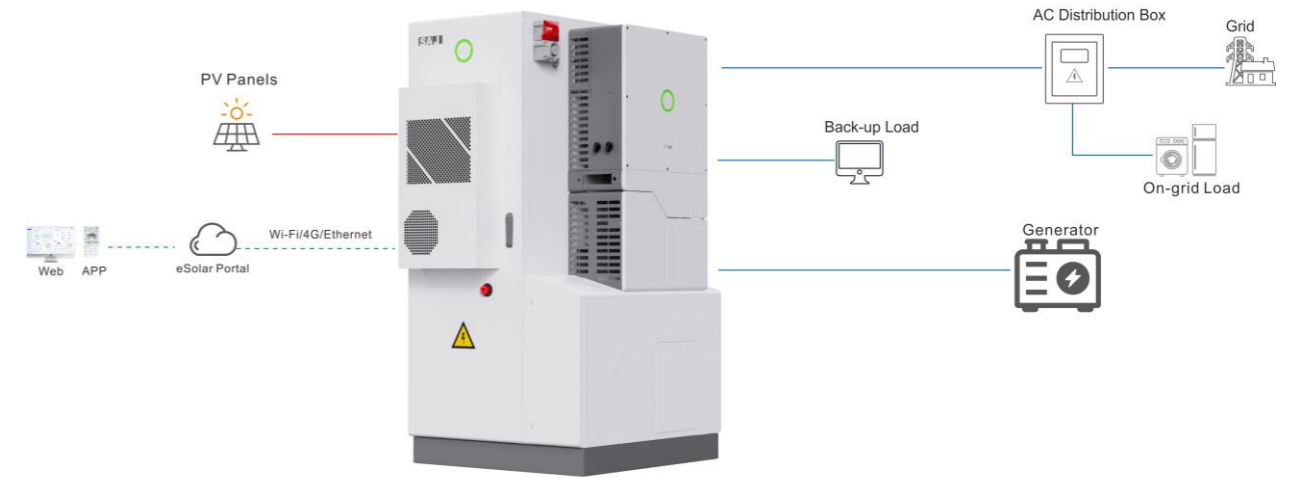


Figure 3.1
System overview

3.2 Specification for Product Model

CHS2 - **XK** - **T4** - **X**
 ① ② ③ ④

- ①CHS2 represents for product name.
- ②XK represents rated energy XkW of storage system, for example, 30K means 30kW.
- ③T means three phases, T4 means three phases with 4MPPT
- ④X indicates the Battery Rated Voltage/Rated Capacity/Usable Energy

3.3 Overview of Products

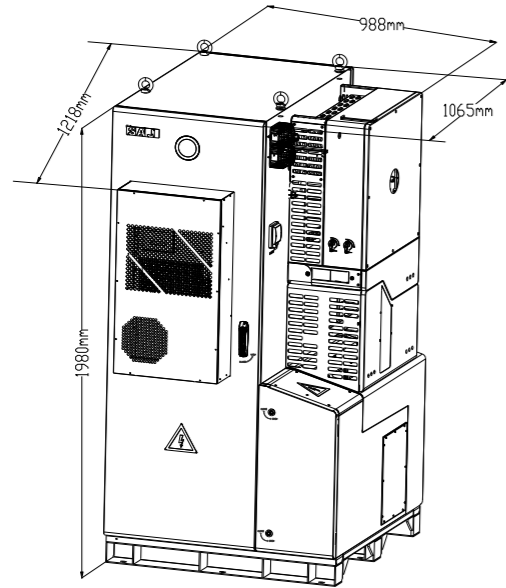


Figure 3.2
Dimensions of inverter

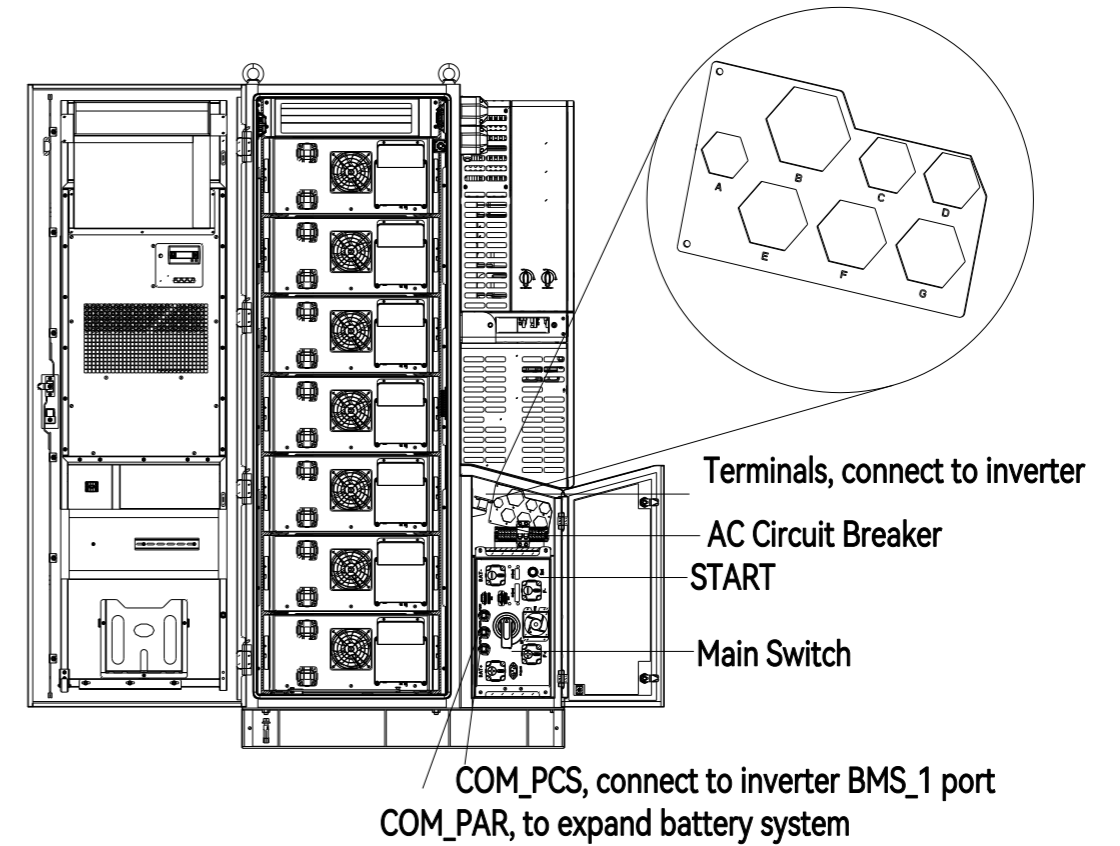


Figure 3.4
Battery control unit interface

3.4 Terminals Description

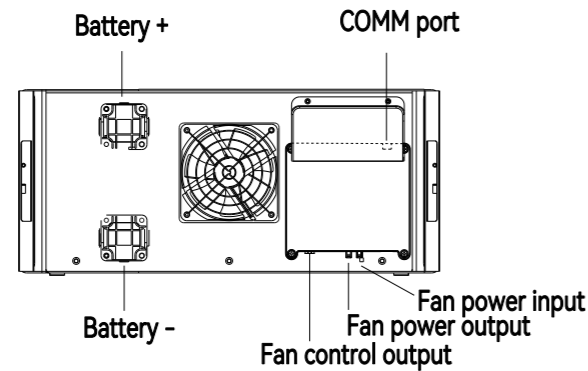


Figure 3.3
Battery module interface

A	220V input from CH2
B	High voltage box and CH2 power line
C	CAN communication with CH2 and parallel machine
D	Parallel 220V AC output
E	Parallel DC positive input
F	Parallel DC negative input
G	Parallel DC negative output

Table 3.1
Waterproof connector wiring identification

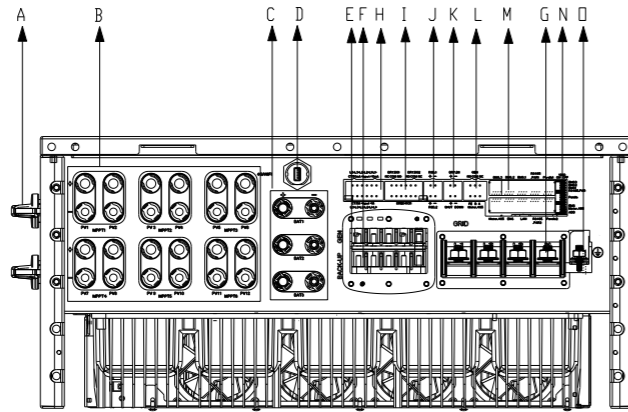


Figure 3.5
Electrical interface of Inverter

Code	Name
A	DC Switch
B	PV Input
C	Battery Port
D	4G/ Wi-Fi
E	Generator
F	Backup
G	Grid
H	CT
I	DRY/DRED/RCR
J	RSD
K	DRY/SHUT DOWN
L	Generator /Meter
M	BMS/ LAN/ EMS/ METER/ PARELLE
N	120Ω Resistor
O	Ground Connection

Table 3.2
Terminals description

3.5 Datasheet Inverter

Model	CHS2-29.9K-T4-X	CHS2-30K-T4-X	CHS2-40K-T5-X	CHS2-50K-T6-X	CHS2-63K-T6-X
DC Input					
Max. PV Array Power [Wp]@STC	59800	60000	80000	100000	126000
Max. DC Voltage [V]	1000				
MPPT Voltage Range [V]	180~850				
Rated DC Voltage [V]	600				
Start Voltage [V]	200				
Max. DC Input Current [A]	4*45		5*45		6*45
Max. DC Short Circuit Current [A]	4*56.5		5*56.5		6*56.5
Number of Strings per MPPT	2				
Battery Parameters					
Battery Type	LiFePO4				
Rated Energy [kWh]	57.3~100.3				
Battery Voltage Range [V]	179.2~403.2				
Max. Charging/Discharging Current [A]	140				
AC Output [On-grid]					
Rated AC Power [W]	29900	30000	40000	50000	63000
Rated Apparent Power [VA]	29900	30000	40000	50000	63000
Max. Apparent Power [VA]	29900	33000	44000	55000	63000
Rated Output Current [A]@230Vac	43.3	43.5	58.0	72.5	91.3
Max. AC Output Current to Utility Grid [A]	43.3	47.9	63.8	79.8	91.3
Current Inrush[A]	192				
Max. AC Fault Current[A]	182.6				
Max. AC Over Current Protection[A]	86.6	87	116	145	182.6
Rated AC Voltage [V]	3+N+PE/3+PE,400				
Rated Output Frequency/Range [Hz]	50,60/45~55,55~65				
Power Factor [cos φ]	0i - 1 - 0c				
Total Harmonic Distortion [THDi]	<3%				
AC Input [On-grid]					
Rated AC Voltage [V]	3+N+PE/3+PE,400				
Rated Input Frequency [Hz]	50,60				
Max. Input Current [A]	150				
AC Input [Generator]					
Max. Input Power [W]	29900	30000	40000	50000	63000
Max. Input Current [A]@230V	43.3	43.5	58.0	72.5	91.3
Rated Input Voltage [v]	3+N+PE/3+PE,400				
Rated Input Frequency/Range [Hz]	50,60/45~55,55~65				

Model	CHS2-29.9K-T4-X	CHS2-30K-T4-X	CHS2-40K-T5-X	CHS2-50K-T6-X	CHS2-63K-T6-X
AC Output [Back-up]					
Max. Apparent Power [VA]	29900	33000	44000	55000	63000
Peak Output Apparent Power [VA]	29900	45000,5s	60000,5s	75000,5s	75000,5s
Rated AC Voltage [V]	3+N+PE/3+PE,400				
Rated Output Frequency/Range [Hz]	50,60/45 ~ 55,55 ~ 65				
Output THDv (@ Linear Load)	<3%				
Efficiency					
Max. Efficiency	98.6%				
Euro Efficiency	98.0%				
Max. Battery to AC Efficiency	96.0%				
Protection					
PV String Current Monitoring	Integrated				
PV Insulation Resistance Detection	Integrated				
Residual Current Monitoring	Integrated				
PV Reverse Polarity Protection	Integrated				
Anti-islanding Protection	AFD				
AC Overcurrent Protection	Integrated				
AC Short Circuit Protection	Integrated				
AC Overvoltage Protection	Integrated				
DC switch	Integrated				
DC Surge Protection	II				
AC Surge Protection	II				
AFCI	Integrated				
RSD	Optional				
General Parameters					
Communication	Wi-Fi/Ethernet/CAN/RS485				
Topology	Non-isolated				
Operating Temperature Range	-30°C to +50°C (45°C to 50°C with derating)				
Cooling Method	Air Conditioner				
Ambient Humidity	0-100% Non-condensing				
Altitude	4000m (>3000m Power Derating)				
Ingress Protection	IP55, IP66(Inverter)				
Dimensions [H*W*D] [mm]	1980*988*1065				
Weight [kg]	1050(57.3kWh)/1150(71.6kWh)/1250(85.9kWh)/1350(100.3kWh)				
Warranty [Year]	5/10				
Standard	VDE4105,IEC61727/62116,VDE0126,AS4777.2, CEI 0 21,EN50549-1,G98,G99,C10-11,UNE217002,NBR16149/NBR16150 IEC62109-1/-2, NBT32004-2018, EN61000-6-1,EN61000-6-2,EN61000-6-3, EN61000-6-4				

Note: X=204.8V/280Ah/51.5kWh,256.0V/280Ah/64.4kWh,307.2V/280Ah/77.3kWh,358.4V/280Ah/90.2kWh

Battery

Model	CB2-57.3-HV5	CB2-71.6-HV5	CB2-85.9-HV5	CB2-100.3-HV5
Rated Energy [kWh]	57.3	71.6	85.9	100.3
Usable Energy [kWh]	51.5	64.4	77.3	90.2
Rated Capacity [Ah]	280	280	280	280
No. of Modules	4	5	6	7
Nominal Voltage [V]	204.8	256	307.2	358.4
Voltage Range [V]	179.2~230.4	224~288	268.8~345.6	313.6~403.2
Charge/Discharge Current [A]	140	140	140	140
Rated Power [kW]	28.6	35.6	42.9	50.1
Weight [kg]	960	1060	1160	1260
Dimension [mm]	1980*988*1065			
Communication	CAN			
Operating Temperature Range [°C]	-30~50			
Cooling Method	Air Conditioner			
Relative Humidity	5~95% (non-condensing)			
Altitude [m]	2000			
Ingress Protection	IP55			
Mounting	Ground-Mounted			
Control Module	CBC2-HV5			
Dimension (H*W*D)[mm]	225*483*610			
Weight [kg]	28			
Battery Module	CBU2-14.33-HV5			
Rated Energy [kWh]	14.33			
Weight [kg]	115			
Dimension [mm]	231*523*805			
Applicable Standard	IEC62619-2017, UN38.3, IEC61000-6-2/4, IEC62477			

4.

INSTRUCTIONS FOR INSTALLATION



4.1 Unpacking and Inspection







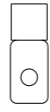
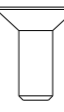






4.1.1 Checking the Package

Although SAJ's product have thoroughly tested and checked before delivery, it is uncertain that the product may suffer damages during transportation. Please check the package for any obvious signs of damage, and if such evidence is present, do not open the package and contact your dealer as soon as possible

4.1.2 Scope of Delivery

Please contact after sales if there are missing or damaged components.

Inverter Package

				
CHS2 Inverter*1	RJ45 plug*10	Plug(2P)*4	Plug(3P)*2	Plug(6P)*4
				
PV terminal T4*8*2 T5*10*2 T6*12*2	Terminals (RNBS 38-8)*2	(M4*10) flat head screw *4	(M8*16) screw*2 (M6*12) screw*1	expansion screw (M12*80)*6
				
D4 Disassembly and assembly tool*1	socket wrench *1	Documents	Communication module*1 (Optional)	

The documents include the user manual, quick installation guide and packaging list.

4.2 Installation Method and Position

4.2.1 Installation Position and Clearance

This device is cooled by natural convection and suggested an indoor installation or an installation under a sheltered place to prevent the product from exposure to direct sunlight, rain and snow erosion.

Please reserve enough clearance around the product to ensure a good air circulation at the installation area. Because poor air ventilation will affect the working performance of internal electronic components and shorten the service life of the system.

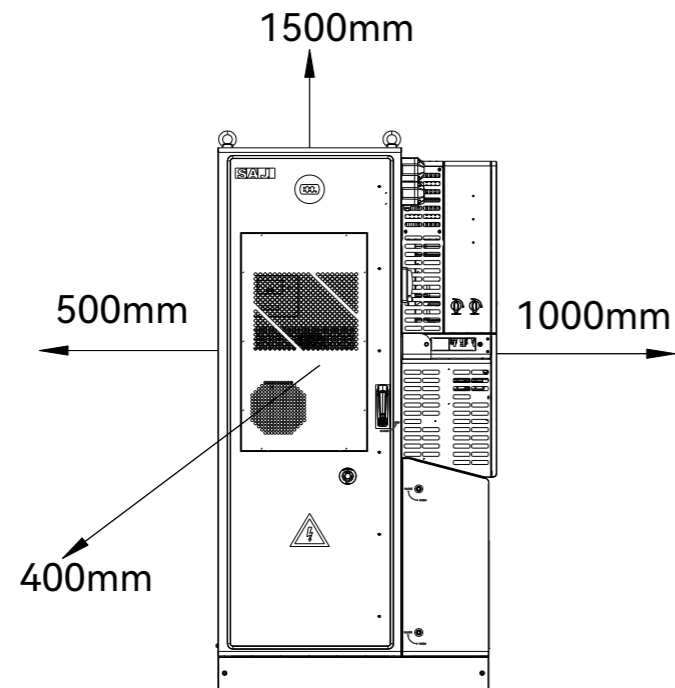


Figure 4.2
Installation clearance

4.2.2 Mounting Method

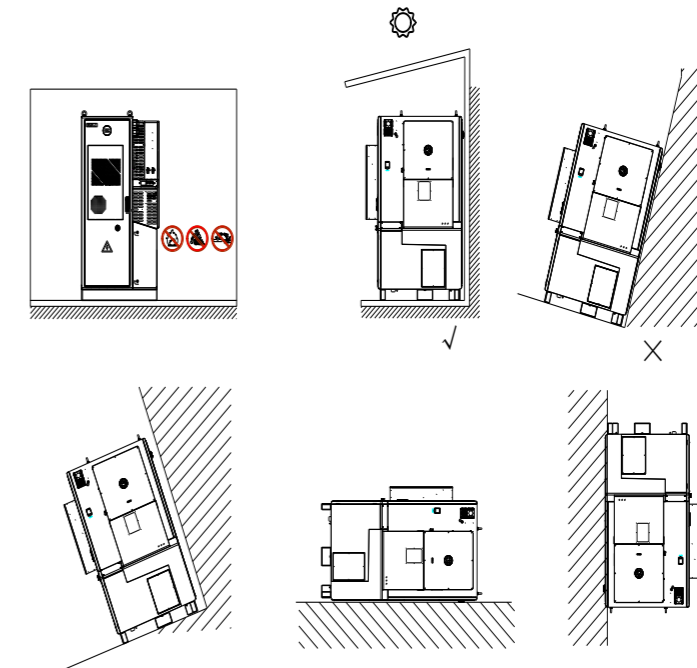


Figure 4.3
Mounting method

- ① The equipment employs natural convection cooling, and it can be installed indoor or outdoor.
- ② Mount vertically. Never install the device tilted forwards, sideways, horizontally or upside down.
- ③ The ground should be flat and no inclination. The load-bearing capacity of the ground should reach 1.5 tons.

Installation Environment Requirements

- The installation environment must be free of inflammable or explosive materials.
- Install the device away from heat source.
- Do not install the device at a place where the temperature changes extremely.
- Keep the device away from children.
- Do not install the device at daily working or living arears, including but not limited to the following areas:

bedroom, lounge, living room, study, toilet, bathroom, theater and attic.

- When installing the device at the garage, please keep it away from drive way.
- Keep the device from water sources such as taps, sewer pipes and sprinklers to prevent water seepage.
- The product is to be installed in a high traffic area where the fault is likely to be seen.

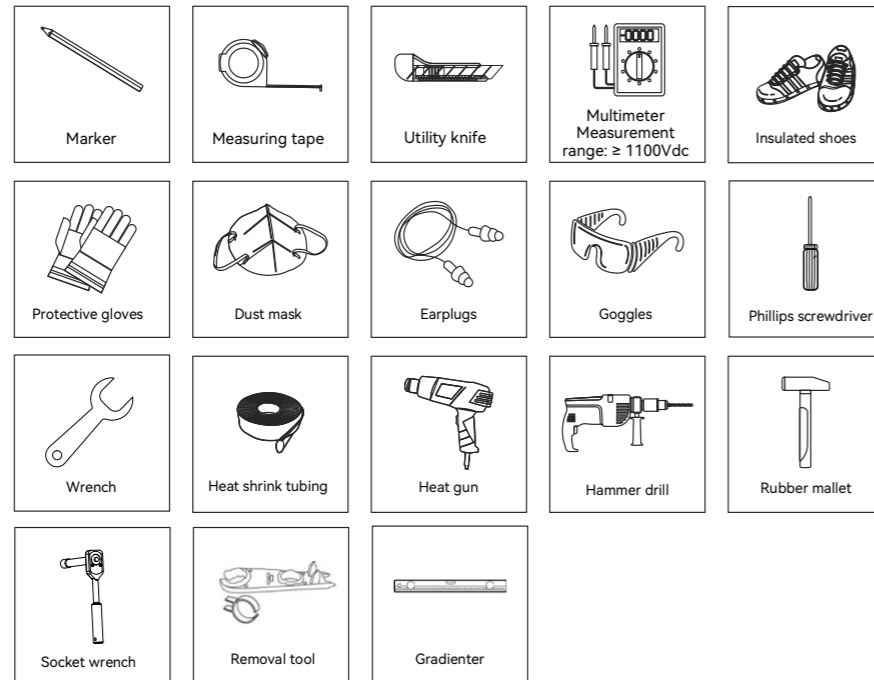
Note: When installing outdoors, the height of the device from the ground should be considered to prevent the device from soaking in water. The specific height is determined by the site environment.

4.3 Mounting Procedure

After Installation, you are suggested to tick in the right box (☐) on the system label according to the battery Rated Voltage/Rated Capacity/Usable Energy.

4.3.1 Installation Tools

Installation tools include but are not limited to the following recommended ones. Please use other auxiliary tools on site if necessary.



4.3.2 Mounting Procedures

Ground Mounting

The ground should be flat and no inclination.

Step 1: Drill six holes (16mm in diameter, 50-55mm in depth) at the position marked by the measuring tape, Disassemble the M12*80 expansion screw and put the screw sleeve into the hole.

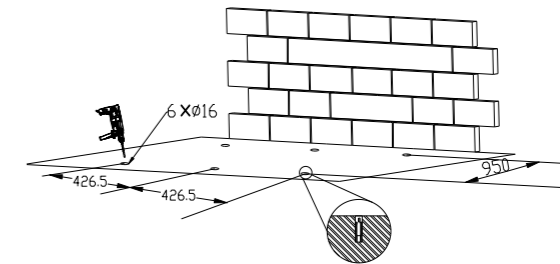


Figure 4.4
Drilling holes

Step 2: Transportation method

Crane handling:

Secure the eyebolts onto the top of the cabinet. Lift the cabinet and place it on the position of drilled holes. Moving this device requires a force greater than 2t, and the angle between the sling and the top surface must be greater than 60 degrees.

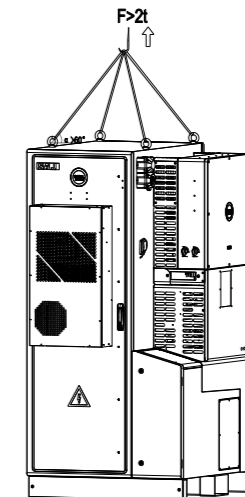


Figure 4.5
Placing the machine

Forklift transportation:

Move the cabinet and place it over the drilled holes. Adjust the width of the forklift legs so that the center of gravity is in the center of the forklift legs. The forks should completely fit the bottom of the cabinet without damaging the cabinet. The forklift load capacity must be greater than 2 tons, and the fork depth must be greater than 1.2m.

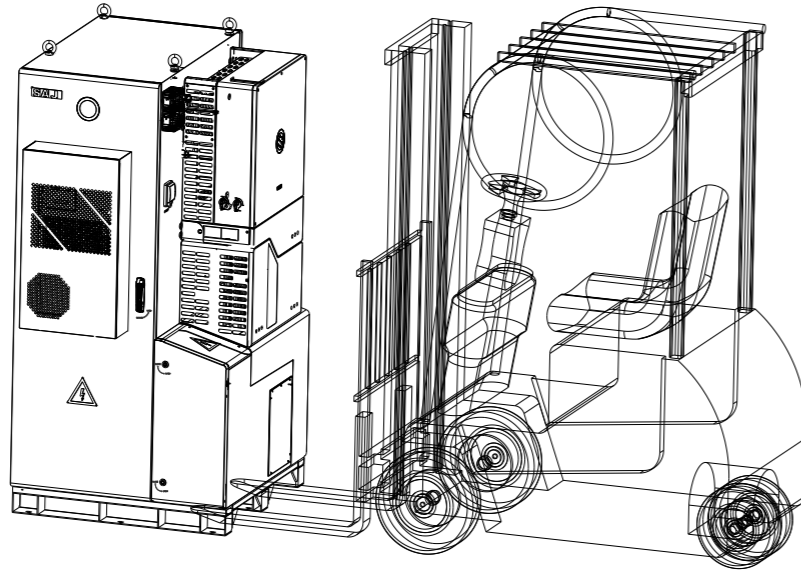


Figure 4.6
Forklift transportation

Step 3: Use the wrench to secure the bottom with the expansion bolts (M12*80).

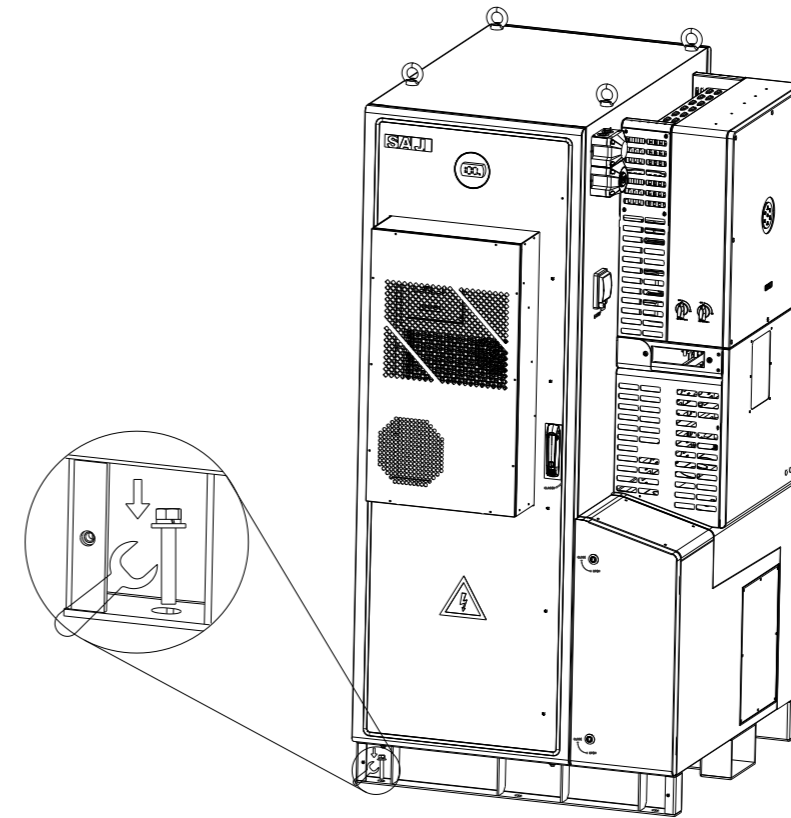


Figure 4.7
Securing the base


5.

ELECTRICAL CONNECTION



5.1 Additional Grounding Cable

Electrical connection must only be operated by professional technicians. Before connection, necessary protective equipment must be employed by technicians, including insulating gloves, insulating shoes and safety helmet.

 WARNING
· Connect this additional grounding cable before other electrical connection.

Note: The additional cable and OT/DT terminal should be prepared by user themselves.

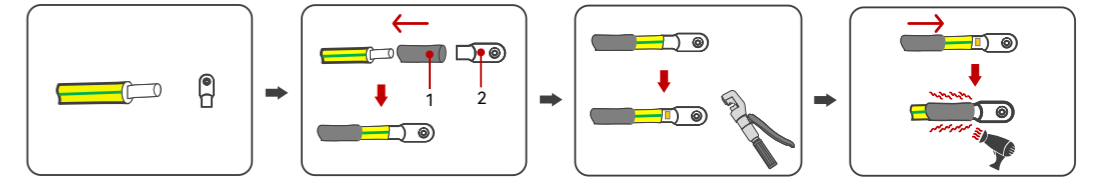


Figure 5.1
Preparing additional grounding cable

1. Heat shrink tubing 2. OT/DT terminal

Remove the screw of grounding terminal and secure the additional grounding cable by insert a screw into the screw hole in the OT/DT terminal. Connect the grounding cables as the following diagram.

Note: A 6 mm² conductor cross-sectional area of cable is recommended for additional grounding cable.

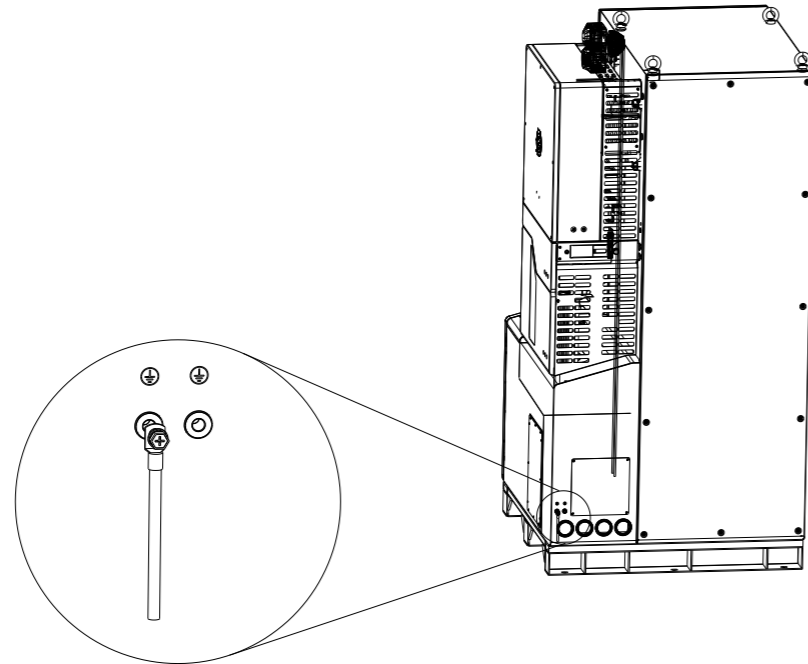


Figure 5.2
Connecting the additional
grounding cable

5.2 Communication Connection

Remove the decorative panel and AC cover

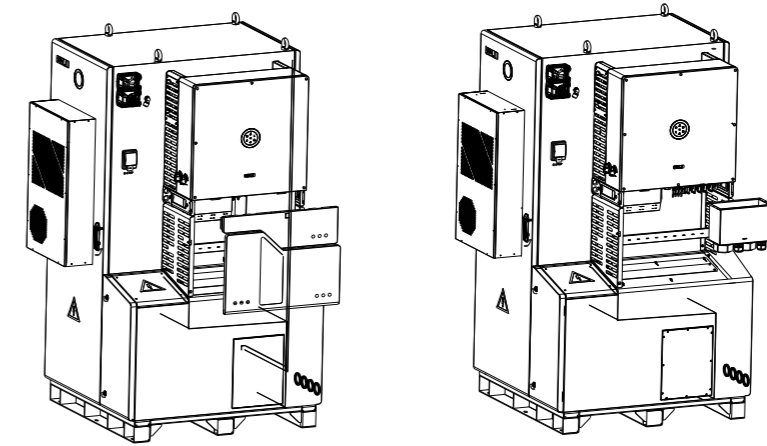


Figure 5.3
Remove the decorative
panel and AC cover

Note: The machine and external wiring need to pass through the machine through the hole in the lower right corner of the machine.

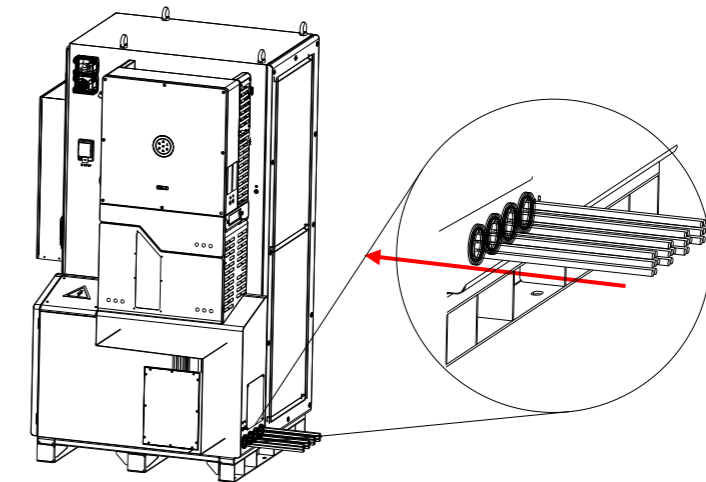


Figure 5.4
Cabinet outlet hole position

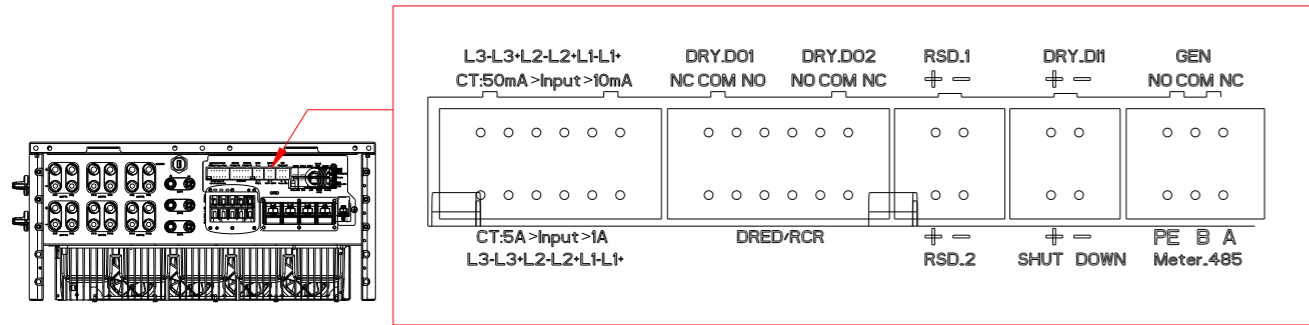


Figure 5.5
Ports definition

5.2.1 Grid Current Sampling

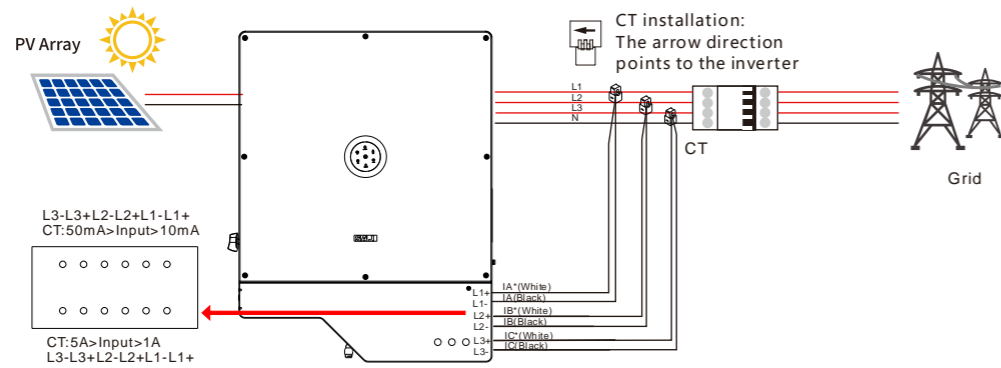


Figure 5.6
Connect the CT

5.2.2 Dry Contact Connection

Reserved output dry contact

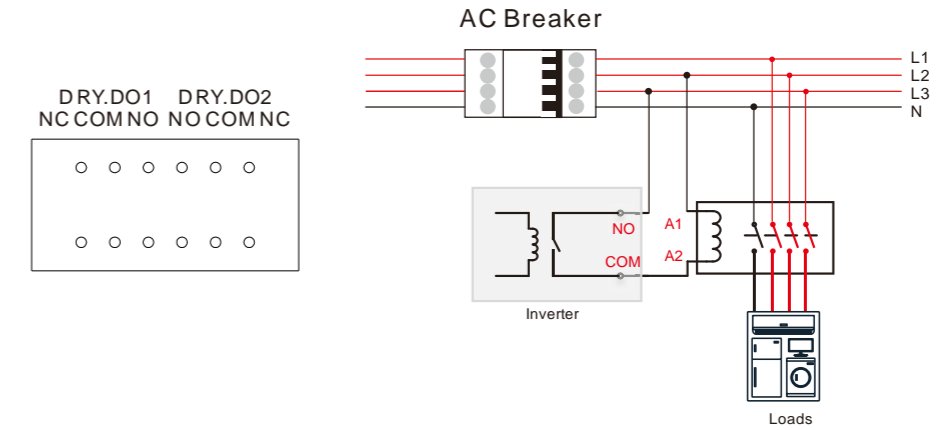


Figure 5.7
Connect the Reserved output dry contact

Generator start and stop control signal

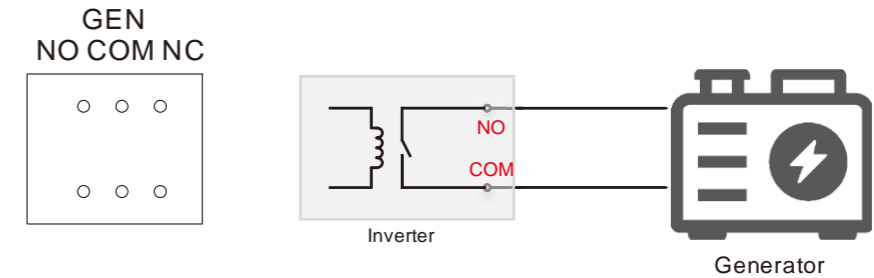


Figure 5.8
Connect the Generator

5.2.3 DRM Connection

DRED provides a DRED signal controlling port to meet the Australia DERD certification requirements and other regions.

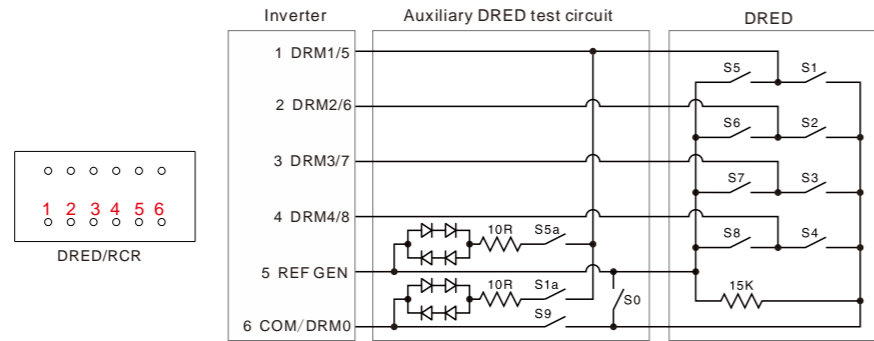


Figure 5.9
Connect the DRED

5.2.4 12V Power Output

RSD_1, RSD_1 supplies power to the external photovoltaic fast shutdown module, and controls the power on and off by controlling the power of the module.

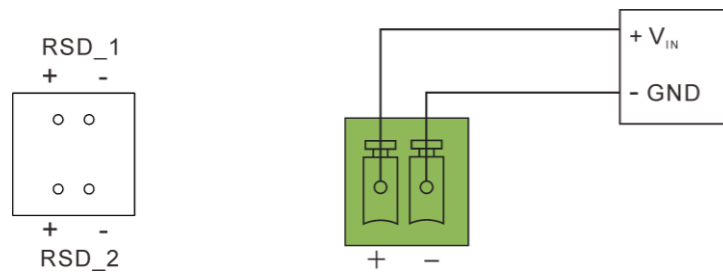


Figure 5.10
Connect the Power Output

5.2.5 Emergency Stop Dry Contact

When + contact and - contact are shorted by external controlled switch, the inverter will stop immediately.
DRY_DI1: Reserved input dry contact.

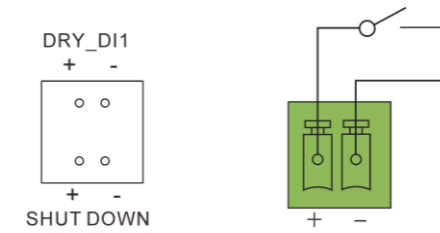


Figure 5.11
Connect the Emergency Stop Dry Contact

5.2.6 RJ45 Pin Port Definition



Figure 5.12
Pinout of RJ45

EMS		
1	NC	
2	NC	
3	NC	
4	NC	
5	NC	
6	NC	
7	RS485-A	
8	RS485-B	

RS485_PAR1/RS485_PAR2		
1	NC	
2	NC	
3	NC	
4	NC	
5	NC	
6	NC	
7	RS485-A	
8	RS485-B	

METER		
1	RS485-B	
2	RS485-A	
3	NC	
4	RS485-B	
5	RS485-A	
6	NC	
7	RS485-A	
8	RS485-B	

BMS_1/ BMS_2/ BMS_3		
1	Shut down—BMS	
2	GND_S	
3	NC	
4	CANH	
5	CANL	
6	NC	
7	NC	
8	NC	

Parelle1/ Parelle2		
1	SYN B	
2	SYN A	
3	SYN B	
4	SYN A	
5	SYN B	
6	SYN A	
7	CANL	
8	CANH	

LAN		
1	TX_D1+	
2	TX_D1-	
3	RX_D2+	
4	BI_D3+	
5	BI_D3-	
6	RX_D2-	
7	BI_D4+	
8	BI_D4-	

5.3 Connecting the AC Cable

Type	Cable cross-sectional area (mm ²)		Conductor material
	Range	Recommend	
CHS2-29.9~63K-T4/T5/T6-X	25~35	25	Copper
Grounding cable cross-sectional area (mm ²): 16			

Table 5.1
Recommended specifications of GRID cables

Note: If the grid-connection distance is too far, please select an AC cable with larger diameter as per the actual condition.

Type	Cable cross-sectional area (mm ²)		Conductor material
	Range	Recommend	
CHS2-29.9~63K-T4/T5/T6-X	16~25	16	Copper
Grounding cable cross-sectional area (mm ²): 16			

Table 5.2
Recommended specifications of GEN and Back-up cables

Procedure:

Step 1: Pass the cables to be connected through the corresponding waterproof holes.

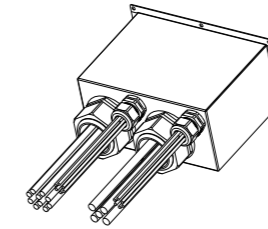


Figure 5.13
Thread the cables

Step 2: Connect the communication cable to the corresponding port. GRID, GEN and Back-up Fix the cables according to conductor marks of L1,L2,L3,N and PE.

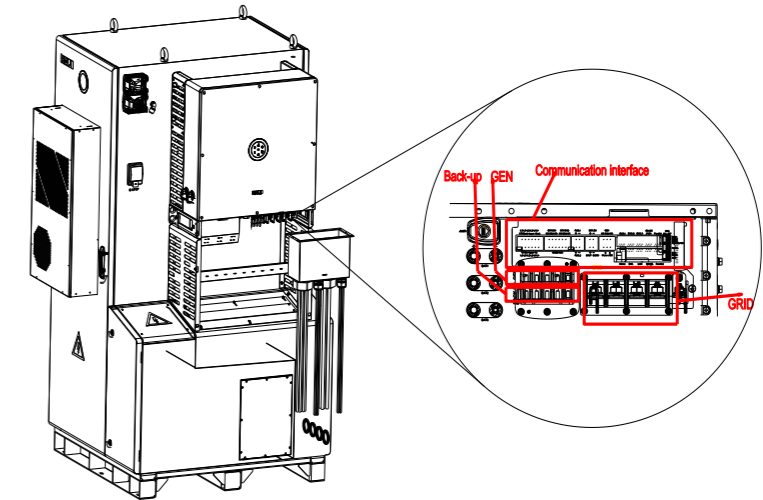


Figure 5.14
Connect the Cables

Step 3: Secure all parts of the grid and backup connector tightly.

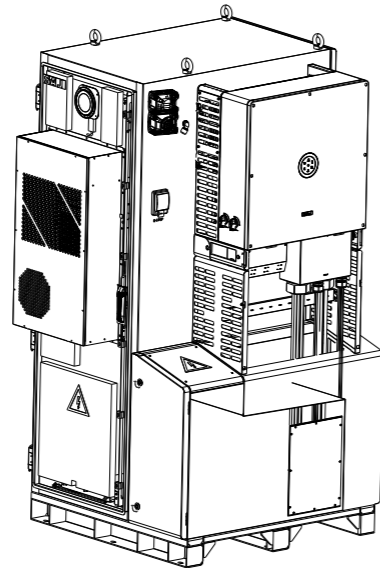


Figure 5.15
Screw the Connector

Step 4: During off grid operation time, PE line at the BACK-UP end will remain to be connected with the PE line at the power grid end inside the inverter. (Only applicable to market in Australia)

5.3.1 Earth Fault Alarm

This inverter complies with IEC 62109-2 clause 13.9 for earth fault alarm monitoring. If an Earth Fault Alarm occurs, the ring light will be lit up in red and error code <31> will be displayed on LED panel 1 until the error being solved and inverter functioning properly.

Note: The inverter cannot be used with functionally earthed PV Arrays.

5.3.2 External AC Circuit Breaker and Residual Current Device

Please install a circuit breaker to ensure the inverter is able to disconnect from grid safely. The integrated leakage current detector of inverter is able to detect the real time external current leakage. When a leakage current detected exceeds the limitation, the inverter will be disconnected from grid quickly.

The inverter does not require an external residual current device, as it has integrated with a RCMU. If local regulations require the application of external residual current device, either type A or type B RCD is compatible with the inverter. The action current of external residual current device should be 300mA.

Inverter type	Recommended breaker specification
CHS2-29.9~63K-T4/T5/T6-X	200A
Notice: Do not connect multiple inverters to one AC circuit breaker.	

Table 5.3
Recommended circuit breaker specification

5.4 PV Side Connection



WARNING

- Make sure the PV array is well insulated to ground before connecting it to the inverter.

Conductor cross-sectional area of cables (mm ²)		Conductor material
Scope	Recommended value	Outdoor multi-core copper wire cable, complying with 1000Vdc
4.0~6.0	4.0	

Table 5.4
Recommended specifications of DC cable

5.4.1 PV Connector Assembly



WARNING

- Dangerous to life due to electric shock when live components or DC cables are touched.
- when the photovoltaic array is exposed to light, it supplies a d.c. voltage to the PCE.. Touching live DC cables results in death or lethal injuries.
- DO NOT touch non-insulated parts or cables
- Disconnect inverter from voltage sources.
- DO NOT disconnect DC connectors under load.
- Wear suitable personal protective equipment for all work.

DC connector is made up of positive connector and the negative connector

Figure 5.16
Positive connector
& Negative connector



NOTICE

- Please place the connector separately after unpacking in order to avoid confusion for connection of cables.
- Please connect the positive connector to the positive side of the solar panels, and connect the negative connector to the negative side of the solar side. Be sure to connect them in right position.

Connecting Procedures:

1. Remove the upper cover of the PV cover

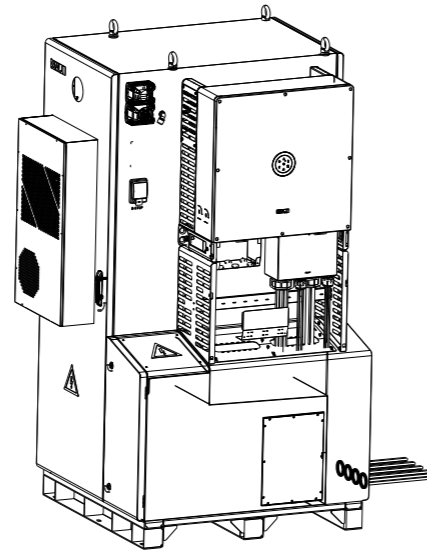


Figure 5.17
Striping off the insulation skin of cables

2. Loosen the lock screws on positive and negative connector.

3. Strip the insulation of the positive and negative cables with 8-10mm length.

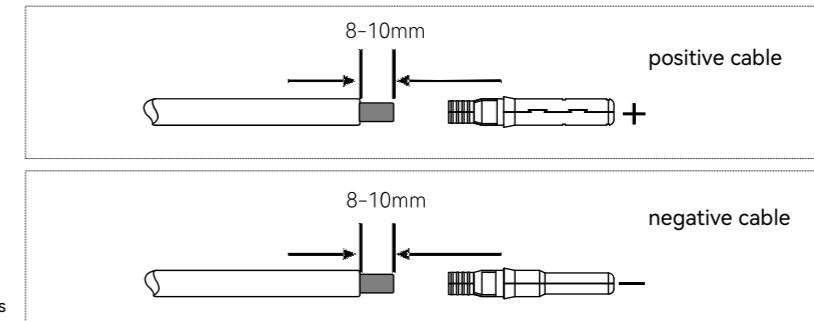


Figure 5.18
Striping off the insulation skin of cables

4. Assembly the positive and negative cables with corresponding crimping pliers.

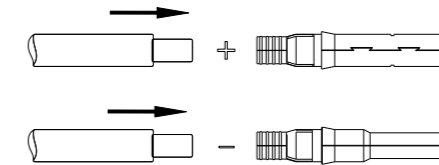


Figure 5.19
Inserting cables to lock screws

5. Insert the positive and negative cable into positive and negative connector. Gently pull the cables backward to ensure firm connection.

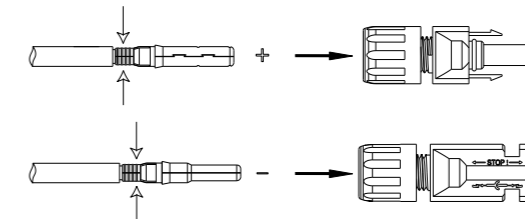


Figure 5.20
Inserting crimped cables to connectors

6. Fasten the lock screws on positive and negative connectors.

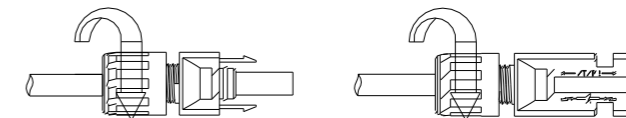


Figure 5.21
Securing the connectors

7. Make sure the DC switch is at OFF position

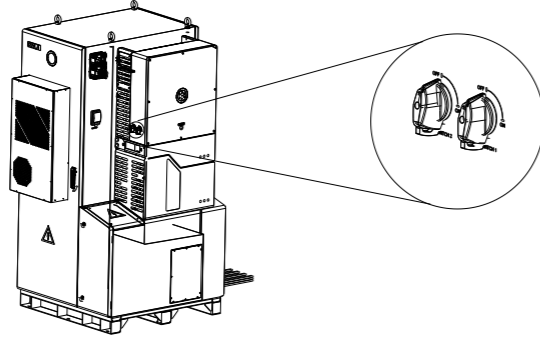


Figure 5.22
DC switch

8. Connect the positive and negative connectors into positive and negative DC input terminals of the inverter, a “click” should be heard or felt when the contact cable assembly is seated correctly.

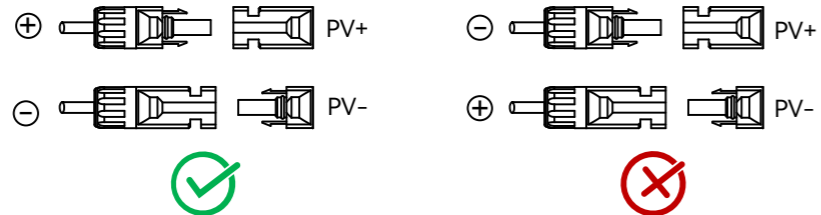
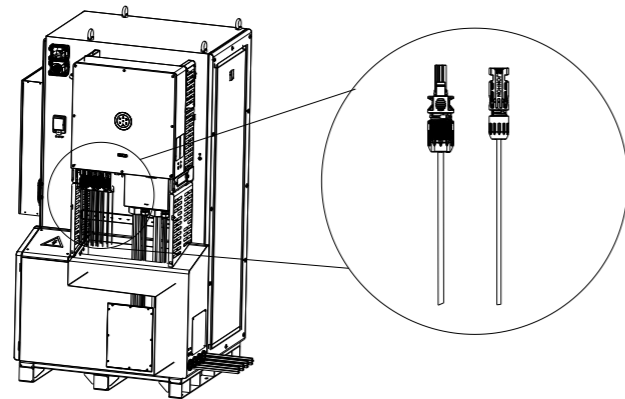


Figure 5.23
Plug in PV connectors

9. Install the PV cover on the PV port, secure it with screws.

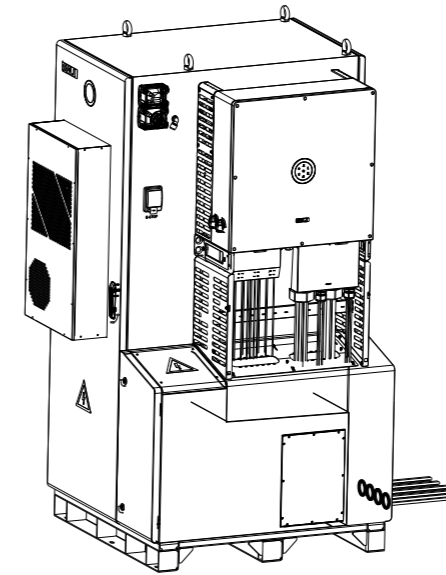


Figure 5.24
Install the PV cover

5.5 Communication Module Installation

Plug in the communication module to 4G/WiFi port and secure the module by rotating the nut.

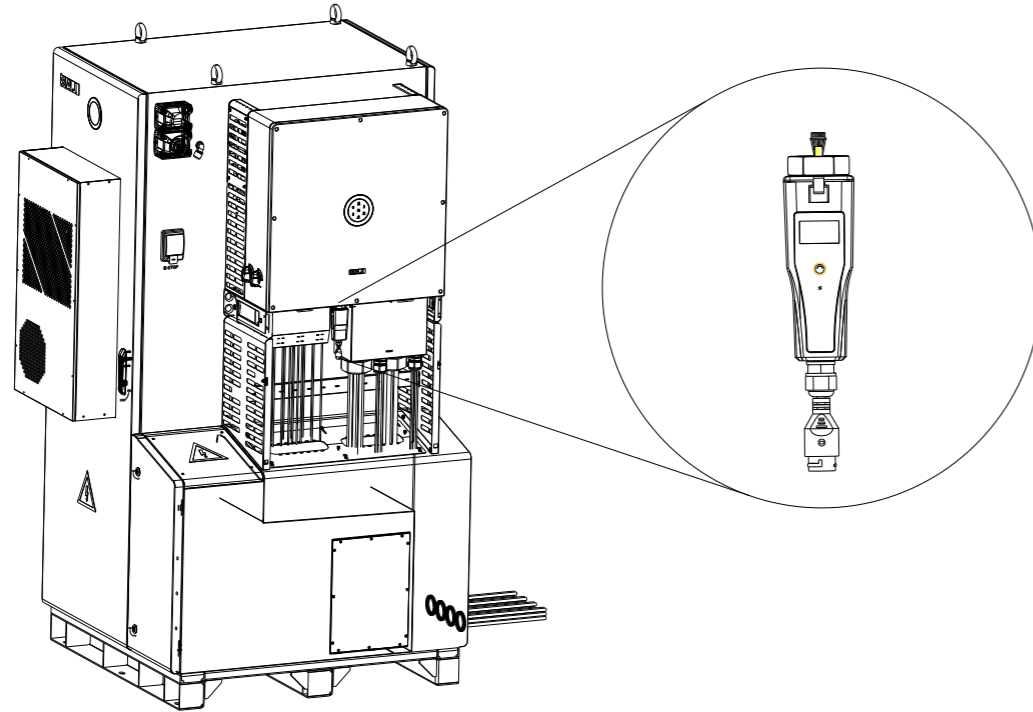


Figure 5.25
4G/WiFi port

1. 4G/Wi-Fi port could be externally connected with eSolar 4G module, eSolar Wi-Fi module or eSolar AIO3 module, for operation in details please refer to communication module Quick Installation Guide in <https://www.saj-electric.com/>.

5.6 Install Decorative Panels

Reinstall the removed decorative panel onto the machine.

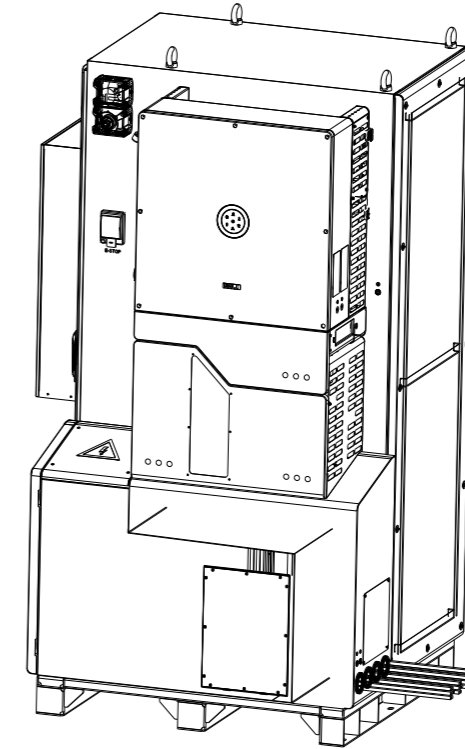
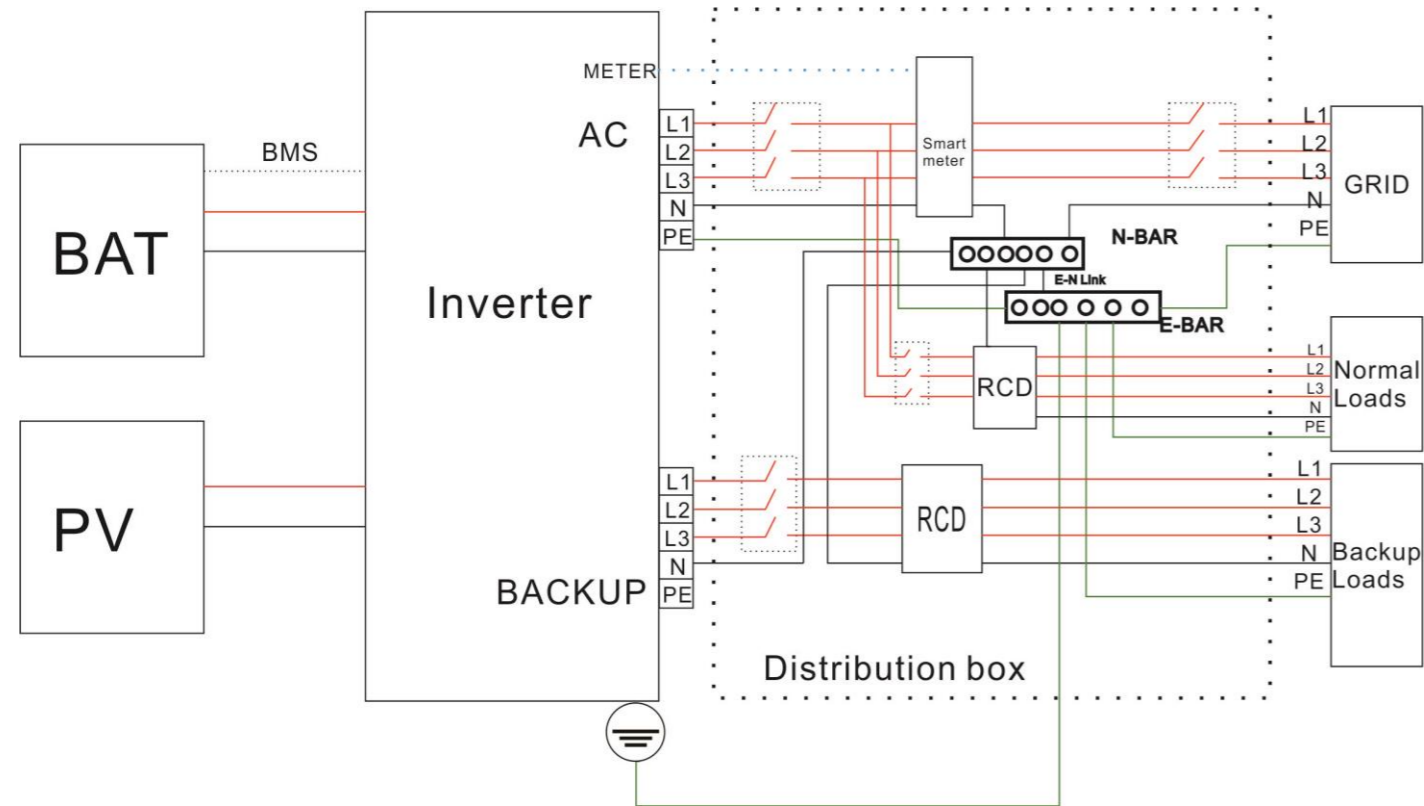


Figure 5.26
Install Decorative Panels

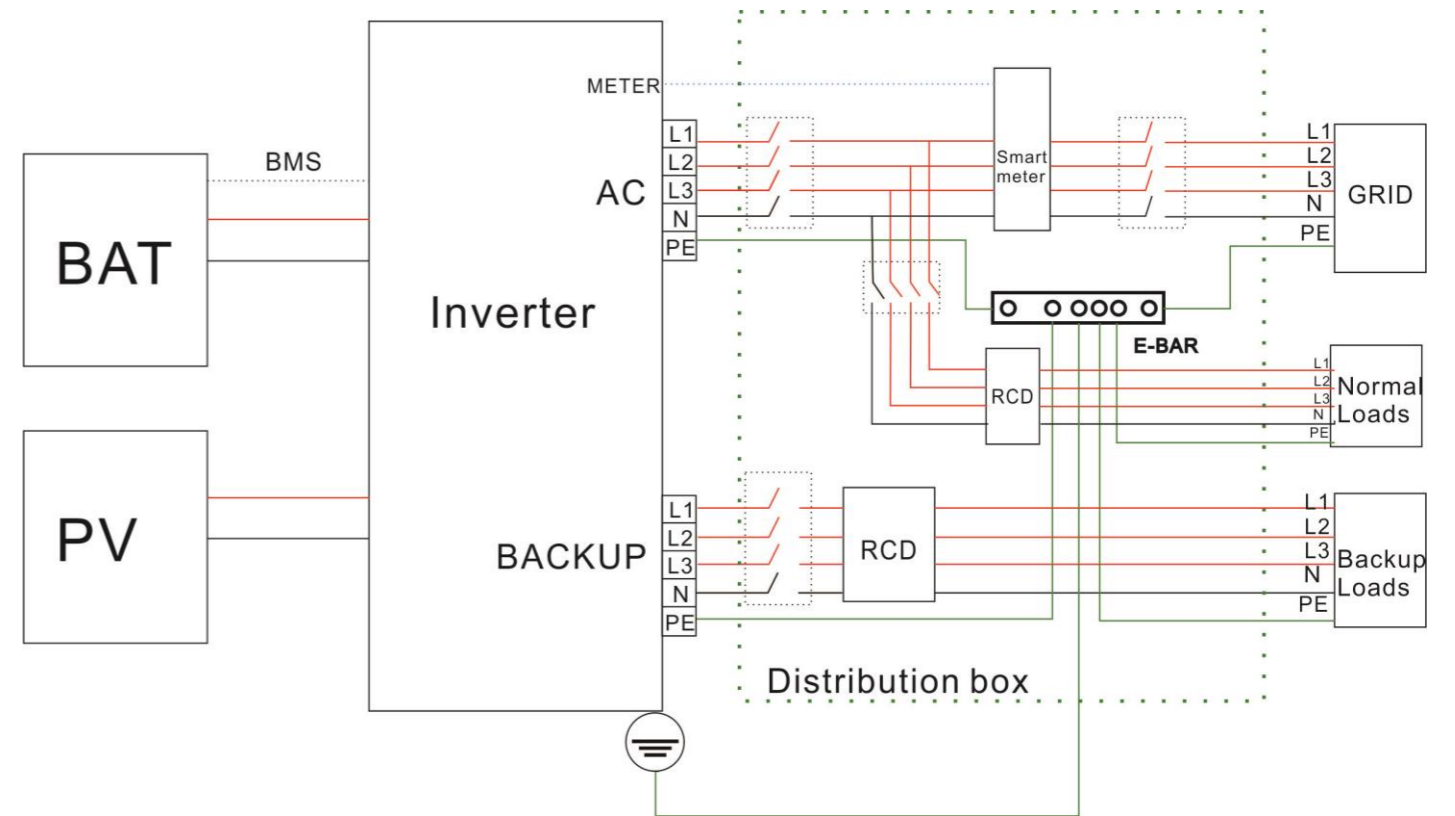
5.7 System Connection

The system connection in Australia and New Zealand is as below, the neutral cable of AC and backup side must be connected together for the safety reason.
 Note: DO NOT connect the PE terminal of BACKUP side.

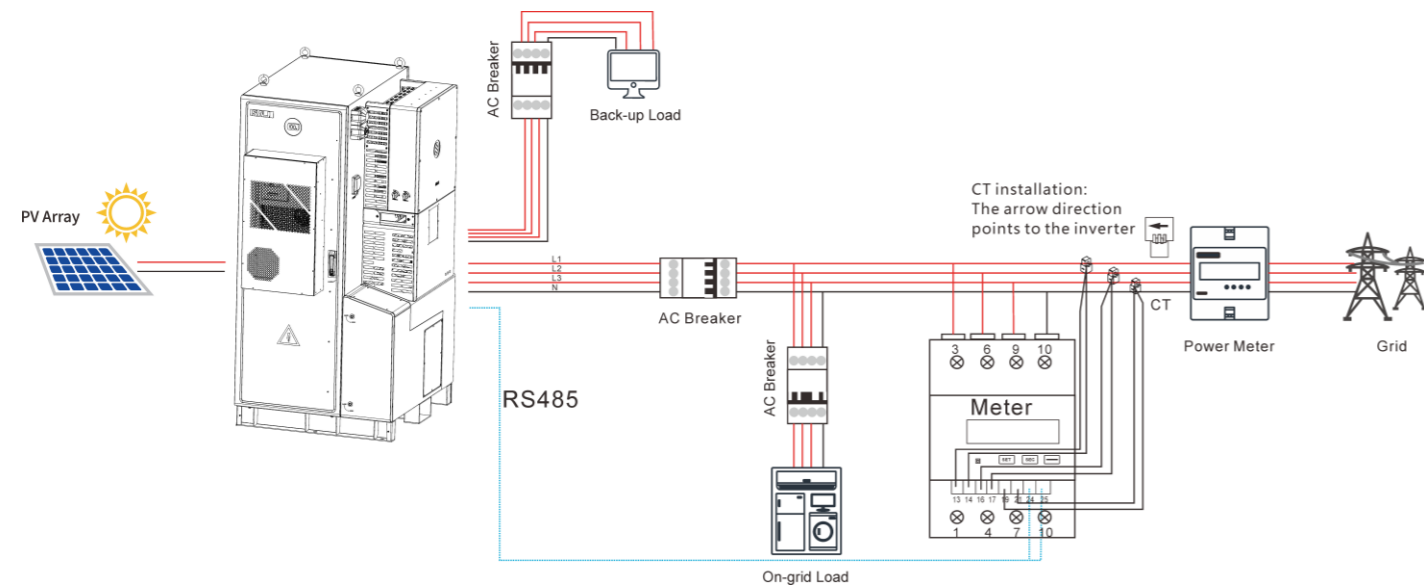


The system connection for grid system without special requirements is as below.

Note: The backup PE line and earthing bar must be grounded properly. Otherwise, backup function may be inactive during blackout.

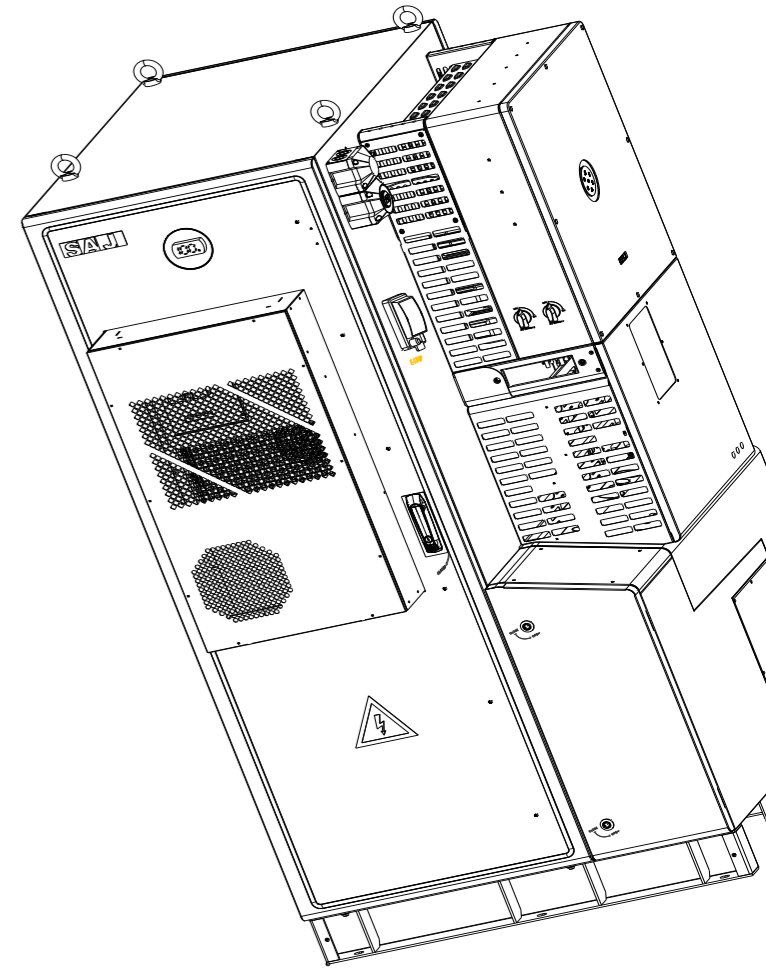


5.8 System Connection Diagram



5.9 AFCI

The inverter is equipped with arc-fault circuit interrupter (AFCI). With AFCI protection, when there is an arc signal on the DC side due to aging of the cable or loose contact, inverter can quickly detect and cut off the power to prevent fire, making the PV system run more safely.



6.

COMMISSIONING



6.1 Start Up and Shut Down the Energy Storage System

6.1.1 Start Up

Step 1: Turn ON the DC switch on the inverter.

Step 2: Turn on the AC Circuit Breaker.

Step 3: Rotate the Main Switch to ON position.

Step 4: Press and hold the START switch for 3 seconds until the LED light flashes.

Step 5: If the grid is disconnected, press the START button following step 4.

Note: If the Main Switch suddenly trips while the machine is running, it is required to reset the Main Switch and re-rotate the Main Switch to **ON** position.

6.1.2 Shut Down

Step 1: Turn off the AC Circuit Breaker.

Step 2: Rotate the Main Switch to OFF position.

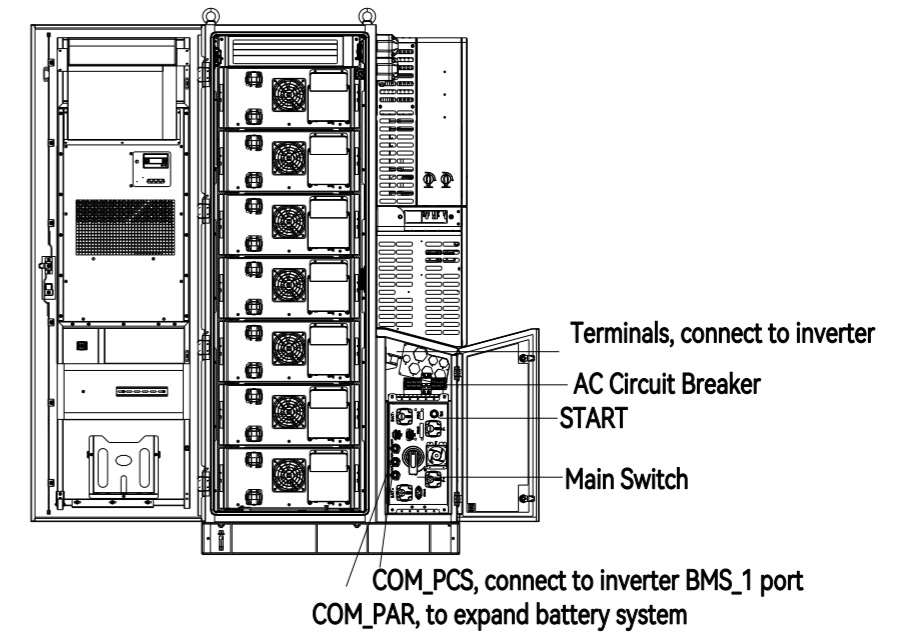


Figure 6.1
Circuit breaker of inverter

6.2 Introduction of Human-computer Interface

System commissioning

After the wiring is completed, please refer to the inverter manual for system commission and operation.

Note: Turn on the circuit breaker and main switch when using battery.

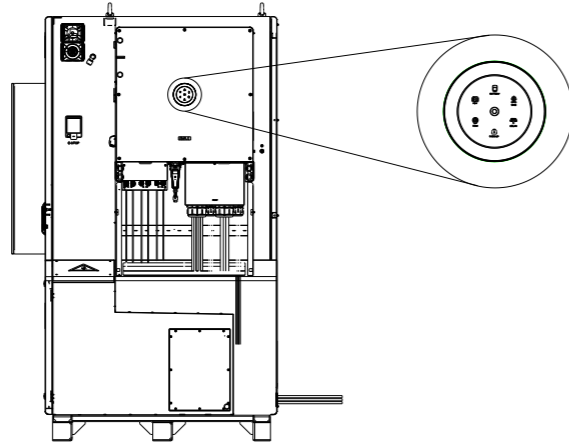


Figure 6.2
Human-computer interface

Table 6.1
Interface description

LED indicator	Status	Description
	LED off	Inverter power off
	Breathing	Inverter is at initial state or standby state
	Solid	Inverter running properly
	Breathing	Inverter is upgrading
	Solid	Inverter is faulty

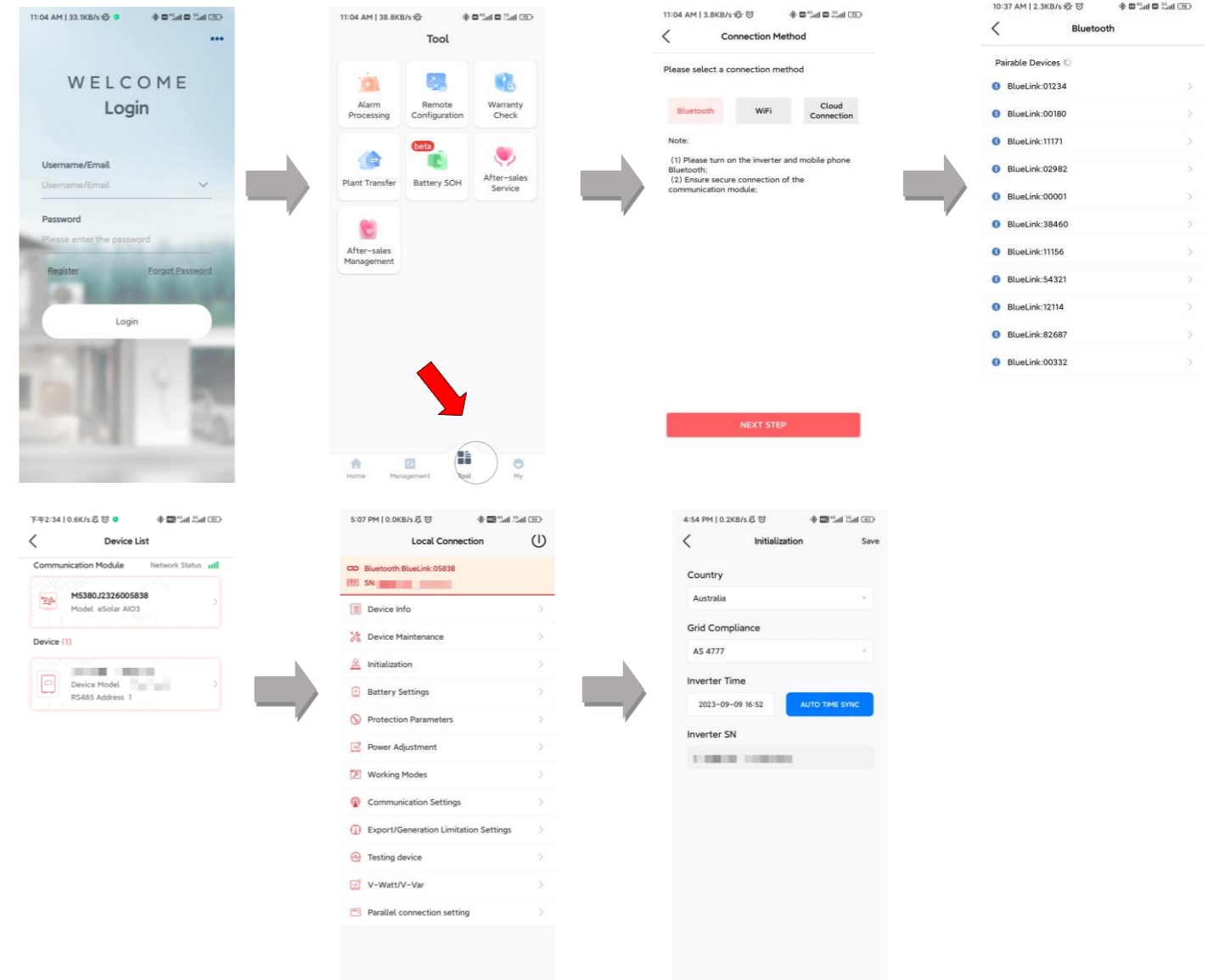
 System	Solid	Importing electricity from grid
	On 1s, off 1s	Exporting electricity to grid
	On 1s, off 3s	Not importing and exporting at all
	Off	Off-grid
 Battery	Solid	Battery is discharging
	On 1s, off 1s	Battery is charging
	On 1s, off 3s	SOC low
	Off	Battery is disconnected or inactive
 Grid	Solid	Connected to grid
	On 1s, off 1s	Counting down to grid connection
	On 1s, off 3s	Grid is faulty
	Off	No grid
 PV	Solid	PV array is running properly
	On 1s, off 1s	PV array is faulty
	Off	PV array is not operating
 Backup	Solid	AC side load is running properly
	On 1s, off 1s	AC side load overload
	Off	AC side is turned off
 Communication	Solid	Both BMS and meter communication are good
	On 1s, off 1s	Meter communication is good, BMS communication is lost
	On 1s, off 3s	Meter communication is lost, BMS communication is good
	Off	Both meter and BMS communication are lost
 GEN	Solid	Power input connected
	On 1s, off 1s	Power output connected
	Off	Disconnected

Note: One breathing cycle is 6 seconds

6.3 Commissioning

Start up:

- (1) Turn ON the DC switch on the inverter
- (2) Connect the AC circuit breaker
- (3) Rotate the Main Switch to ON position
- (4) Press and hold the START switch for 3 seconds until the LED light flashes
- (5) If the grid is disconnected, press the START button following step 4
- (6) Setup the initial setting for inverter on eSAJ Home
- (7) Observe the LED indicators on the inverter to ensure the inverter is running properly



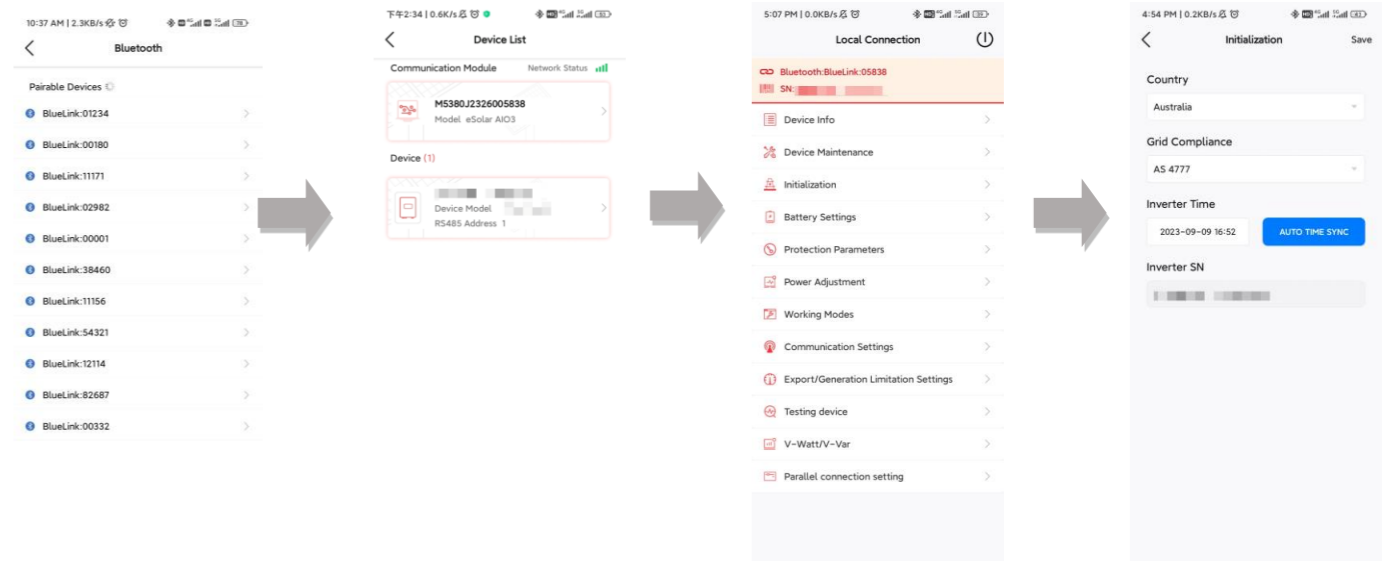
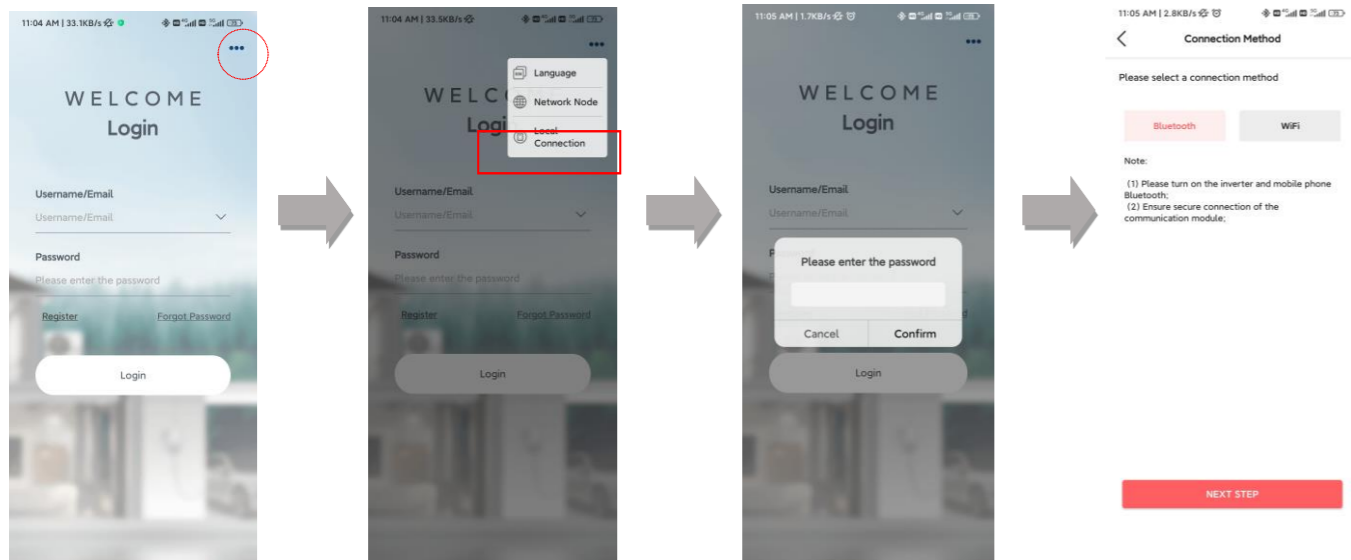
6.4 eSAJ APP Connection

6.4.1 Account Login

- Step 1: Log in to eSAJ Home, if you do not have an account, please register first
- Step 2: Go to the “Tool” interface and select “Remote Configuration”
- Step 3: Click on “Bluetooth” and activate the Bluetooth function on your phone, then click on “Next”
- Step 4: Choose your inverter according to your inverter SN’s tail numbers
- Step 5: Click on the inverter to enter inverter setting
- Step 6: Select the corresponding country and grid code

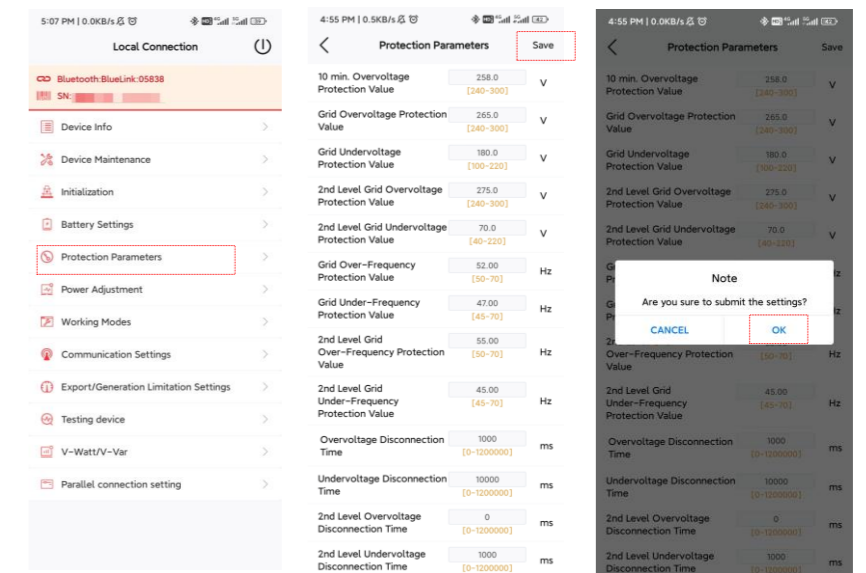
6.4.2 Local Connection

- Step 1: Open eSAJ APP and click on the dot icon on the top right corner
- Step 2: Select "Local Connection"
- Step 3: Enter password "123456"
- Step 4: Click on "Bluetooth" and activate the Bluetooth function on your phone, then click on "Next"
- Step 5: Choose your inverter according to your inverter SN's tail numbers
- Step 6: Click on the inverter to enter inverter setting
- Step 7: Select the corresponding country and grid code for



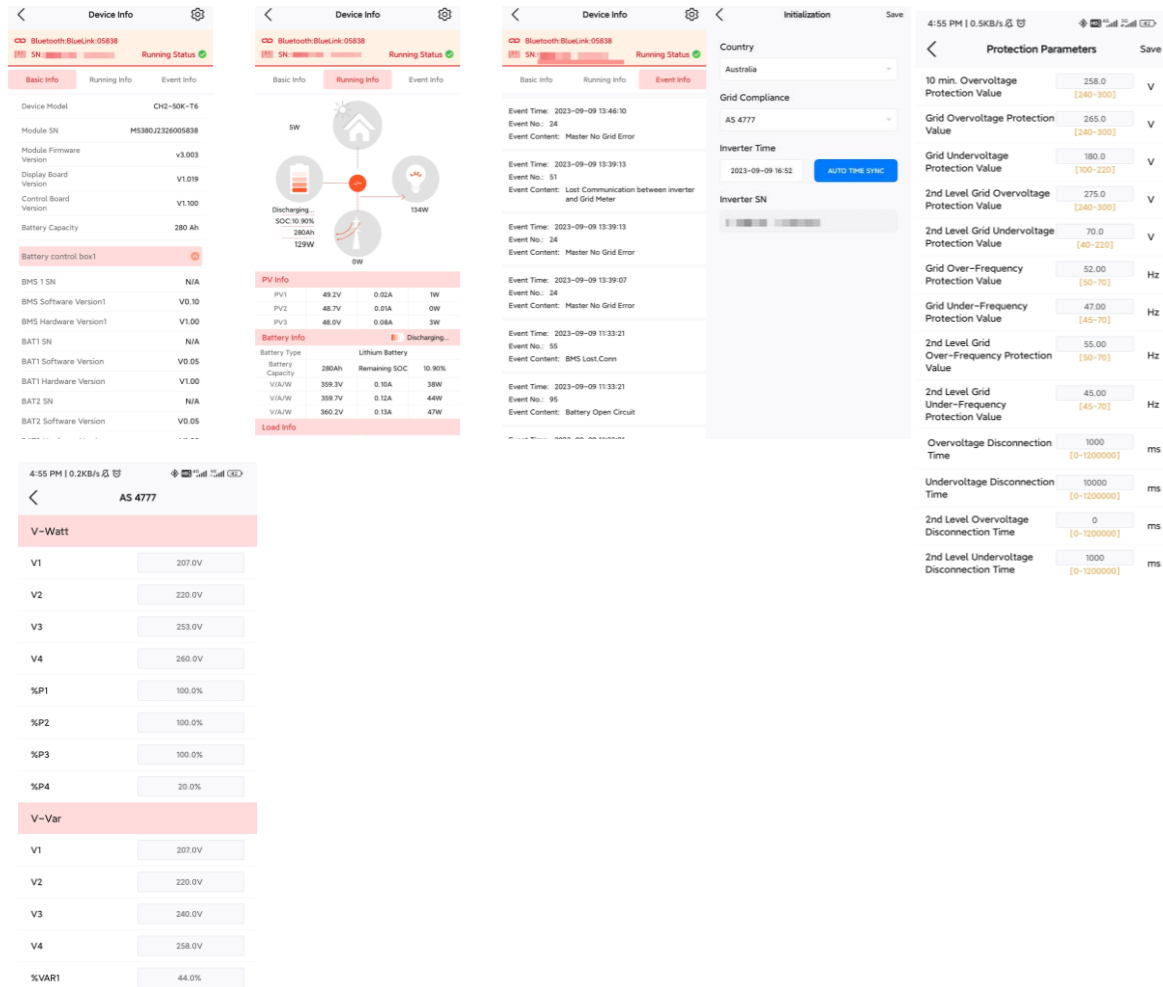
6.4.3 Protection parameter setting

Corresponding modification of protection parameters will take effect only after saving.



6.4.4 Inverter Setting Review

After commissioning, the device info including device basic info, running info and event info can be viewed. Country and grid code , power quality response modes and grid connection settings can be viewed from initial setting.

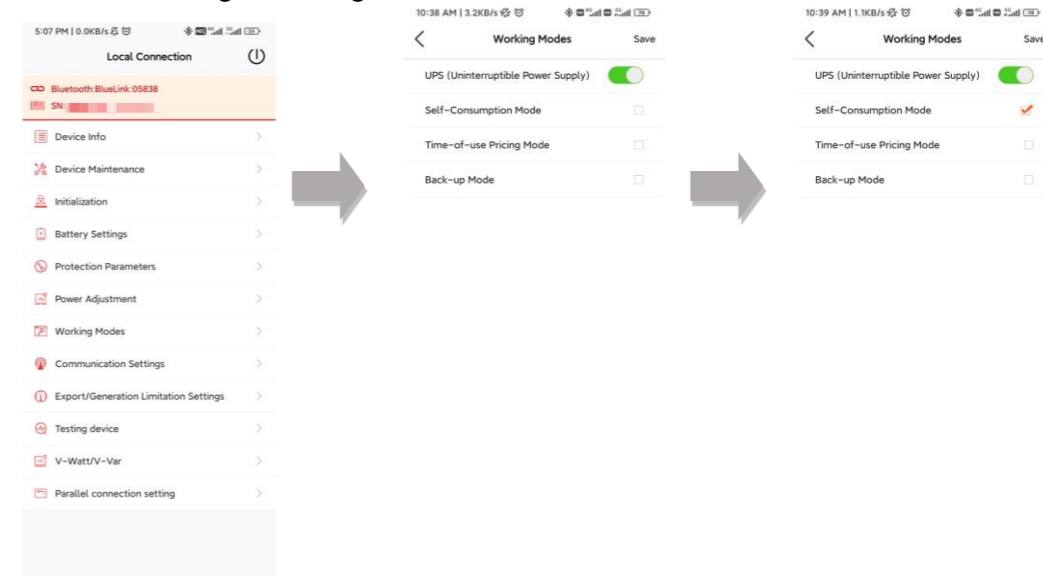


6.4.5 Remote Monitoring

Connect the internet via the eSolar AIO3 module, and upload the inverter data onto the server and customers could monitor running information of the inverter remotely via the eSolar Web Portal or their mobile customer terminals.

6.5 Working Modes

6.5.1 Selecting Working Modes Procedures



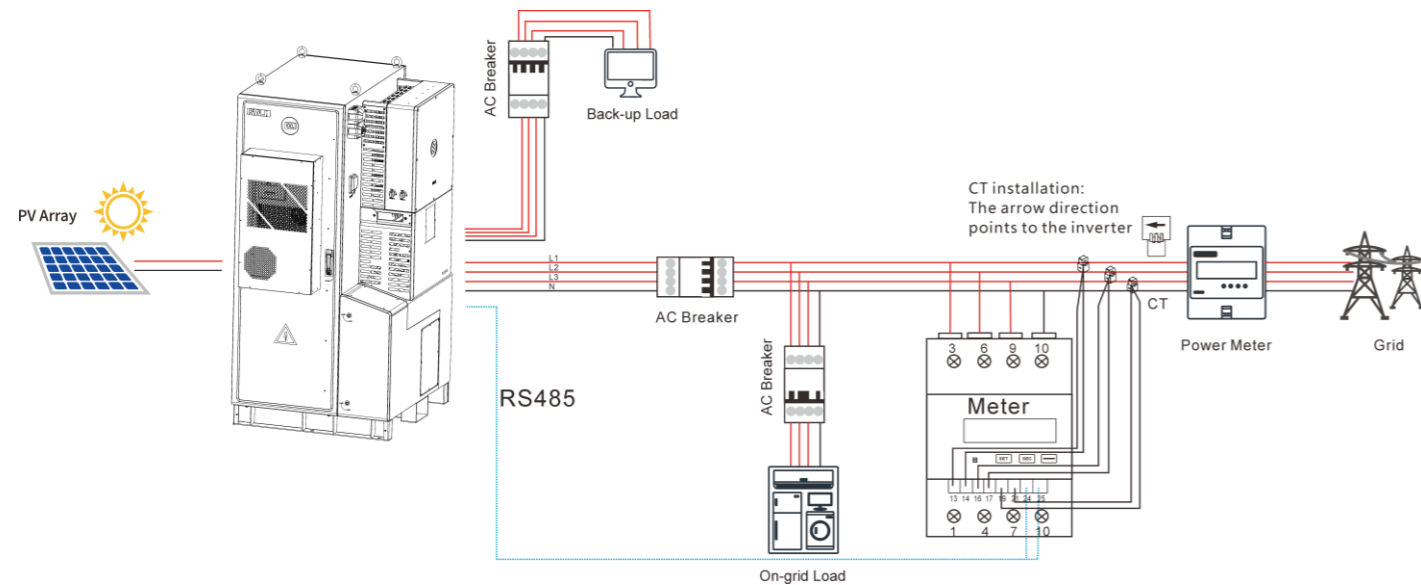
6.5.2 Working Modes Introduction

Self-consumption Mode: When the solar is sufficient, electricity generated by photovoltaic system will be supplied to load first, the surplus energy will be stored in battery, then the excess electricity will be exported to the grid. When the solar is insufficient, the battery will release electricity to supply load.

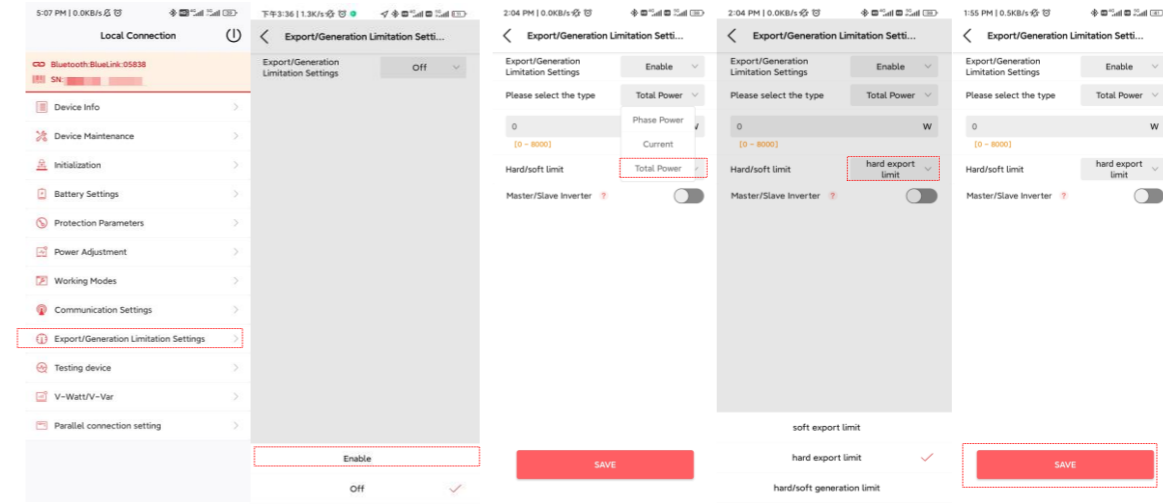
Back-up Mode: Reserved Backup SOC setting value can be adjusted, when battery SOC is less than reserved SOC value, battery can only be charged, until SOC reaches reserved value, the battery will be stopped charging; when SOC is larger than SOC setting value, battery will behave as Self-use mode.

Time-of-use Mode: Battery charging period and discharging period can be set , during charging period, battery can only be charged, while in discharging period, battery can only be discharged, the rest of the period, battery will behave as Self-use mode.

6.6 Export Limit Setting



6.6.1 APP Setting



Step 1: click Export/Generation Limitation Settings.

Step 2: Enable Export Limit.

Step 3: choose "Total Power"

Step 4: click Hard/soft Limit Select control mode.

Step 5: Click "SAVE" Save Settings.

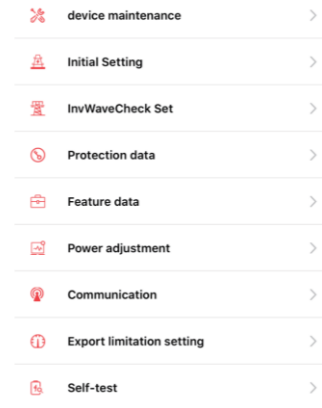
6.7 Self-test (For Italy)

Italian Standard CEI0-21 requires a self-test function for all inverter that connected to utility grid. During the self-testing time, inverter will check the reaction time for over frequency, under frequency, overvoltage and undervoltage. This self-test is to ensure the inverter is able to disconnect from grid when required. If the self-test fails, the inverter will not able to feed into the grid.

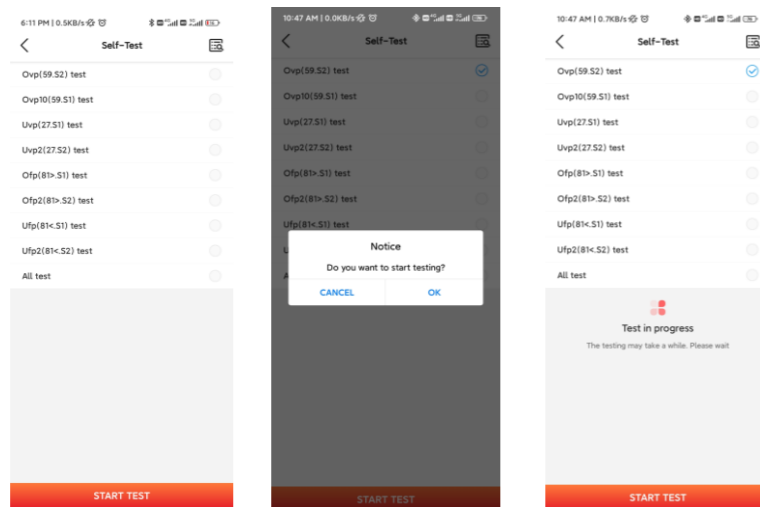
The steps of running Self-test are as followed:

Step 1: Connect a communication module (Wi-Fi/ 4G/Ethernet) with inverter (connection procedure can refer to eSolar Module Quick Installation Manual)

Step 2: Select Italy for Country and choose your corresponding Grid Code from Initial Setting.



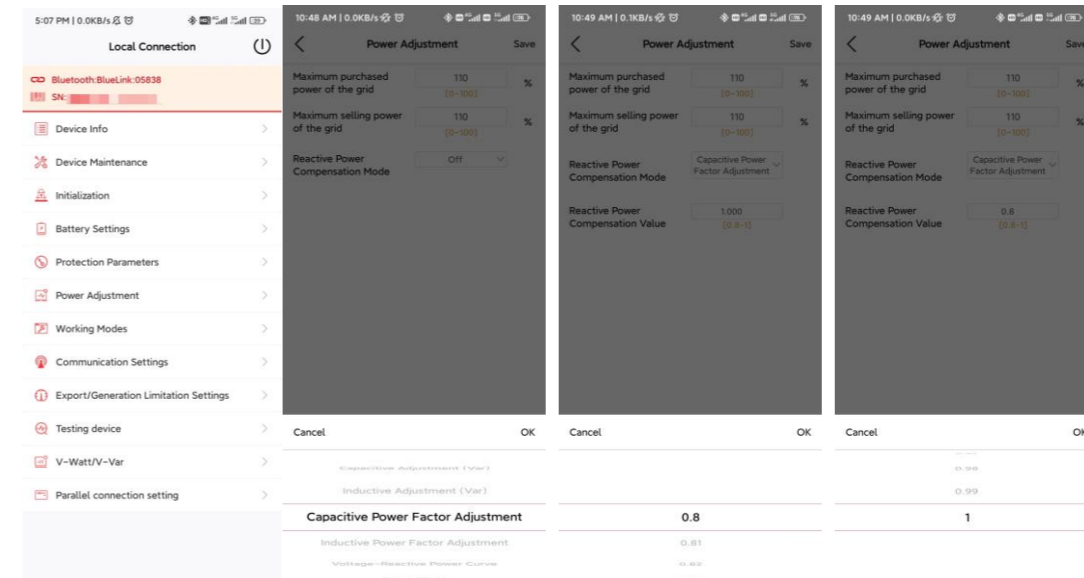
Step 3: You can choose self-test item required. Individual self-test time is approx. 5 minutes. All self-test time is approx. 40 minutes. After the self-test is completed, you can save the test report. If self-test is failed, please contact with SAJ or your inverter supplier.



6.8 Setting Reactive Power Control (For Australia)

6.8.1 Setup Fixed Power Factor Mode & Fixed Reactive Power Mode

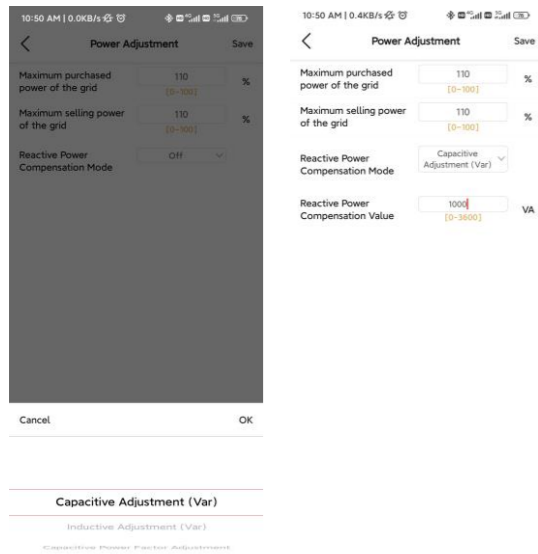
Fixed Power Factor Mode



Step 1: Select Power Adjustment and enter password "201561".

Step 2: Select Capacitive Power Factor or Inductive Power Factor according to your local grid regulation. The power factor range is from 0.8 leading ~ 0.8 lagging.

Fixed Reactive Power Mode



Step 1: Select Inductive Adjustment Var or Capacitive Var according to your local grid regulation. The power range is from -60%Pn ~ 60%Pn.

6.8.2 Setup V-Watt and Volt-Var Mode

This inverter complies with AS/NZS 4777.2: 2020 for power quality response modes. The inverter satisfies different regions of DNSPs' grid connection rules requirements for volt-watt and volt-var Settings. e.g.: AS4777 series setting as below Fig 6.2&6.3.

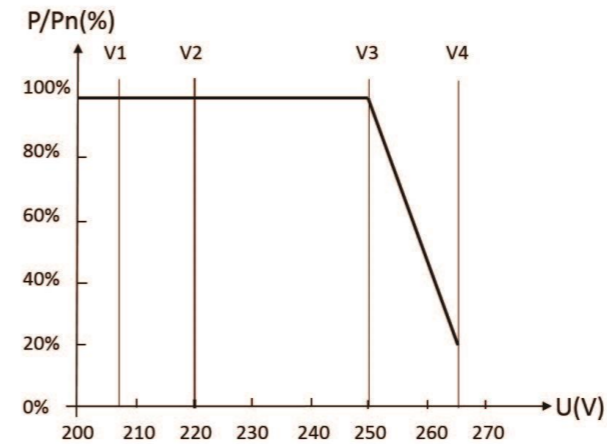


Figure 6.2

Curve for a Volt-Watt response mode (AS4777 Series)

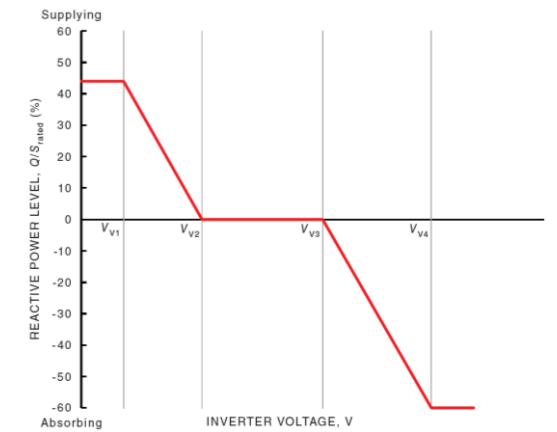
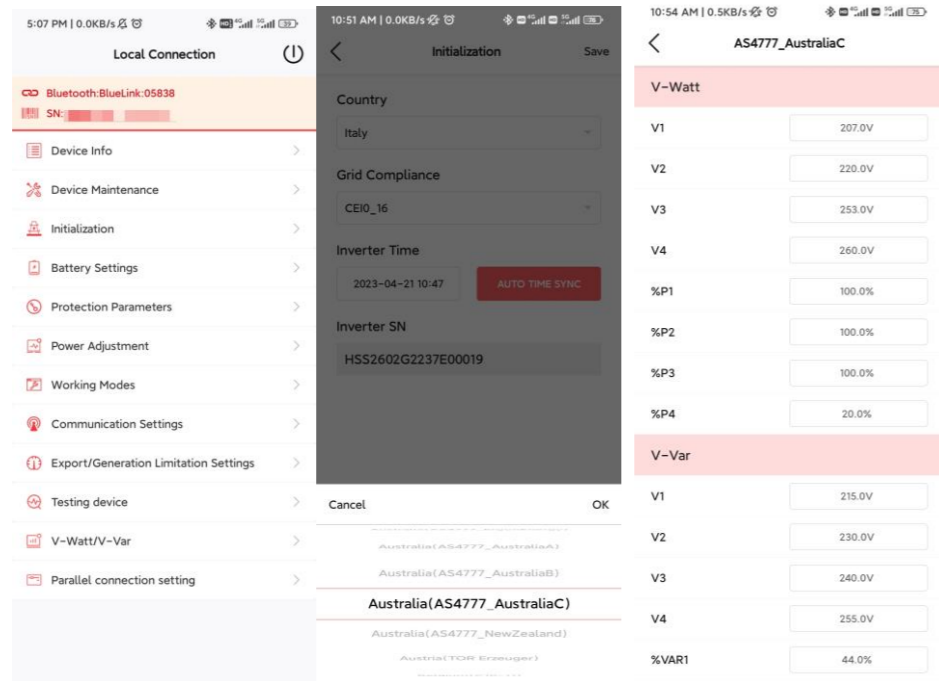


Figure 6.3

Curve for a Volt-Var control mode (AS4777 Series)

Setting procedure:

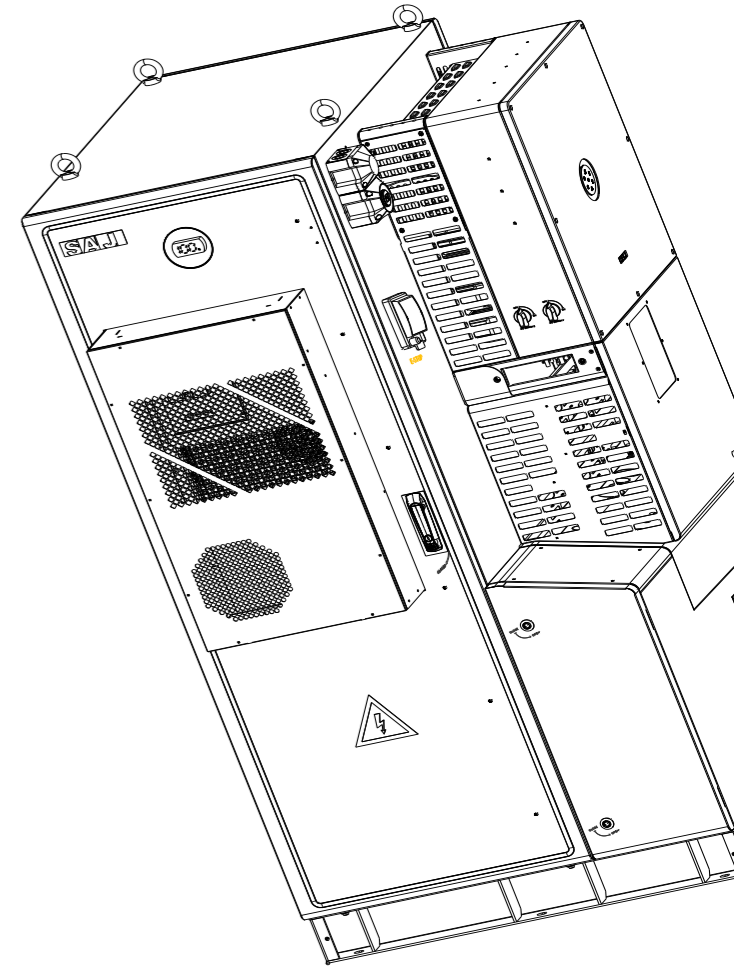
1. AS4777 grid compliance has been set during production, please select corresponding grid compliance according to state regulation during installation. You can choose a state regulation compliance with your local grid via eSAJ Home.
2. Log in to eSAJ Home, click "Local Connection", for connection procedure please refer to chapter 5.3 for Nearby monitoring.
3. Click "V-Watt/V-Var" to enter DNSPs settings, choose a suitable state regulation from the drop down list.



Note:

With regard to the Power rate limit mode, SAJ sets the product WGr_a to 16.67%P_n by default in the following cases according to the requirements of 3.3.5.2 as 4777.2: 2020.

1. Soft ramp up after connect.
2. Reconnect or soft ramp up/down following a response to frequency disturbance.



7.

MAINTENANCE



7.1 Transportation

Lithium batteries are dangerous goods. Passed the test of UN38.3, this product meets the transportation requirements for dangerous goods for lithium batteries. After the installation of the battery on site, the original packaging (contains the lithium battery identification) should be kept. When the battery needs to be returned to the factory for repair, please pack the battery with the original packaging to reduce unnecessary trouble.

Take care of the product during transportation and storage. Products are not allowed to be stacked.

7.2 Storage

After purchasing the battery, please store it with following instructions:

- 1) Please store it in a dry and ventilated environment, keep it away from heat sources;
- 2) Please keep it in an environment with storage temperature as $-20^{\circ}\text{C} \sim 40^{\circ}\text{C}$, humidity $<85\% \text{ RH}$;
- 3) For long-term storage (>3 months), please put it in an environment with a temperature of -20°C to 25°C and a humidity of $< 85\% \text{ RH}$;
- 4) The battery should be stored in accordance with the storage requirements mentioned above, and the battery should be installed within 6 months since delivered from the factory and used with compatible inverters;

NOTICE

- The battery remains 50% power when it is sent from the factory.
- The longer the battery is stored, lower the SOC. When the battery remaining voltage fails to reach the startup voltage requirement, the battery may be damaged.
- Judgment condition: Close the battery breaker switch and press the main switch. At this time, if the LED light is solid green, it is running normal. If the LED light is red or off, the battery is in fault.

The battery cannot be disposed of as household refuse. When the service life of the battery reaches to the limit, it is not required to return it to the dealer or SAJ, but it must be recycled to the special waste lithium battery recycling station in the area.

Troubleshooting

Code	Fault Information
1	Master Relay Error
2	Master EEPROM Error
3	Master Temperature High Error
4	Master Temperature Low Error
5	Lost Communication M<->S
6	GFCI Device Error
7	DCI Device Error
8	Current Sensor Error
9	Master Phase1 Voltage High
10	Master Phase1 Voltage Low
11	Master Phase2 Voltage High
12	Master Phase2 Voltage Low
13	Master Phase3 Voltage High
14	Master Phase3 Voltage Low
15	Grid Voltage 10Min High
16	Off Grid Output Voltage Low
17	Off Grid Output Short Circuit
18	Master Grid Frequency High
19	Master Grid Frequency Low
20	BAT Input Mode Error
21	Phase1 DCV High
22	Phase2 DCV High
23	Phase3 DCV High
24	Master No Grid Error
25	DC Reverse Connect Error
26	Parallel machine CAN Com Error
27	GFCI Error
28	Phase1 DCI Error
29	Phase2 DCI Error
30	Phase3 DCI Error
31	ISO Error
32	Bus Voltage Balance Error
33	Master Bus Voltage High
34	Master Bus Voltage Low

Code	Fault Information
35	Master Grid Phase Lost
36	Master PV Voltage High
37	Master Islanding Error
38	Master HW Bus Voltage High
39	Master HW PV Current High
40	Master Self-Test Failed
41	Master HW Inv Current High
42	Master AC SPD Error
43	Master DC SPD Error
44	Master Grid NE Voltage Error
45	Master Fan1 Error
46	Master Fan2 Error
47	Master Fan3 Error
48	Master Fan4 Error
49	Lost Communication between Master and Meter
50	Lost Communication between M<->S
51	Lost Communication between inverter and Grid Meter
52	HMI EEPROM Error
53	HMI RTC Error
54	BMS Device Error
55	BMS Lost. Conn
56	CT Device Err
57	AFCI Lost Err
58	Lost Com. H<->S Err
59	Lost Communication between inverter and PV Meter
61	Slave Phase1 Voltage High
62	Slave Phase1 Voltage Low
63	Slave Phase2 Voltage High
64	Slave Phase2 Voltage Low
65	Slave Phase3 Voltage High
66	Slave Phase3 Voltage Low
67	Slave Frequency High

TROUBLESHOOTING & WARRANTY



Code	Fault Information
68	Slave Frequency Low
73	Slave No Grid Error
74	Slave PV Input Mode Error
75	Slave PV Input Mode Error
76	Slave PV Voltage High
77	Slave HW Bus Volt High
81	Lost Communication D<->C
83	Master Arc Device Error
84	Master PV Mode Error
85	Authority expires
86	DRM0 Error
87	Master Arc Error
88	Master SW PV Current High
89	Battery Voltage High
90	Battery Current High
91	Battery Charge Voltage High
92	Battery Over Load
93	Battery Soft Connect Time Out
94	Output Over Load
95	Battery Open Circuit Error
96	Battery Discharge Voltage Low
97	BMS Internal Communication Error
98	Battery Module Sequence Error
99	Discharge Overcurrent Protection
100	Charge Overcurrent Protection
101	Module Under Voltage Protection
102	Module Over Voltage Protection

Code	Fault Information
103	Single Cell Under Voltage Protection
104	Single Cell Over Voltage Protection
105	BMS hardware error
106	Charging temperature low protection
107	Charging temperature high protection
108	Discharging temperature low protection
109	Discharging temperature high protection
110	BMS relay error
111	Pre-charge error
112	BMS Insulation error
113	BMS supplier incompatibility
114	Battery cell supplier impartibility
115	Battery cell incompatibility
116	Voltage inconsistency
117	Circuit breaker is open
118	Temperature difference is too wide
119	Voltage difference is too wide (Class II)
120	Voltage difference is too wide (Class I)
121	BMS over temperature protect
122	Short circuit protect
123	Total voltage match failed
124	The system is locked
125	FUSE error protection
126	Voltage on charging port is high protection

Warranty

Please go to SAJ website for warranty conditions and terms
<https://www.saj-electric.com/>

Please contact your supplier for troubleshooting and remedy.