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V1.1



H2 series

HYBRID SOLAR INVERTER

user manual

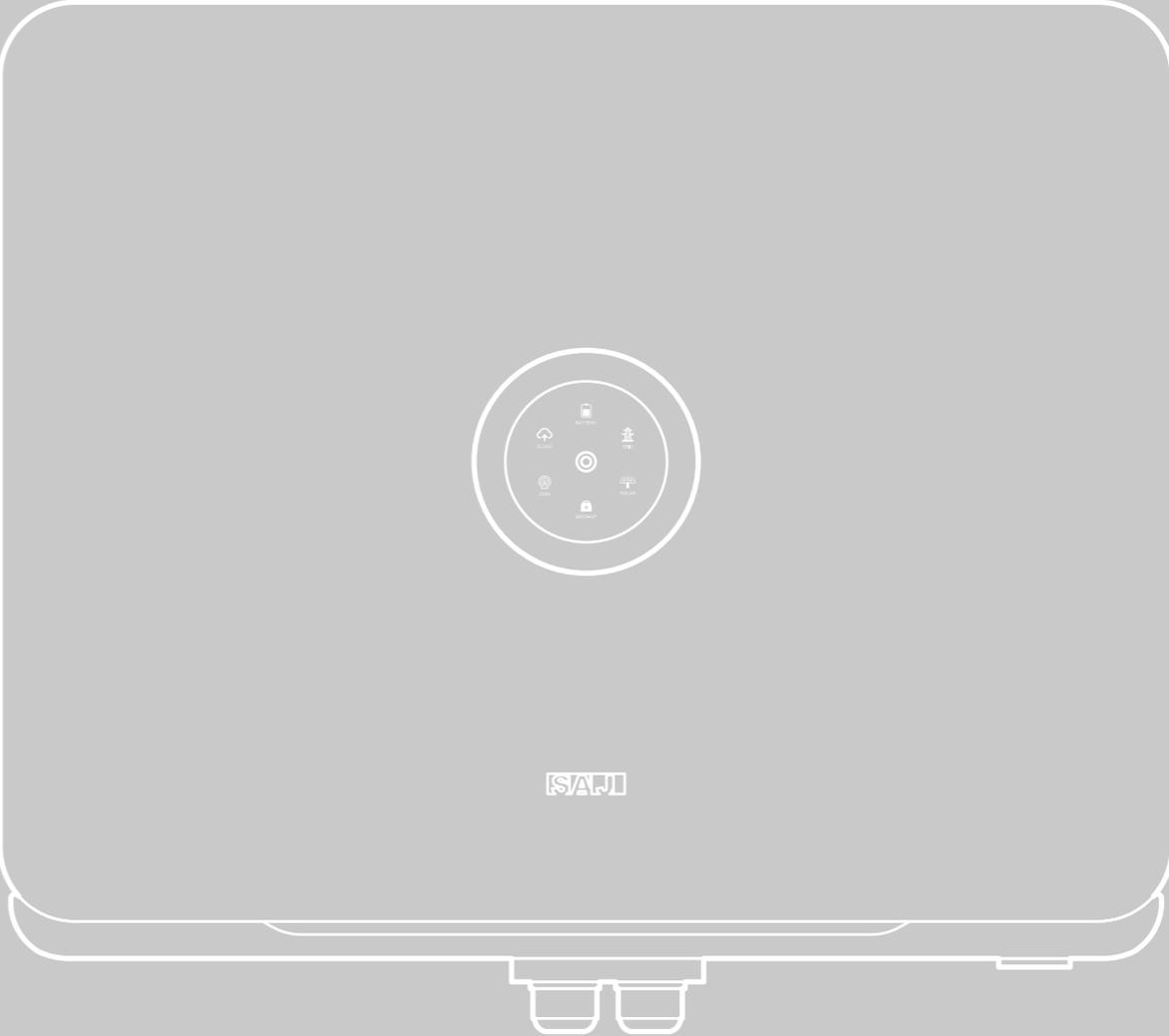


TABLE OF contents



1. SAFETY PRECAUTIONS -----01

- 1.1 Scope of Application-----02
- 1.2 Safety-----02
 - 1.2.1 Safety instruction-----02
 - 1.2.2 Explanations of Symbols-----03
 - 1.2.3 Safety Instructions-----04



2. PRODUCT OVERVIEW -----05

- 2.1 packing list-----07
- 2.2 Appearance-----07
- 2.3 Datasheet-----09



3. INSTALLATION INSTRUCTION-----11

- 3.1 The Determination of the Installation Position-----12
 - 3.1.1 Mounting position-----12
- 3.2 Mounting-----14



4. ELECTRICAL CONNECTION-----17

- 4.1 Safety Instruction -----18
- 4.2 Specifications for Electrical Interface-----18
- 4.3 AC Grid Wire and Backup Output Connection-----19
- 4.4 PV Connection-----21
- 4.5 Battery Connection-----24
- 4.6 Earth Fault Alarm-----25
- 4.7 Communication Connection-----26
 - 4.7.1 Serial Port Definition-----26
 - 4.7.2 RJ45 Pin Port Definition-----26
 - 4.7.3 Insert the communication cable-----27
 - 4.7.4 Smart Meter Connection-----27
- 4.8 Connection Diagram-----28
- 4.9 Ground Connection-----29
- 4.10 External AC Circuit Breaker and Residual Current Device-----29



5. DEBUGGING INSTRUCTIONS-----31

- 5.1 Introduction of LED Indicator-----32
- 5.2 Commissioning-----34
 - 5.2 eSolar APP Connection-----34



6. FAULT CODE-----35



7. RECYCLING AND DISPOSAL-----37

1.1 Scope of Application

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

H2-5K-T2, H2-6K-T2, H2-8K-T2, H2-10K-T2

Please read the user manual carefully before any installation, operation and maintenance and follow the instruction during installation and operation. Please keep this manual all time available in case of emergency.

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

1.2 Safety

1.2.1 Safety instruction



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.

SAFETY

precautions



1.2.2 Explanations of Symbols

Symbol	Description
	Dangerous electrical voltage This device is directly connected to public grid, thus all work to the inverter shall only be carried out by qualified personnel.
	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.
	Notice, danger! This is directly connected with electricity generators and public grid.
	Danger of hot surface The components inside the inverter will release a lot of heat during operation. Do not touch metal plate housing during operating.
	An error has occurred Please go to Chapter 9 "Troubleshooting" to remedy the error.
	This device SHALL NOT be disposed of in residential waste Please go to Chapter 8 "Recycling and Disposal" for proper treatments.
	Without Transformer This inverter does not use transformer for the isolation function.
	CE Mark With CE mark & the inverter fulfills the basic requirements of the Guideline Governing Low-Voltage and Electro-magnetic Compatibility.
	RCM Mark Equipment meets safety and other requirements as required by electrical safety laws/ regulations in Australian and New Zealand.
 <small>ATTENTION! Risk of electric shock! Only authorized personnel are allowed to do disassembly, modification or maintenance. Any resulting defect or damage (device/person) is not covered by SAJ guaranty.</small>	No unauthorized perforations or modifications Any unauthorized perforations or modifications are strictly forbidden, if any defect or damage (device/person) occurred, SAJ shall not take any responsibility for it.

1.2.3 Safety Instructions

 DANGER
<ul style="list-style-type: none"> · 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 inverter while the housing is wet, otherwise, it might cause electrical shock. · Do not stay close to the inverter 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.
 WARNING
<ul style="list-style-type: none"> · The installation, service, recycling and disposal of the inverters must be performed by qualified personnel only in compliance with national and local standards and regulations. · Any unauthorized actions including modification of product functionality of any form may cause lethal hazard to the operator, third parties, the units or their property. SAJ is not responsible for the loss and these warranty claims. · The SAJ inverter must only be operated with PV generator. Do not connect any other source of energy to the SAJ inverter. · Be sure that the PV generator and inverter are well grounded in order to protect properties and persons.
 CAUTION
<ul style="list-style-type: none"> · The inverter will become hot during operation. Please do not touch the heat sink or peripheral surface during or shortly after operation. · Risk of damage due to improper modifications.
 NOTICE
<ul style="list-style-type: none"> · Public utility only. · The inverter is designed to feed AC power directly to the public utility power grid; do not connect AC output of the inverter to any private AC equipment.

2.

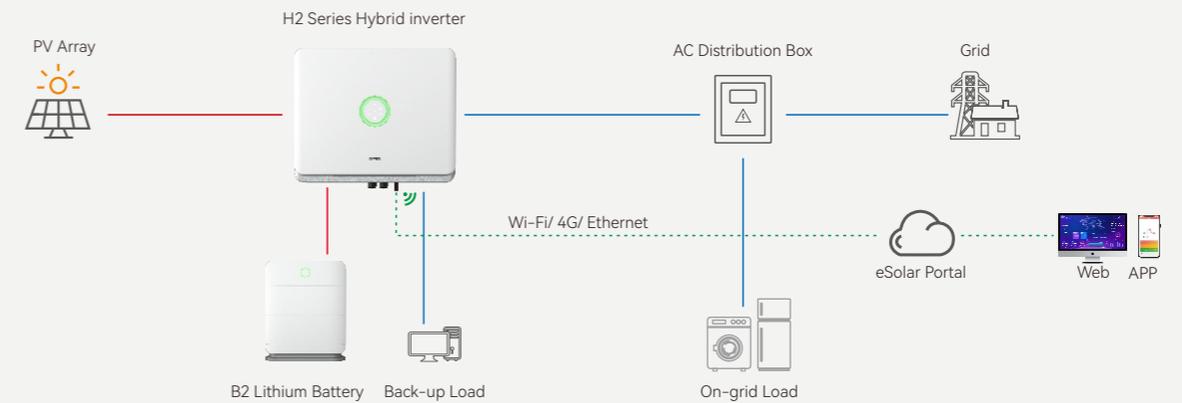
PRODUCT overview



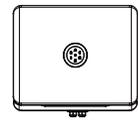
H2 series

H2 series is a hybrid photovoltaic inverter and it is applicable to both on-grid and off-grid solar systems. The energy generated by PV system will be fed to loads first, and then the surplus energy can charge the battery for later use, if there is still excess more energy, it will be exported to the grid. H2 inverter can significantly improve the self-consumption rate of solar energy and lower the dependency on grid.

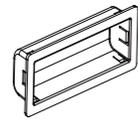
Figure 2.1
System overview



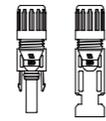
2.1 Packing list



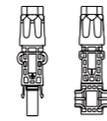
Inverter



AC Cover



PV Plug



Battery Plug



Plug-in Connector



Screw & expansion bolt & washer

2.2 Appearance

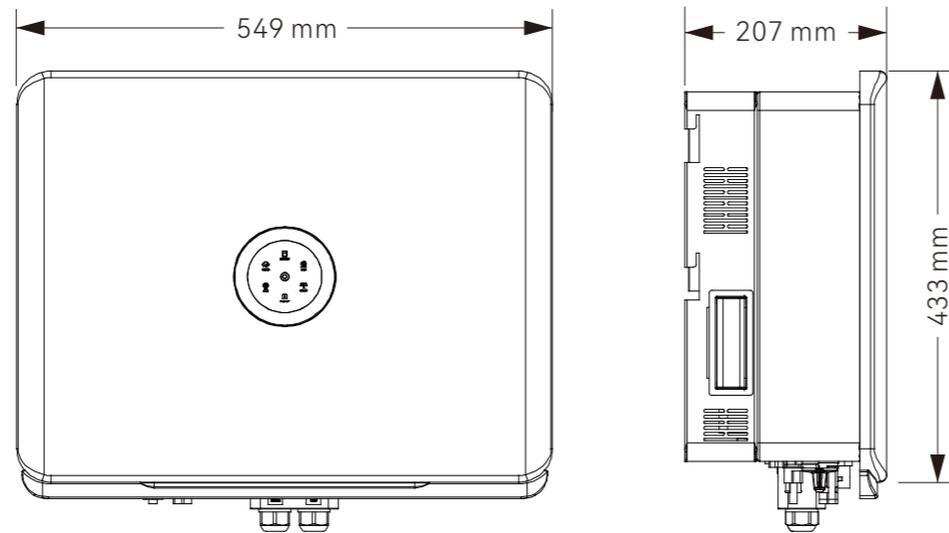


Figure 2.2
Dimensions of H2 series Product



2.3 Datasheet

H2-5K/ 6K/ 8K/ 10K-T2

MODEL	H2-5K-T2	H2-6K-T2	H2-8K-T2	H2-10K-T2
DC Input				
Max.PV Array Power [Wp]@STC	7500	9000	12000	15000
Max. DC Voltage [V]	1000			
MPPT Voltage Range [V]	180~900			
Nominal DC Voltage [V]	600			
Start Voltage [V]	180			
Max. DC Input Current [A]	15 / 15			
Max. DC Short Circuit Current [A]	18 / 18			
No. of MPPT	2			
No. of Strings per MPPT	1/1			
Battery Data				
Battery Type	Lithium battery			
Voltage Range [V]	180~600			
Max. Charging/ Discharging Current [A]	30/30			
Rated Charging/ Discharging Power [W]	5000	6000	8000	10000
AC Output [On-grid]				
Rated AC Power [W]	5000	6000	8000	10000
Max. AC Power [VA]	5500	6600	8800	11000
Rated AC Current [A]@230Vac	7.2	8.7	11.6	14.5
Max. AC Current [A]	8.3	10.0	13.3	16.7
Nominal AC Voltage [V]	220/ 380Vac, 230/ 400Vac, 3L/ N/ PE			
Rated Grid Frequency / Range [Hz]	50/ 60 ± 5			
Power Factor [cos φ]	0.8 leading~0.8 lagging			
Total Harmonic Distortion [THDi]	<3%			
AC Output [Back-up Mode]				
Rated Output Power [W]	5000	6000	8000	10000
Max. Output Current [A]	8.0	9.6	12.8	15.9
Rated Output Voltage [V]	220/ 380Vac, 230/ 400Vac, 3L/ N/ PE			
Rated Output Frequency [Hz]	50/ 60 ± 5			
Total Harmonic Distortion of Voltage	<3%			
Peak Output Apparent Power [VA]	10000, 60s	12000, 60s	16000, 60s	16500, 60s

MODEL	H2-5K-T2	H2-6K-T2	H2-8K-T2	H2-10K-T2
Efficiency				
Max. Efficiency	98.0%			
Euro Efficiency	97.6%			
MPPT Efficiency	>99.9%			
Max. Battery Charging/ Discharging Efficiency	97.6%			
Protection				
AC Short Circuit Protection	Integrated			
Overload Protection	Integrated			
Residual Current Monitoring Unit	Integrated			
Battery Input Reverse Polarity Protection	Integrated			
Anti-islanding protection	Integrated			
AC Surge Protection	Type III			
DC Surge Protection	Type III			
AFCI	Optional			
Interface				
PV Connection Type	MC4			
Battery Connection Type	Quick Connector			
AC Output	Plug-in Connector			
Display	LED+APP			
Communication port	CAN/ RS485/ DRM/ RS232			
Communication	Wi-Fi/ Ethernet/ 4G (Optional)			
General Data				
Topology	Transformerless			
Ingress Protection	IP65			
Operating Temperature Range	-40°C to +60°C			
Ambient Humidity	0~100% No Condensing			
Altitude	4000m (>3000m power derating)			
Noise [dBA]	<30			
Cooling method	Natural Convection			
Dimensions [H*W*D][mm]	433*549*207			
Weight [kg]	25			
Standard Warranty [year]	5			
Applicable Standard	CEI 0-21, VDE4105-AR-N, VDE0126-1-1, EN50438, G98, G99, EN50549, AS4777.2 IEC62109-1&-2, IEC62040-1, EN61000-6-1/2/3/4			

3.

INSTALLATION instruction



3.1 The Determination of the Installation Position

3.1.1 Mounting position

The equipment employs natural convection cooling, and it can be installed indoor or outdoor. (1) Do not expose the inverter to direct solar irradiation as this could cause power derating due to overheating.

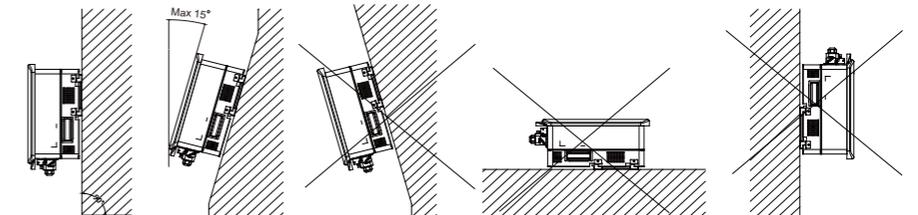


Figure 3.1
Mounting Method

DANGER

- Dangerous to life due to potential fire or electricity shock.
- Do not install the inverter near any inflammable or explosive items.

NOTICE

- This equipment meets the pollution degree .
- Inappropriate or the harmonized installation environment may jeopardize the life span of the inverter.
- Installation directly exposed under intensive sunlight is not recommended.
- The installation site must be well ventilated.

(2) Mount vertically or tilted backwards by max. 15°. Never install the inverter tilted forwards, sideways, horizontally or upside down.

(3) Install the inverter at eye level for convenience when checking the LCD display and possible maintenance activities.

(4) When mounting the inverter, please consider the solidness of wall for inverter, including accessories. Please ensure the Rear Panel mount tightly.

To make sure the installation spot is suitably ventilated, if multiple SAJ hybrid solar inverters are installed same area.

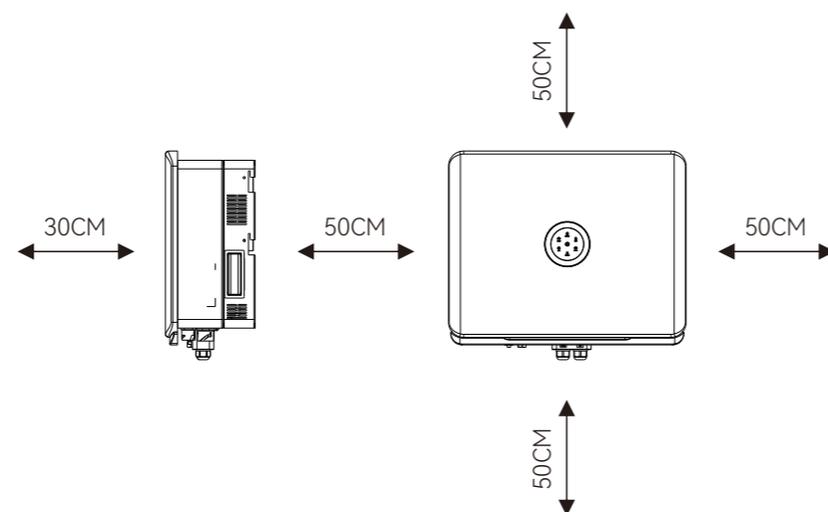
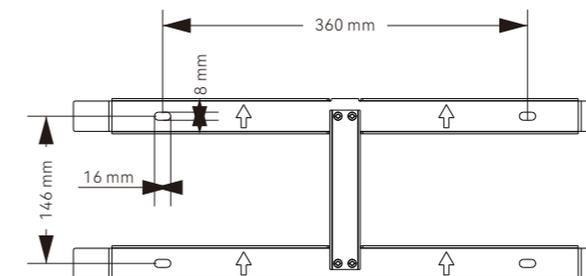


Figure 3.2
Minimum Clearance

3.2 Mounting Procedure

Figure 3.3
Dimensions of rear panel of H2 inverter

(1) Mark the Positions of the Drill Holes of the Rear Panel
The mounting position should be marked as shown in Figure 3.3.



(2) Drill Holes and Place the Expansion Tubes

Drill 4 holes in the wall (in conformity with position marked in Figure 3.4, and then place expansion tubes in the holes using a rubber mallet.

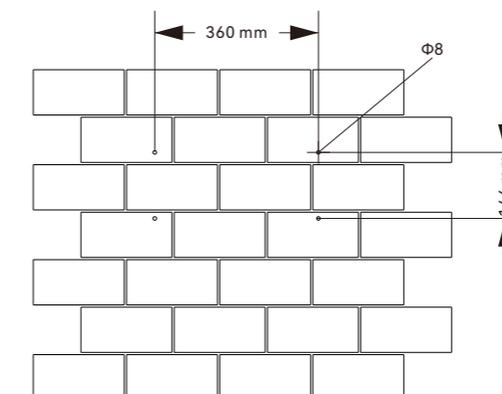


Figure 3.4
Drill holes dimensions of H2 inverter

(3) Secure the Screws and the Rear Panel

The panels should be secured onto the mounting position by screws as shown in Figure 3.5.

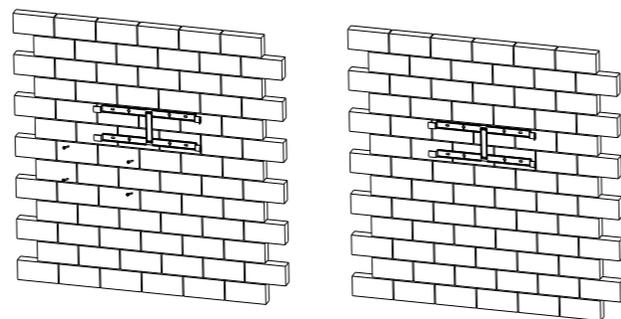


Figure 3.5
Mount the Rear Panel of H2 inverter

(4) Mount the Inverter

Carefully mount the inverter into the rear panel . Make sure that the rear part of the equipment is closely mounted into the rear panel.

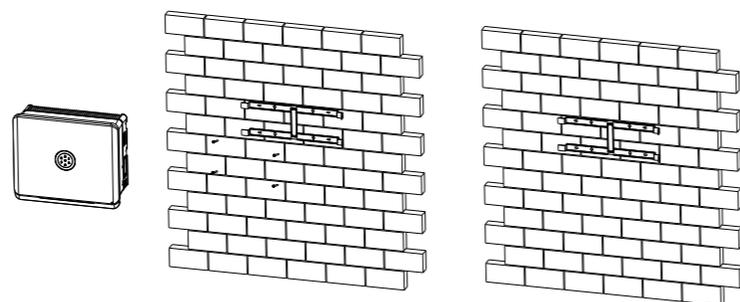
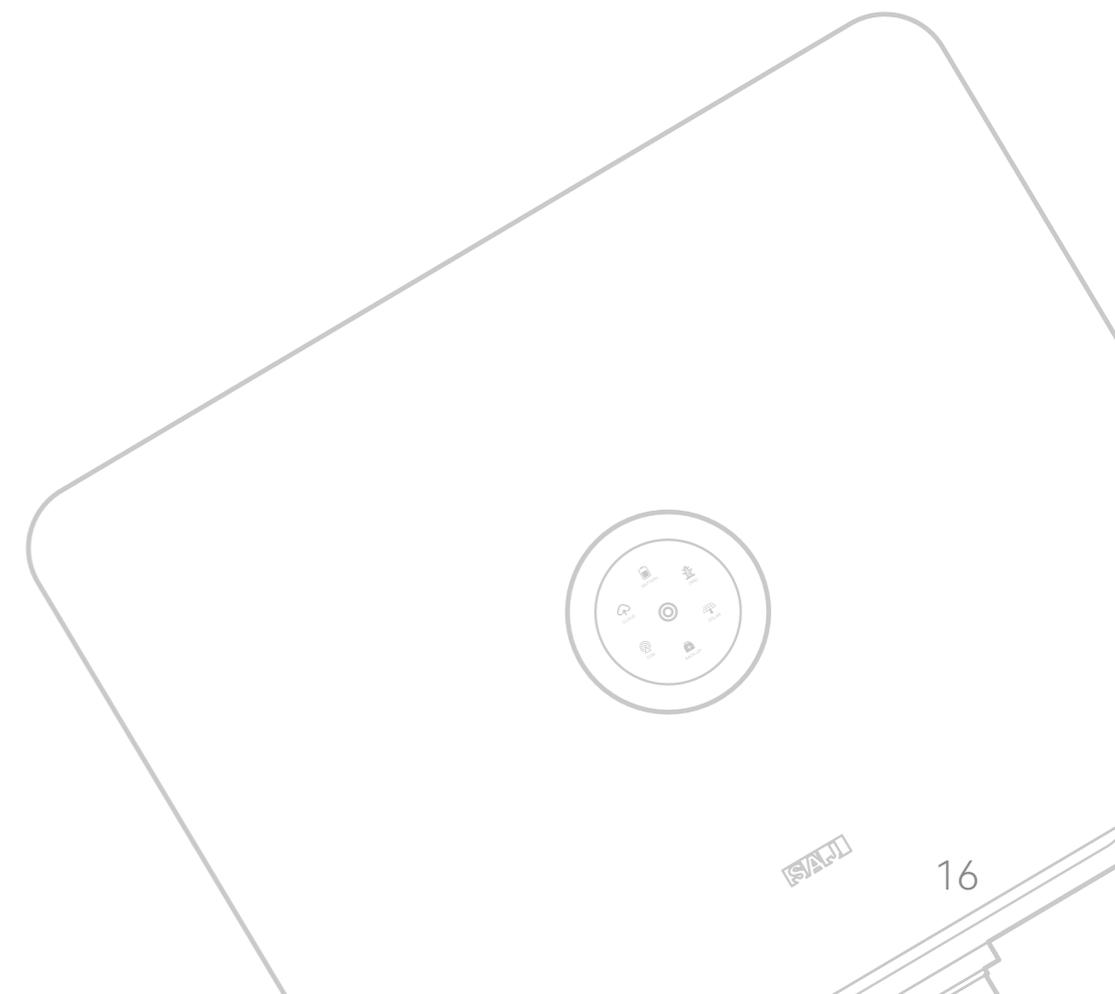


Figure 3.6
Mount H2 inverter



4.

ELECTRICAL connection



4.1 Safety Instruction

Electrical connection must only be operated on by professional technicians. Please keep in mind that the inverter is a bi-power supply equipment. Before connection, necessary protective equipment must be employed by technicians including insulating gloves, insulating shoes and safety helmet.

 DANGER
<ul style="list-style-type: none"> · Dangerous to life due to potential fire or electricity shock. · When power-on, the equipment should in conformity with national rules and regulations. · The direct connection between the inverter and high voltage power systems must be operated by qualified technicians in accordance with local and national power grid standards and regulations. · The PV arrays will produce lethal high voltage when exposed to sunlight.

 NOTICE
<ul style="list-style-type: none"> · Any improper operation during cable connection can cause device damage or personal injury

4.2 Specifications for Electrical Interface

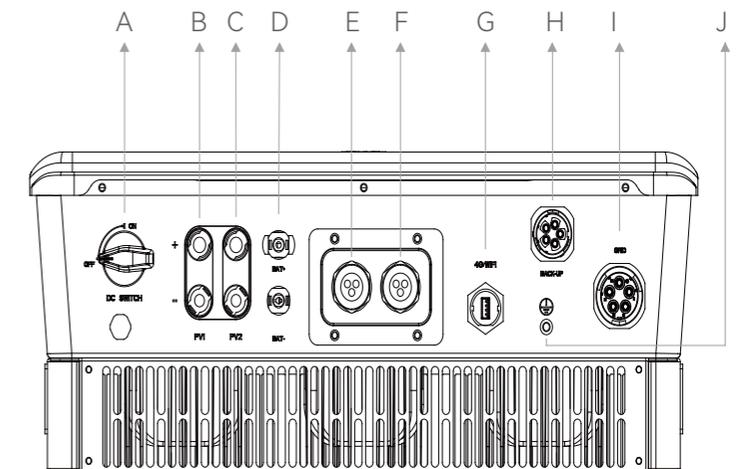


Figure 4.1
Electrical Interface of H2 inverter

Table 4.1
Specifications for Interface

Code	Name
A	DC Switch
B	PV Input
C	PV Input
D	Battery Input
E	BMS/ CAN/ METER/ DRM
F	CT/ Inverter Parallel port
G	4G/ Wi-Fi/ Ethernet
H	Backup
I	Grid
J	Ground Connection

4.3 AC Grid Wire and Backup Output Connection

Table 4.2
Recommended Specifications of AC Cables

Cable Cross-sectional area (mm ²)		External diameter (mm)	
Range	Recommend	Range	Recommend
2.5~6.0	4.0	8~14	14

If the grid-connection distance is too far, please amplify diameter selection of the AC cable as per the actual condition.

Procedure:

(1) Open the waterproof cover, feed the AC cable through the AC waterproof hole.

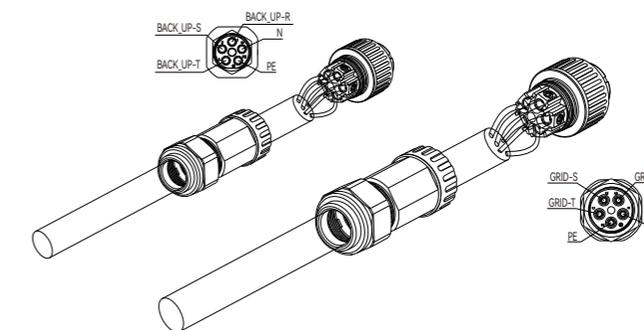


Figure 4.2
Thread the cables

(2) Fix the cables according to conductor marks of L, N and PE.

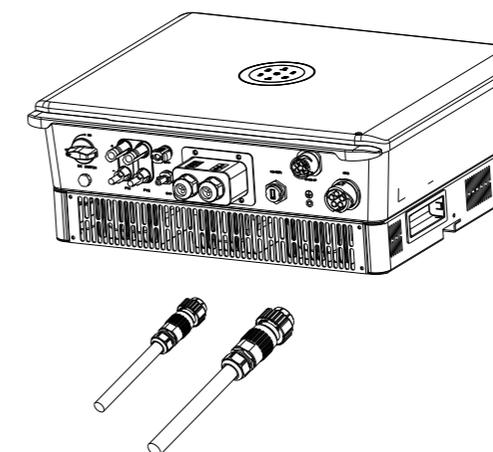


Figure 4.3
Connect the Cables

(3) Secure all parts of the grid and backup connector tightly.

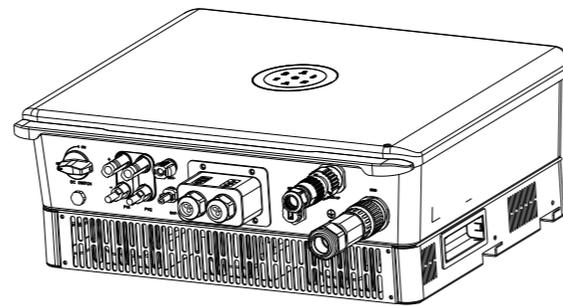


Figure 4.4
Screw the Connector

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

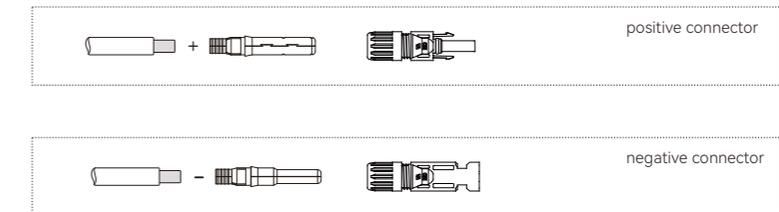
4.4 PV Connection

Table 4.3
Recommended Specifications of DC Cables

Cable Cross-sectional area (mm ²)		External diameter (mm)	
Range	Recommend	Range	Recommend
4.0~6.0	4.0	4.2~5.3	5.3

Figure 4.5
Positive and negative connectors

DC connector is made up of one positive connector and one 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) Use specified strip tool to strip the insulated enclosure of the positive and negative cables with appropriate length (8-10mm).

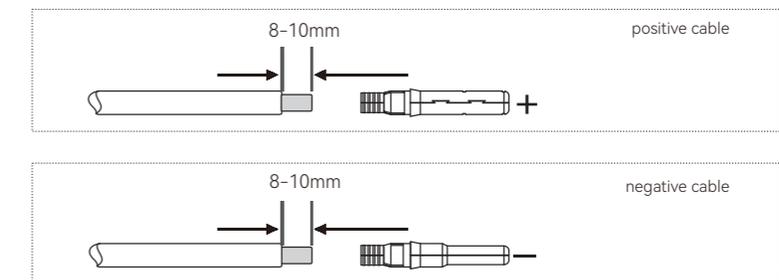


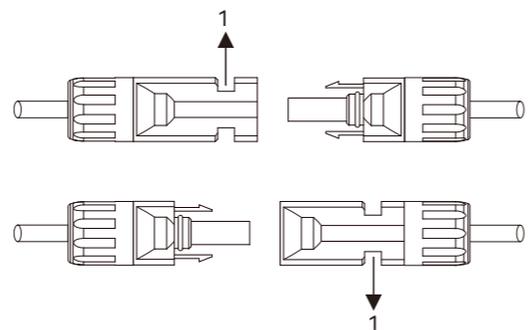
Figure 4.6
Connecting Cables

(2) Feed the positive and negative cables into corresponding lock screws and crimp them tightly with a wire crimper. Make sure that the withdrawal force of the pressed cable is larger than 400N.

(3) Plug in the pressed positive and negative cables into relevant insulated enclosure, a “click” sound should be heard when the contact cable assembly is seated correctly.

(4) Fasten the lock screws on positive and negative connectors into corresponding insulated enclosure and make them tight.

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



1. Connection Port

Figure 4.7
Connect the Inverter

 NOTICE

- Before insert the connector into DC input terminal of the inverter, please make sure that the DC switch of the inverter is OFF.
- Please use the original H4 terminal to install.

4.5 Battery Connection

Table 4.4
Recommended Specifications of DC Cables

Cable Cross-sectional area (mm ²)		External diameter (mm)	
Range	Recommend	Range	Recommend
4~6	5	4~6	5

If lithium battery is connected, it is not required to install a breaker between battery and inverter.

Procedure:

(1) Open the waterproof cover, feed the AC cable through the AC waterproof hole.

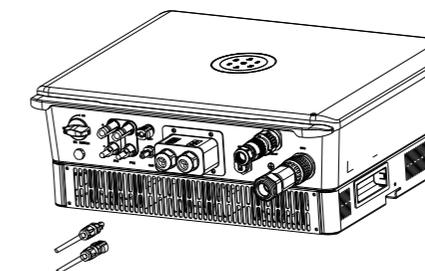


Figure 4.8
Open the waterproof cover

(2) Strip off the insulation skin of DC cable, the core is exposed to 10mm, and use a special tool to press the Battery Terminal.

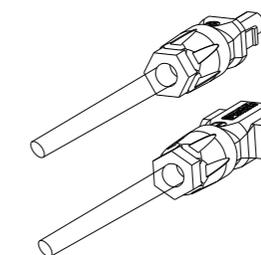


Figure 4.9
Battery Terminal

(3) Fix the battery cable on the battery copper terminal by positive and negative in order.

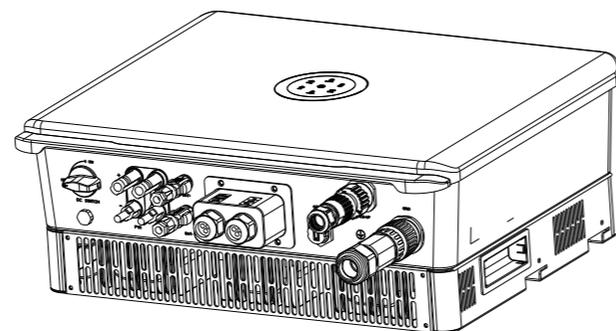


Figure 4.10
Connect the Battery Cable

4.6 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 second LED indicator will be lit up until the error being solved and inverter functioning properly.

4.7 Communication Connection

H2 series hybrid inverter has a RS232 communication port integrated.

4.7.1 Serial Port Definition

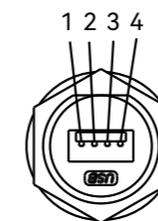


Figure 4.11
9-Pin serial port

Pin Number	Description	Effect
1	+7V	Power supply
2	RS-232 TX	Send data
3	RS-232 RX	Receive data
4	GND	Ground wire

Table 4.4
Recommended Specifications of DC Cables

USB interface with Wi-Fi module, please reference Wi-Fi module user manual.

4.7.2 RJ45 Pin Port Definition



Figure 4.12
Interface definition

Table 4.5
RJ45 pin port definition

RS485/ Meter	
1	NC
2	NC
3	NC
4	NC
5	NC
6	NC
7	RS485-A+
8	RS485-B-

CT	
1	R/CT.1+
2	R/CT.1-
3	S/CT.1+
4	S/CT.1-
5	T/CT.1+
6	T/CT.1-
7	NC
8	NC

DRM	
1	DRM 1/5
2	DRM 2/6
3	DRM 3/7
4	DRM 4/8
5	RefGen
6	Com/DRM 0
7	V+
8	V-

CAN	
1	NC
2	NC
3	NC
4	CANH
5	CANL
6	NC
7	NC
8	NC

4.7.3 Insert the communication cable

Open the waterproof cover, pass the prepared communication cable through each component, insert corresponding communication port, then tighten the screws.

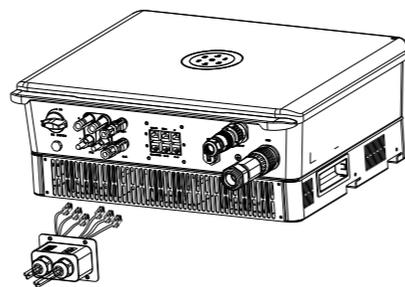


Figure 4.13
Connection of communication cable

4.7.4 Smart Meter Connection

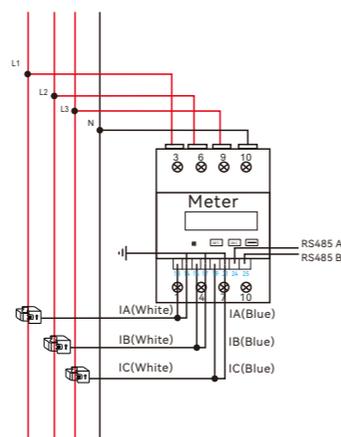


Figure 4.14
Smart meter wiring

Notice: The hybrid inverter is with export limitation function, which can be realized by connecting SAJ recommended smart meter to the hybrid energy storage system. Users can contact SAJ for further details for the smart meters. If users have no intention to set the export limitation function, please ignore chapter 4.7.4.

If users have purchased the smart meter that recommended by SAJ, before setting the export limitation function, users shall connect the meter to the system with procedures below:

4.8 Connection Diagram

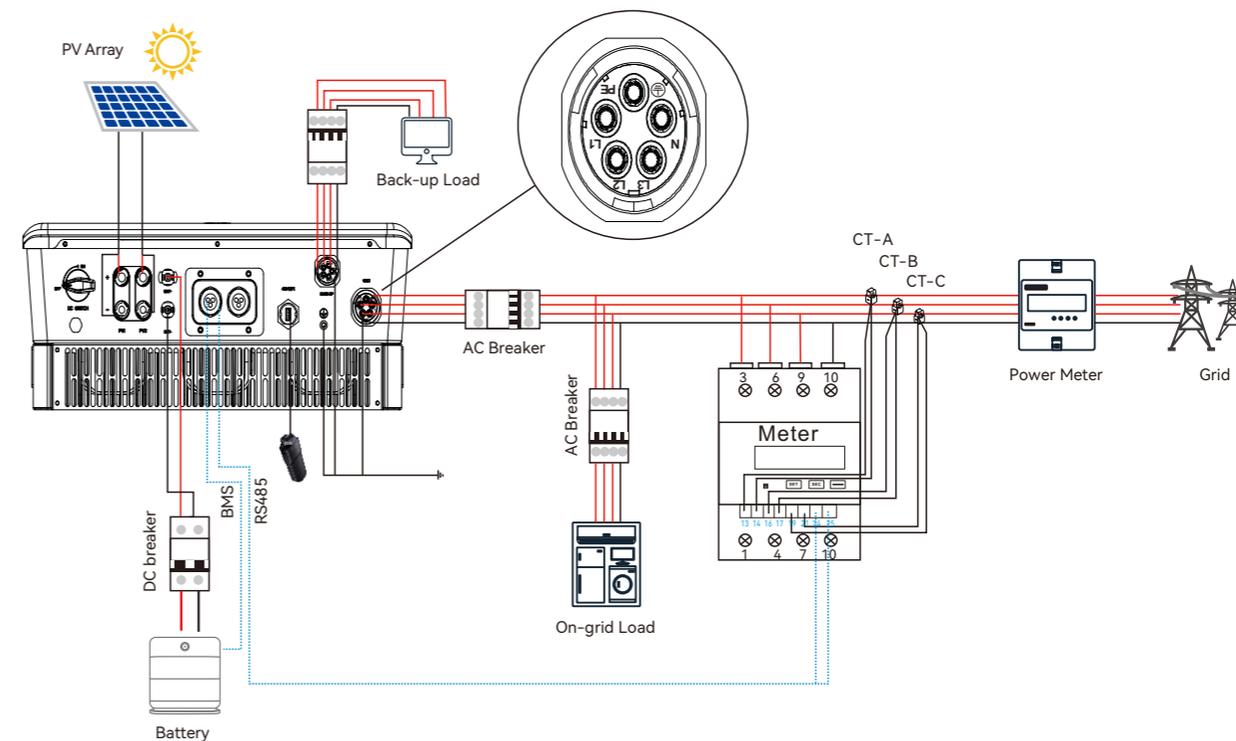


Figure 4.15
H2 Connection diagram

Note: The sequence of Grid wire must be connected correctly, otherwise, an "Master Grid Phase Error" will be occurred (refer to chapter 6). If this fault occurred, please switch the position of L2 and L3 cable.

4.9 Ground Connection

Remove the screw on the ground terminal and secure the cable with a screwdriver.

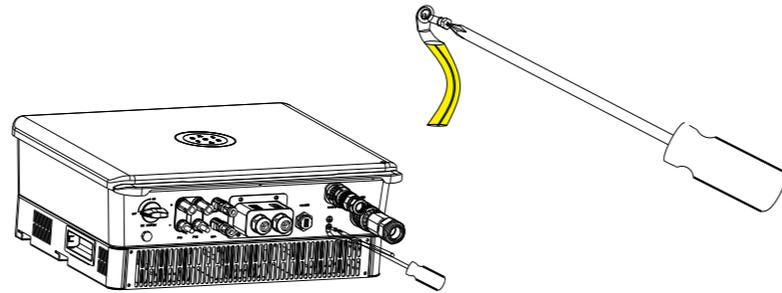
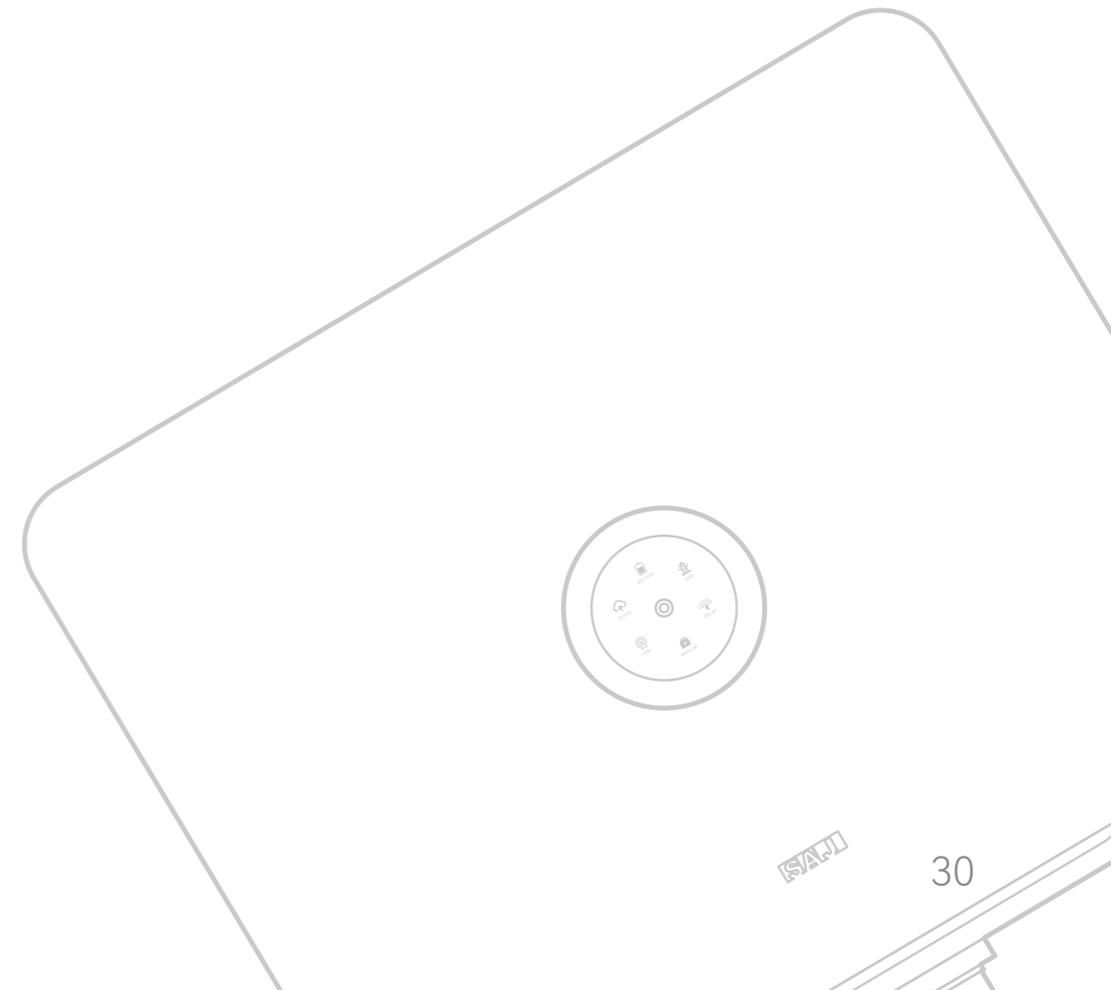


Figure 4.16
Inverter ground protection

4.10 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 inverter is integrated with a RCMU, however, an external RCD is needed to protect the system from tripping, either type A or type B RCD are compatible with the inverter.

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, if an external residual current device is connected, the action current should be 30mA or higher.



5.

DEBUGGING instructions



5.1 Introduction of LED Indicator

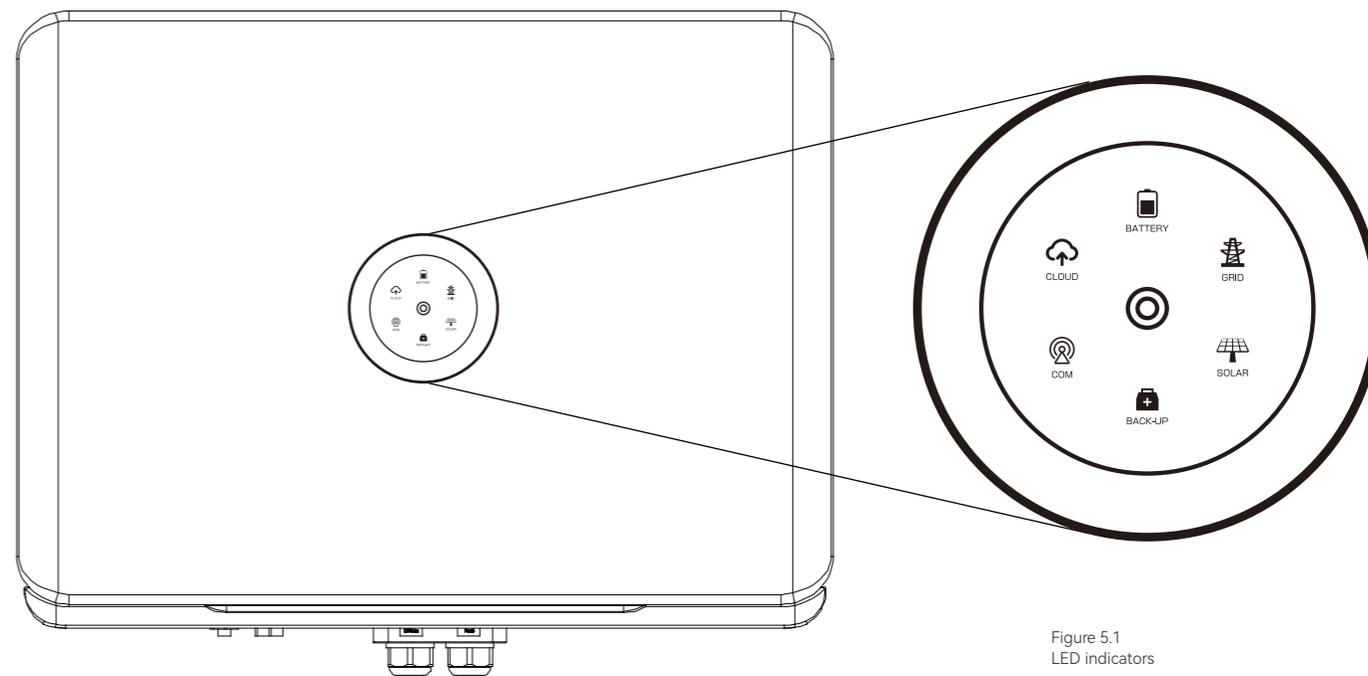


Figure 5.1
LED indicators

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
Cloud	Solid	Connected
	On 1s, off 1s	Connecting
	Off	Disconnected

Talbe 5.1
Instructions of the Interface

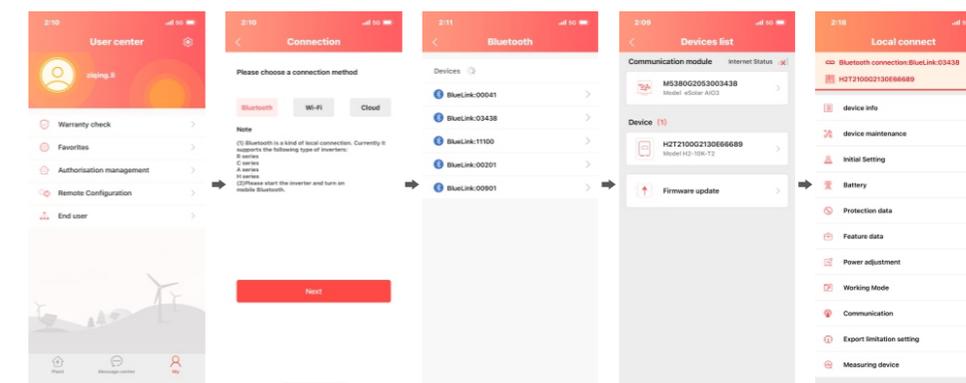
5.2 Commissioning

Start up:

- (1) Connect the AC circuit breaker
- (2) Connect the DC circuit breaker between inverter and battery (if applicable)
- (3) Turn ON the battery (if applicable)
- (4) Turn ON the DC switch on the inverter
- (5) Install the communication module into the inverter
- (6) Setup the initial setting for inverter on eSolar APP
- (7) Observe the LED indicators on the inverter to ensure the inverter is running properly

5.3 eSolar APP Connection

- Step 1** Login to eSolar O&M APP and click on “My” and select “Remote Configuration”
- Step 2** Click on “Bluetooth” and activate the Bluetooth function on your phone, then click on “Next”
- Step 3** Choose your inverter according to your inverter SN’s tail numbers
- Step 4** Click on the inverter to enter inverter setting



○ Error ● Alarm

Code	Fault Information	Explanation	Fault Type
Master Device Error			
01	Master Bus Voltage High	Master Bus Software Voltage High	○
03	Master Grid Phase Error	Master Grid Phase Error	○
04	Master PV Voltage High Error	Master PV Voltage High Error	○
07	Master PVInput Error	Master PV Input Error	○
10	Master HW PV Current High	Master Hardware PV Current High	○
12	Master HW Inv Current High	Master Inverter Hardware Current High	○
15	Master Grid NE Voltage Error	Master Grid N Cable to Ground Voltage Error	○
16	Master DRM0 Error	Master DRM0 Error	○
17	Master Fan1 Error	Master Fan Error	●
23	Master Battery Voltage High	Master Battery Voltage High	●
24	Master Battery Current High	Master Battery Current High	●
25	Master Battery Charge Voltage High	Master Battery Charging Voltage High	●
26	Master Battery OverLoad	Master Battery OverLoad	●
27	Master Battery SoftConnet Time Out	Master Battery Soft Connet TimeOut	●
28	Master Output OverLoad	Master Output OverLoad	●
29	Master Battery Open Circuit Error	Master Battery Open Circuit Error	●
30	Master Battery Discharge Voltage Low	Master Battery Discharging Voltage Low	●
32	Lost Communication D<->C	Inverter Display Board and Master Controller Communication Lost	●
33	Master Relay Error	Master Relay Error	○
34	Master EEPROM Error	Master Storage (EEPROM) Error	○
35	Master Temperature High Error	Master Temperature High Error	○
36	Master Temperature Low Error	Master Temperature Low Error	○
38	Master GFCI Device Error	Master Ground Fault Circuit Interrupter Device Error	○
40	Master Current Sensor Error	Master Current Sensor Error	○
41	Master Phase1 Voltage High	Master Phase1 Grid Voltage High	○
42	Master Phase1 Voltage Low	Master Phase1 Grid Voltage Low	○
43	Master Phase2 Voltage High	Master Phase 2 Grid Voltage High	○
44	Master Phase2 Voltage Low	Master Phase 2 Grid Voltage Low	○

Code	Fault Information	Explanation	Fault Type
45	Master Phase3 Voltage High	Master Phase 3 Grid Voltage High	○
46	Master Phase3 Voltage Low	Master Phase 3 Grid Voltage Low	○
47	Master Voltage 10Min High	Master Grid Voltage 10 mins Average Value High	○
48	Master OffGrid Voltage Low	Master Off Grid Output Voltage Low	○
49	Master Output_Shorter	Master Output Short Circuit	●
50	Master Grid Frequency High	Master Grid Frequency High	●
51	Master Grid Frequency Low	Master Grid Frequency Low	●
53	Master Phase1 DCV Error	Master Phase 1 DCV High Error	●
54	Master Phase2 DCV Error	Master Phase 2 DCV High Error	●
55	Master Phase3 DCV Error	Master Phase 3 DCV High Error	●
56	Master No Grid Error	Master No Grid Error	●
59	Master GFCI Error	Master Ground Fault Circuit Interrupter Error	●
60	Master Phase1 DCI Error	Master Phase 1 DCI High Error	●
61	Master Phase2 DCI Error	Master Phase 2 DCI High Error	●
62	Master Phase3 DCI Error	Master Phase 3 DCI High Error	●
63	Master ISO Error	Master Isolation Error	●
64	Master Bus Voltage Balance Error	Master Bus Voltage Balance Error	●
Display Board Error			
65	Lost Com.H<->M Err	Display board communication lost	○
66	Meter Lost Com Warn	Meter Communication Lost Warning	○
67	HMI Eeprom Err	HMI EEPROM Error	○
68	HMI RTC Err	RTC Error	○
69	BMS Device Err	BMS Device Error	○
70	BMS Lost.Conn Warn	BMS Communication Lost Warning	○



Fault code



7.

Recycling and Disposal



This device should not be disposed as residential waste. An Inverter that has reached the end of its life and is not required to be returned to your dealer, it must be disposed carefully by an approved collection and recycling facility in your area.