User Manual

Solar Water Heating Controller

SWHC-1000~6000

Version: 1.0

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ABOUT THIS MANUAL

Purpose

This manual describes the assembly, installation, operation and troubleshooting of this unit. Please read this manual carefully before installations and operations. Keep this manual for future reference.

Scope

This manual provides safety and installation guidelines as well as information on tools and wiring.

SAFETY INSTRUCTIONS

⚠ **WARNING: This chapter contains important safety and operating instructions. Read and keep this manual for future reference.**

1. Before using the unit, read all instructions and cautionary markings on the unit, and all appropriate sections of this manual.
2. Do not disassemble the unit. Take it to a qualified service center when service or repair is required. Incorrect re-assembly may result in a risk of electric shock or fire.
3. To reduce risk of electric shock, disconnect all wiring before attempting any maintenance or cleaning. Turning off the unit will not reduce this risk.
4. For optimum operation of this controller, please follow required spec to select appropriate cable size. It's very important to correctly operate this controller.
5. Please strictly follow installation procedure when you want to disconnect AC or DC terminals. Please refer to INSTALLATION section of this manual for the details.
6. **GROUNDING INSTRUCTIONS** -This controller should be connected to a permanent grounded wiring system. Be sure to comply with local requirements and regulation to install this controller.
7. **NEVER** cause AC output and DC input short circuited. Do NOT connect to the mains when DC input short circuits.
8. **Warning!!** Only qualified service persons are able to service this device. If errors still persist after following troubleshooting table, please send this controller back to local dealer or service center for maintenance.

INTRODUCTION

This controller can provide power to connected loads by utilizing solar power, utility power.

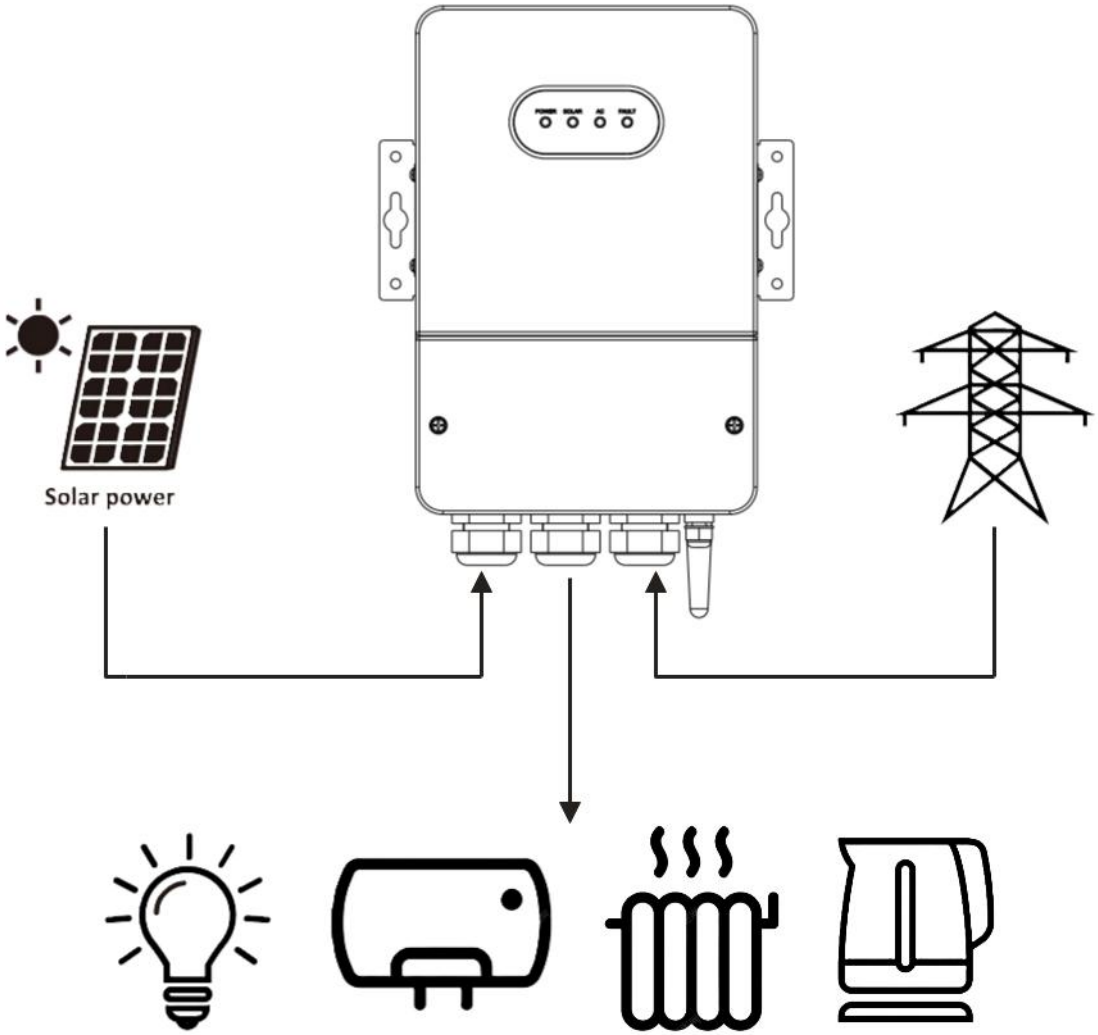
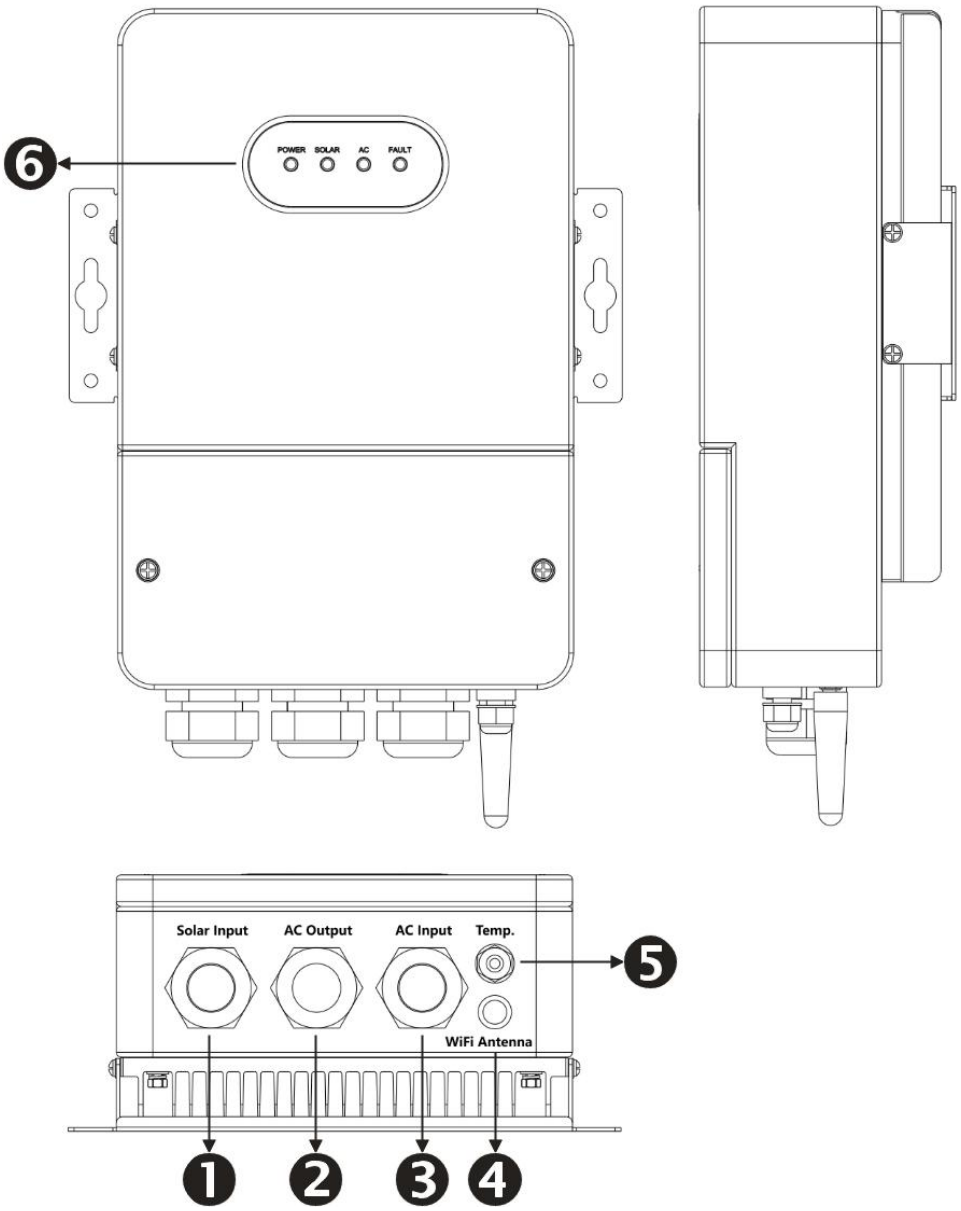


Figure 1 Basic PV System Overview

Depending on different power situations, this controller is designed to generate continuous power from PV solar modules (solar panels) and the utility. When MPP input voltage of PV modules is within acceptable range (see specification for the details), this controller is able to generate power to load. **Never connect the positive and negative terminals of the solar panel to the ground.** See Figure 1 for a simple diagram of a typical solar system with this controller.

Product Overview

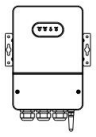


1. Solar Input
2. AC Output (Load connection)
3. AC Input
4. WiFi Antenna port
5. External temperature sensor port
6. Status indicator

INSTALLATION

Unpacking and Inspection

Before installation, please inspect the unit. Be sure that nothing inside the package is damaged. You should have received the following items inside of package:

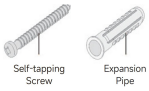


controller unit

Manual

Warranty card

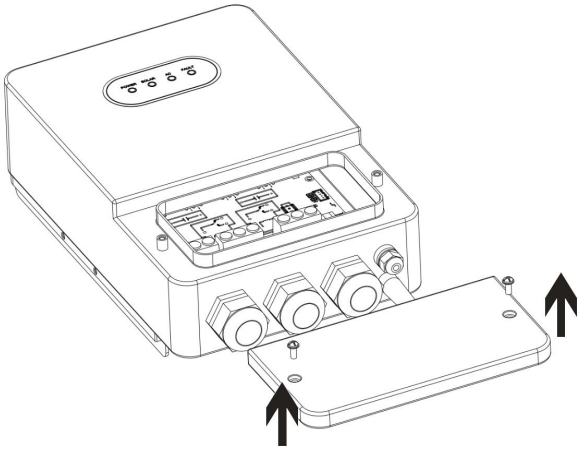
External temperature sensor



Screw Mounting Kit

Preparation

Before connecting all wires, please take off bottom cover by removing two screws as shown below.

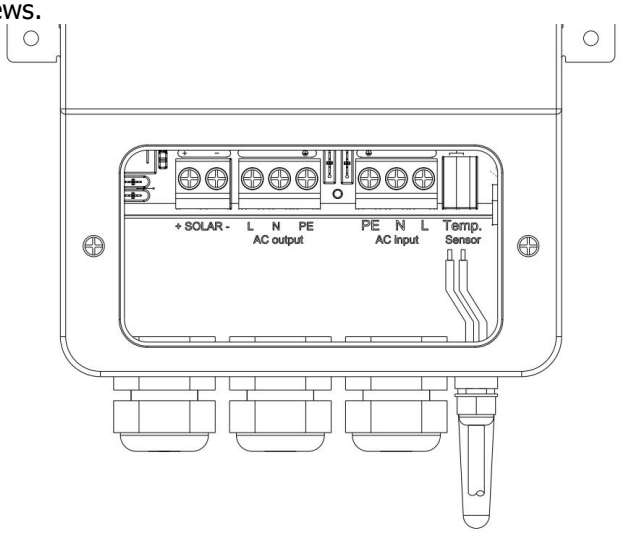


External temperature sensor Connection

WARNING! All wiring must be performed by a qualified personnel.

Please follow below steps to implement external temperature sensor connection:

1. Before making external temperature sensor wires connection, be sure to open AC/DC protector or disconnect first.
2. Insert **external temperature sensor wires** according to polarities indicated on terminal block and tighten the terminal screws.



AC Input/Output Connection

CAUTION!! Before connecting to AC input power source, please install a **separate** AC breaker between controller and AC input power source. This will ensure the controller can be securely disconnected during maintenance and fully protected from over current of AC input.

CAUTION!! There are two terminal blocks with "IN" and "OUT" markings. Please do NOT mis-connect input and output connectors.

WARNING! All wiring must be performed by a qualified personnel.

WARNING! It's very important for system safety and efficient operation to use appropriate cable for AC input connection. To reduce risk of injury, please use the proper recommended cable size as below.

Suggested cable requirement for AC wires

Model	Gauge	Torque Value
SWHC-1000	16 AWG	1.2~ 1.6 Nm
SWHC-2000	14 AWG	1.2~ 1.6 Nm
SWHC-3000	14 AWG	1.2~ 1.6 Nm
SWHC-4000	12 AWG	1.2~ 1.6 Nm
SWHC-5000	10 AWG	1.2~ 1.6 Nm
SWHC-6000	10 AWG	1.2~ 1.6 Nm

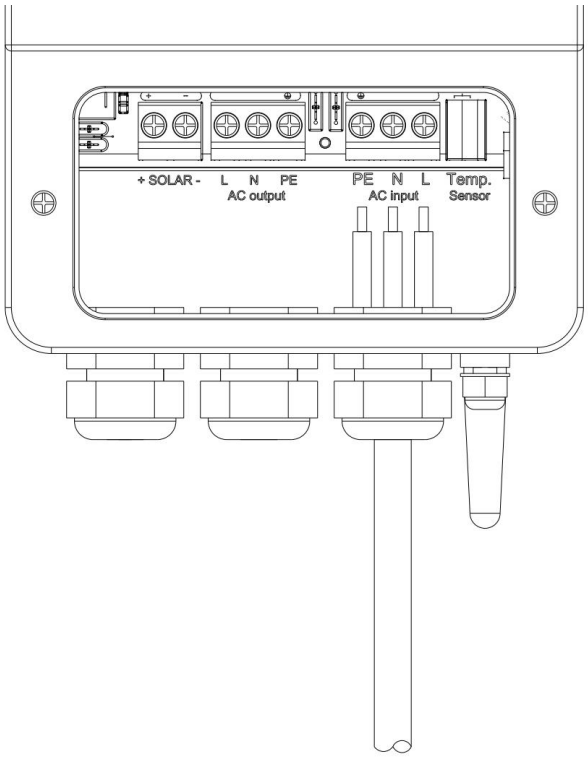
Please follow below steps to implement AC input/output connection:

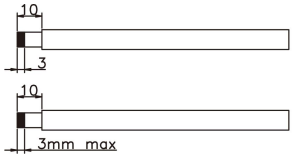
3. Before making AC input/output connection, be sure to open AC protector or disconnect first.
4. Remove insulation sleeve 10mm for six conductors. And shorten phase L and neutral conductor N 3 mm.
5. Insert **AC input wires** according to polarities indicated on terminal block and tighten the terminal screws. Be sure to connect PE protective conductor (⏚**)** first.

   ⏚**→Ground (yellow-green)**

   L→LINE (brown or black)

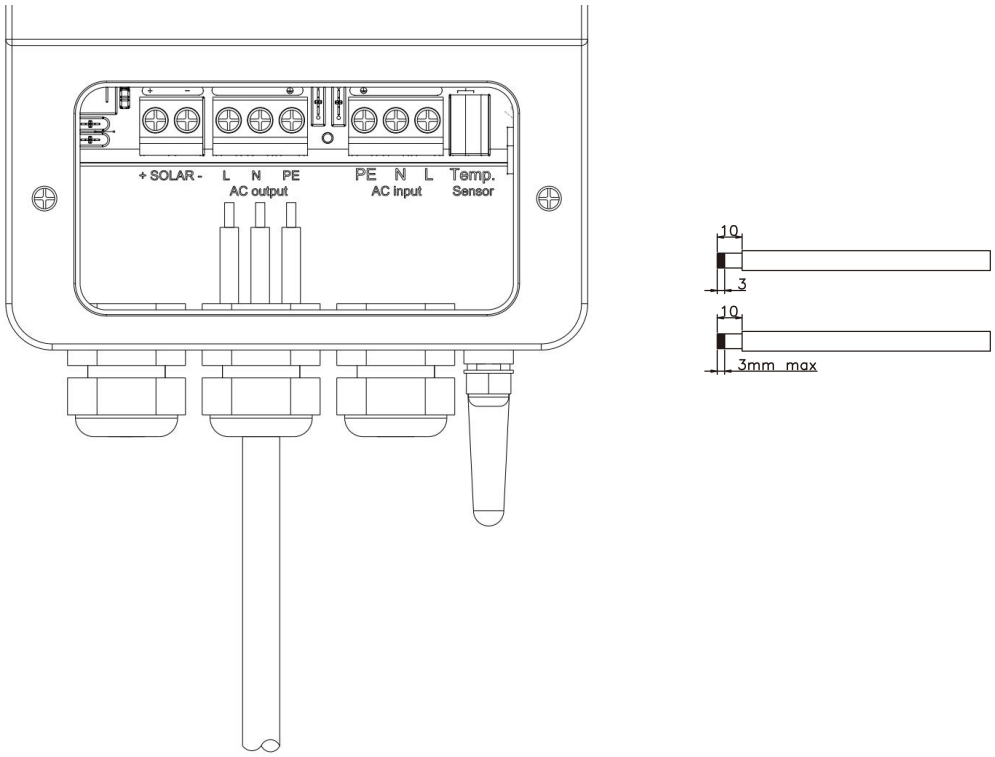
   N→Neutral (blue)





⚠	**WARNING:** Before attempting to connect the wire to the device, make sure the AC power is disconnected .

6. Then, insert **AC output wires** according to polarities indicated on terminal block and tighten terminal screws. Be sure to connect PE protective conductor (⏚**)** first.
   ⏚**→Ground (yellow-green)**
   L→LINE (brown or black)
   N→Neutral (blue)



7. Make sure the wires are securely connected.

CAUTION: Important
Be sure to connect AC wires with correct polarity.
Please don't plug the AC input wires into AC output terminal port, otherwise the controller will be broken.

PV Connection

CAUTION: Before connecting to PV modules, please install **separately** a DC circuit breaker between controller and PV modules.

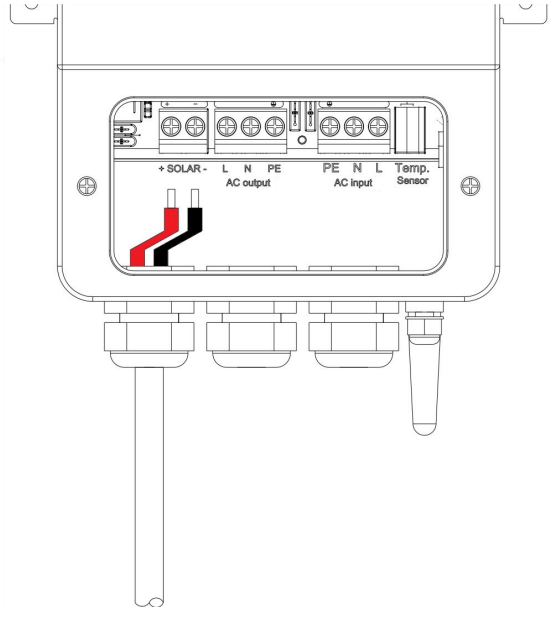
WARNING! All wiring must be performed by a qualified personnel.
WARNING: Please switch off the controller before you connect PV modules. Otherwise, it will damage the controller.
WARNING! It's very important for system safety and efficient operation to use appropriate cable for PV module connection. To reduce risk of injury, please use the proper recommended cable size as below.

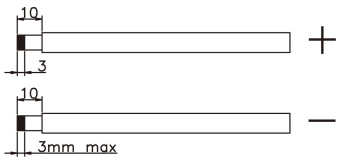
Model	Typical Amperage	Cable Size	Torque
SWHC-1000	40A d.c.	8AWG	2.0~2.4Nm
SWHC-2000	40A d.c.	8AWG	2.0~2.4Nm
SWHC-3000	40A d.c.	8AWG	2.0~2.4Nm
SWHC-4000	40A d.c.	8AWG	2.0~2.4Nm
SWHC-5000	40A d.c.	8AWG	2.0~2.4Nm
SWHC-6000	40A d.c.	8AWG	2.0~2.4Nm

PV Module Selection:
When selecting proper PV modules, please be sure to consider below parameters:
1. Open circuit Voltage (Voc) of PV modules not exceeds max. PV array open circuit voltage of controller.
2. Open circuit Voltage (Voc) of PV modules should be higher than 60V.

Solar Charging Mode	
controller MODEL	SWHC-1000~6000
Max. PV Array Open Circuit Voltage	500V d.c.
PV Array MPPT Voltage Range	60~480V d.c.
Number of input strings	1

Please follow below steps to implement PV module connection:
1. Remove insulation sleeve 10 mm for positive and negative conductors. And shorten positive and negative conductors N 3 mm.
2. Check correct polarity of connection cable from PV modules and PV input connectors. Then, connect positive pole (+) of connection cable to positive pole (+) of PV input connector. Connect negative pole (-) of connection cable to negative pole (-) of PV input connector.



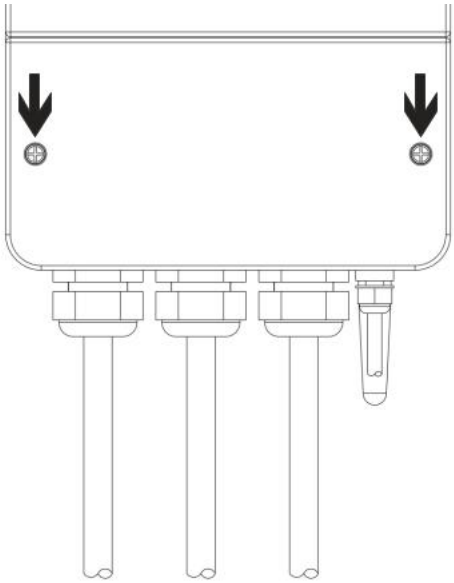


Recommended PV module Configuration

PV Module Spec. (reference)	Total solar input power	Solar input	Q'ty of modules
- 250Wp - Vmp: 30.7V d .c. - Imp: 8.15A d.c. - Voc: 37.4V d.c. - Isc: 8.63A d.c. - Cells: 60	1500W	6 pieces in series	6 pcs
	2000W	8 pieces in series	8 pcs
	2750W	11 pieces in series	11 pcs
	3000W	6 pieces in series 2 strings in parallel	12 pcs
	4000W	8 pieces in series 2 strings in parallel	16 pcs
	5000W	10 pieces in series 2 strings in parallel	20 pcs
	6000W	12 pieces in series 2 strings in parallel	24 pcs

Final Assembly

After connecting all wiring, please put bottom cover back by screwing two screws as shown below.



Mounting the Unit

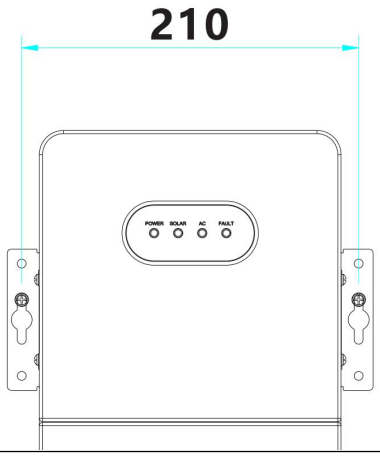
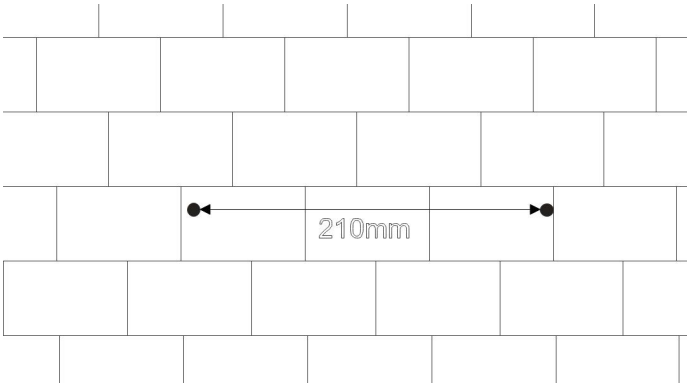
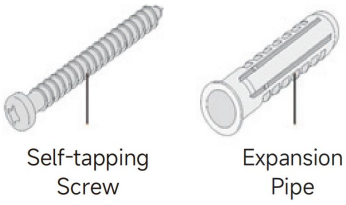
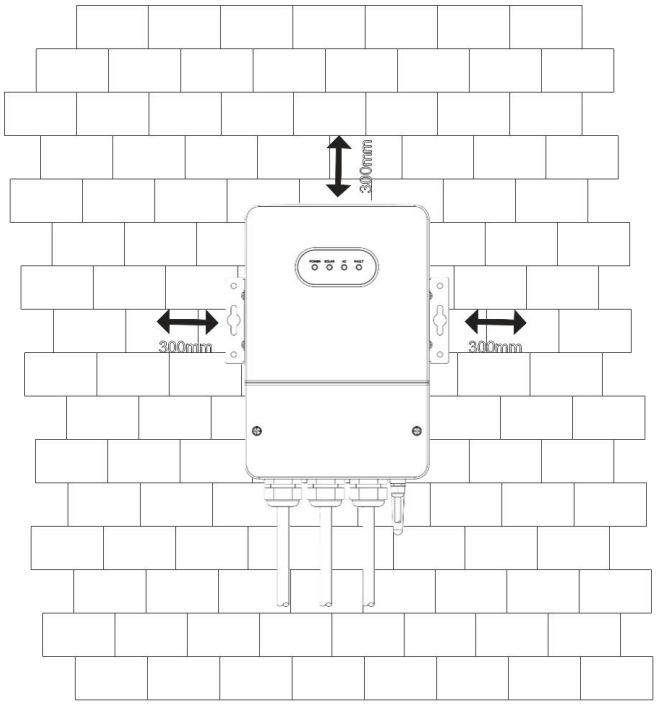
Consider the following points before selecting where to install:

1. Do not mount the controller on flammable construction materials.
2. Mount on a solid surface.
3. Install this controller at eye level so that you can see the machine status.
4. The ambient temperature should be between -30°C and 60°C to ensure optimal operation.
5. The recommended installation position is to be adhered to the wall vertically.
6. Be sure to keep other objects and surfaces as shown in the below diagram to guarantee sufficient heat dissipation and to have enough space for removing wires.

⚠ **SUITABLE FOR MOUNTING ON CONCRETE OR OTHER NON-COMBUSTIBLE SURFACE ONLY.**

Before drilling, avoid the electrical wiring inside the wall to prevent danger!

Place the hanging plate flush on the wall, mark the recommended holes as shown, and drill the holes to a depth of about 30 mm.

Step.1 The distance between the two mounting holes is 210mm.	**Step.2** Mark two punch holes on the wall,then drill two holes in the wall.
	
Step.3 Put the following two into the hole.	**Step.4** Hang the machine on the wall.
	

WiFi Connection

WiFi connection steps

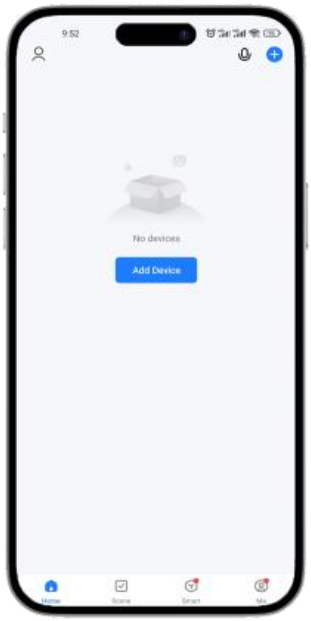
1. Download mobile application

Download “smart life” through App Store or Google Play, or scan the QR code directly.

2. Register account

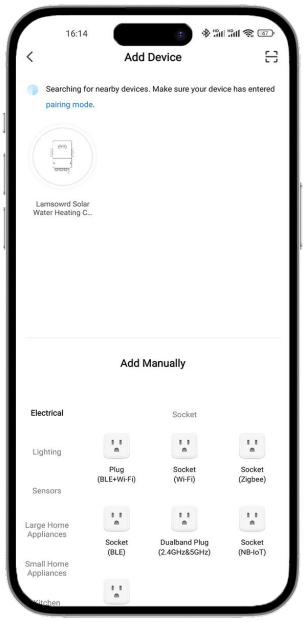
Register a personal account via email.

3. Add Device



4. Check WiFi network

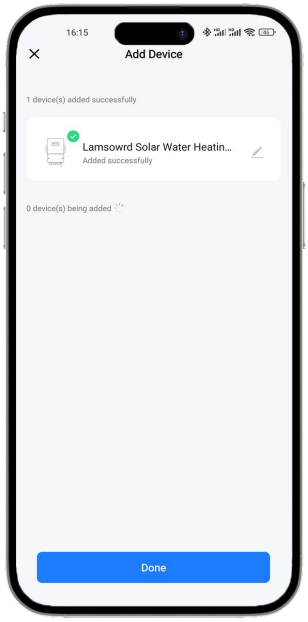
Make sure Bluetooth and wifi are turned on, and connected to **2.4GHz** WiFi network, otherwise the device will not be recognized.



5. Enter WiFi account

Enter the WiFi account and password of the installation address.

6. Complete WiFi connection



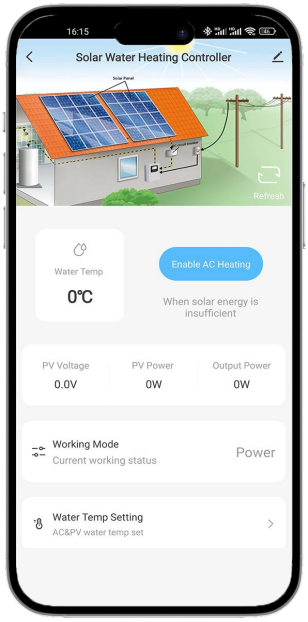
Settings interface

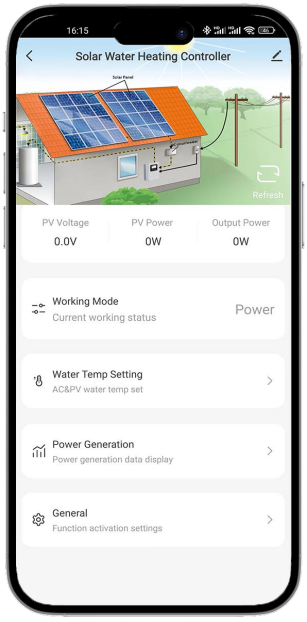
1. Enter the home page

On the home page, it will display the real-time water temperature, PV voltage, PV power, and PV/AC output power.

If the current water temperature does not reach the temperature you want, you can also press ”Enable AC Heating” button to heat until it reaches the AC set temperature.

If the current data is not updated in time, you can also press ”Refresh” button to speed up the data refresh frequency in a short period of time.

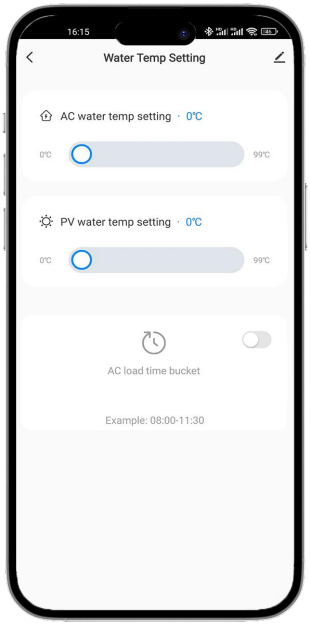




2. Water temperature setting page

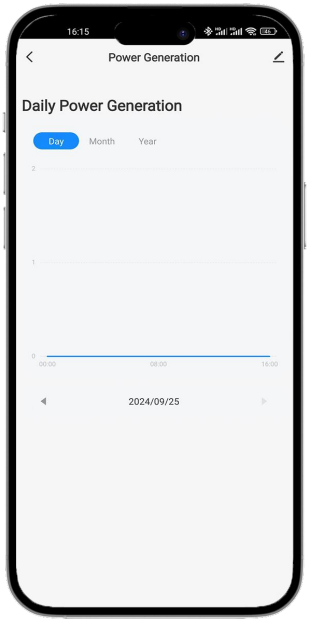
Users can adjust the set temperature of PV and AC according to the needs, the controller stops heating when the set temperature is reached.

If you need to use AC heating within a certain period of time, you can also open the AC load time bucket and enter the heating time period.



3. Power generation page

This page can view daily, monthly and annual power generation.

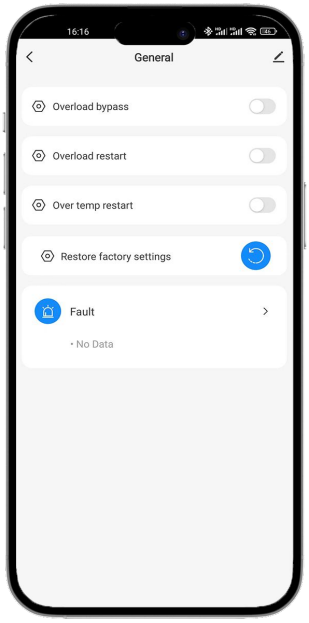


4. General settings page

This page can enable overload bypass, overload restart, and over-temp restart functions to protect the controller from damage in extreme cases.

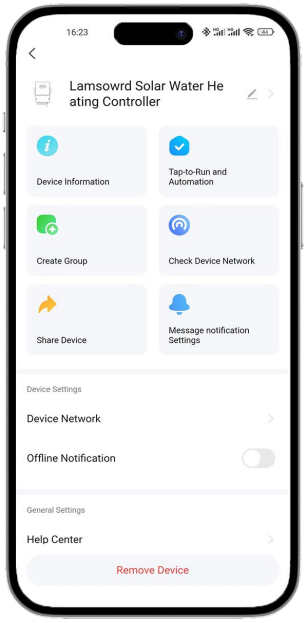
If the controller needs to be restored to factory settings, please click the Restore Factory Settings button and the machine data will be initialized.

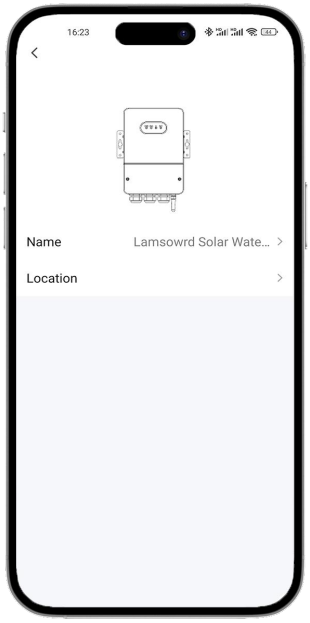
On the fault page, you can view the real-time fault information of the controller, understand the working status of the controller, and provide a reference for equipment maintenance.

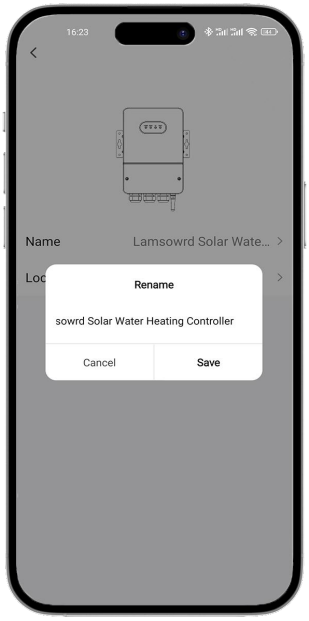


Modify Device Name

1. In the device list, click the device that needs to be modified to enter the device home page.
2. Click the button in the upper right corner of the homepage to enter the device settings page.
3. Then continue to click the button in the upper right corner to reach the name&location page, click the name item, enter the new name, and save it.

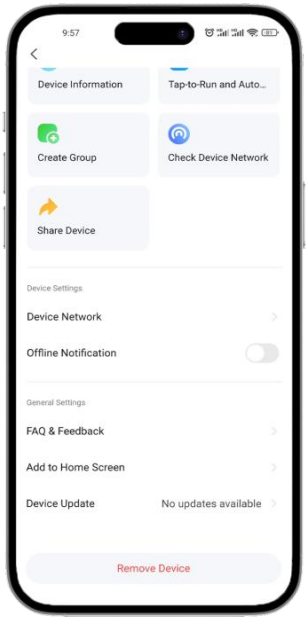


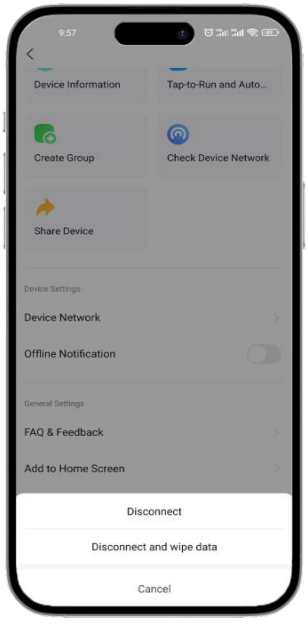




Remove Device

1. In the device list, click the device that needs to be deleted to enter the device home page.
2. Click the button in the upper right corner of the homepage to enter the device settings page
3. Click the "Remove Device" button below, click the "Remove" button to remove the device or click the "Remove and Clear Data" button to remove the device and clear all data saved by the device in the cloud.





Share Device with others

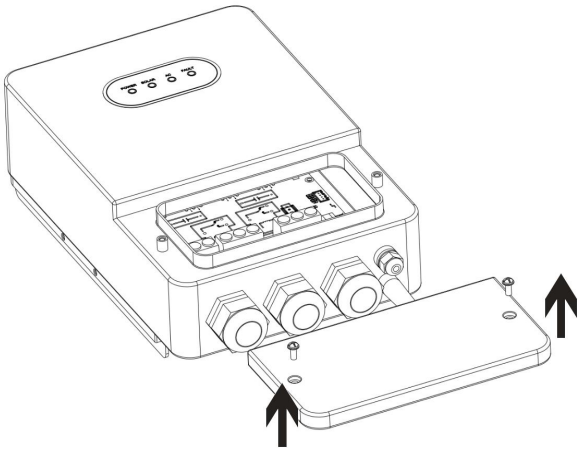
1. In the device list, click the device that needs to be shared to enter the device home page.
2. Click the button in the upper right corner of the homepage to enter the device settings page.
3. Click "Share Device" to enter the add sharing page, there are two sharing modes:
   a. Select "Share with Account" to share with other users who have registered smart life accounts.
   b. Select "Share with Ohters" to share the device link in the most convenient way for you.

WiFi RESET

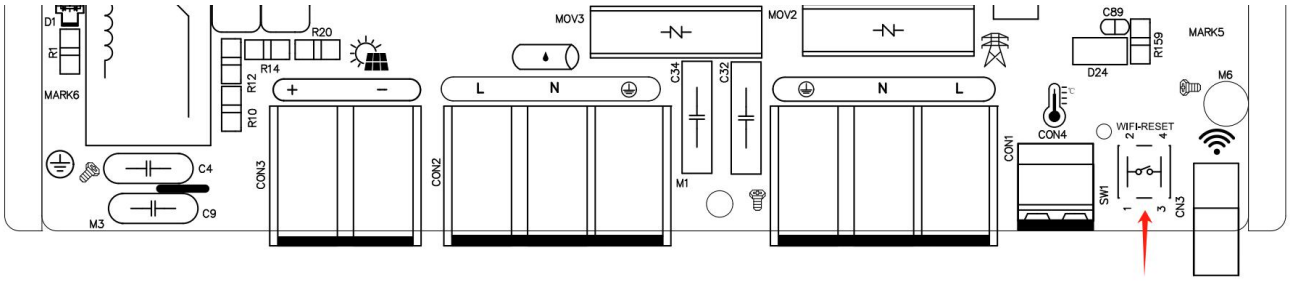
CAUTION: Before the WiFi reset, be sure to open AC/DC protector or disconnect first.

WARNING! All operations must be carried out by qualified personnel.

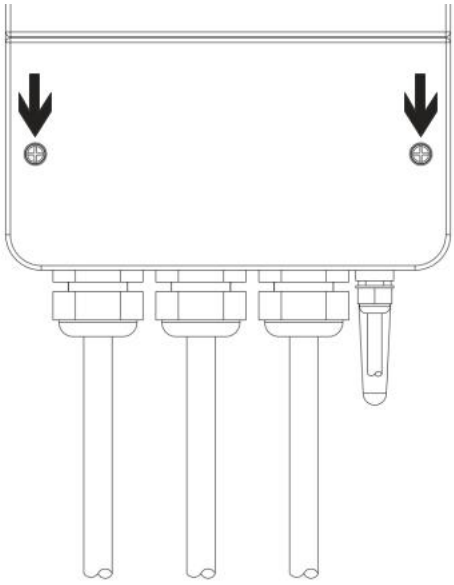
1. Before the WiFi reset, be sure to open AC/DC protector or disconnect first;
2. Please take off bottom cover by removing two screws as shown below;



3. Turn on the PV external switch or AC external switch to power on the controller;
4. Press and hold the switch indicated by the arrow below for 5~10 seconds with a non-metallic object;



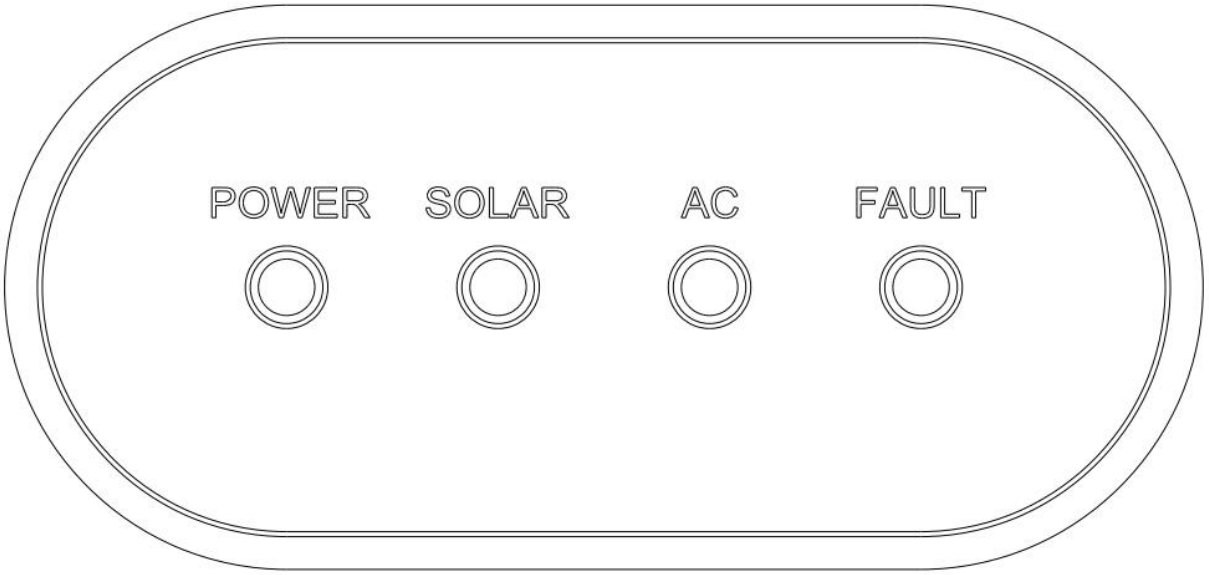
5. Please put bottom cover back by screwing two screws as shown below.



OPERATION

Operation and Display Panel

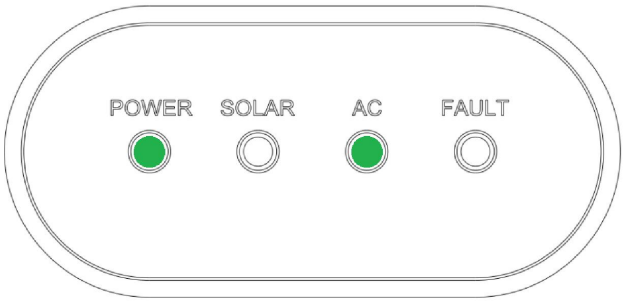
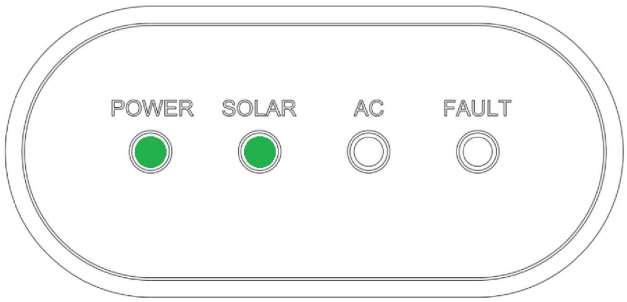
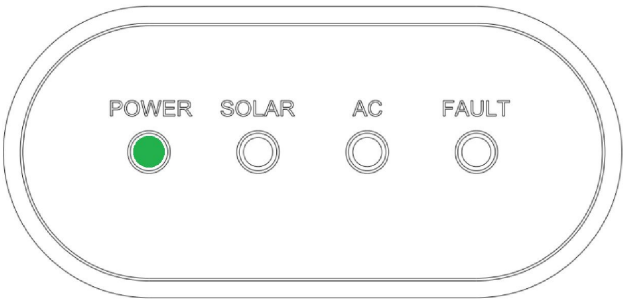
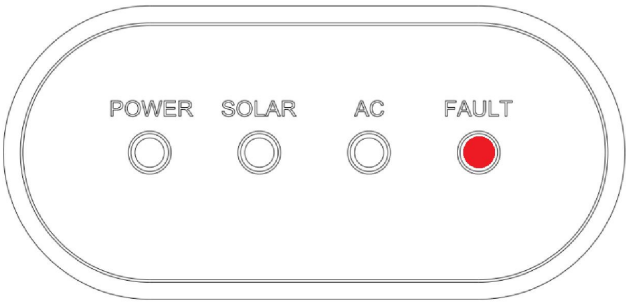
The operation and display panel, shown in below chart, is on the front panel of the controller. It includes four indicators, indicating the operating status.



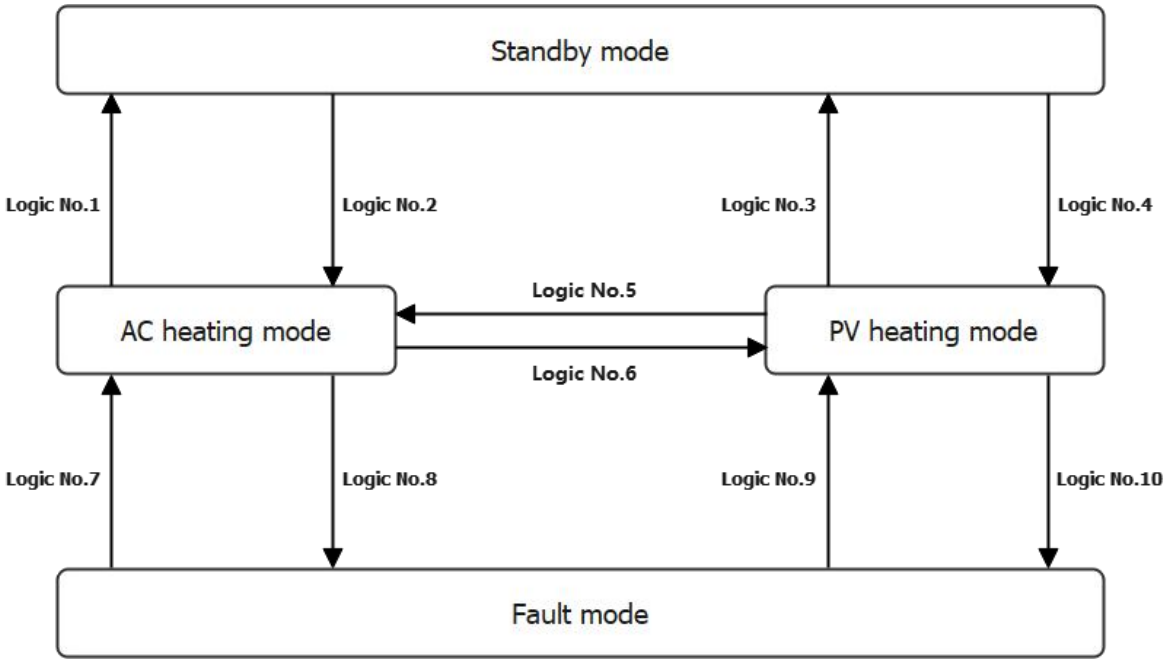
LED Indicators

LED Indicator				Messages
Status Indicator	POWER	Green	Solid On	No output power in Standby mode.
	SOLAR	Green	Solid On	Output is powered by PV in PV heating mode.
	AC	Green	Solid On	Output is powered by utility in AC heating mode.
	FAULT	Red	Solid On	Fault mode.

Operating Mode Description

Operating mode	Behaviors	LED display
AC heating mode	Output power from utility.	Utility provide power to load. 
PV heating mode	Output power from PV.	PV provides power to the load. 
Standby mode	No output.	
Fault mode **Note:** Fault mode: Errors are caused by inside circuit error or external reasons such as over temperature, output short circuited and so on.	No output.	

Logic Chart



Logic No.1 : AC input is unavailable or water temperature reaches AC heating setting.
Logic No.2 : AC input is available and solar is unavailable and water temperature less than AC heating setting -5℃.
Logic No.3 : Solar is unavailable or water temperature reaches PV heating setting.
Logic No.4 : Solar is available and water temperature less than PV heating setting -5℃.
Logic No.5 : AC input is available and turn on AC forced heating.
Logic No.6 : Solar is available and end of AC forced heating.
Logic No.7 : Fault situation is gone.
Logic No.8 : No matter in which mode, if the fault situation is occured, it should change to Fault mode.
Logic No.9 : Fault situation is gone.
Logic No.10 : No matter in which mode, if the fault situation is occured, it should change to Fault mode.

SPECIFICATIONS

MODEL	1K	2K	3K	4K	5K	6K
RATED OUPUT POWER	1000W	2000W	3000W	4000W	5000W	6000W
PV INPUT (DC)						
Max. PV Power	1050W	2100W	3150W	4200W	5260W	6320W
Max. PV Array Open Circuit Voltage	500V d.c.					
MPPT Range @ Operating Voltage	60 ~ 480V d.c.					
Max. PV Array input Current	40A d.c.	40A d.c.	40A d.c.	40A d.c.	40A d.c.	40A d.c.
Max. PV Array Short Circuit Current	40A d.c.	40A d.c.	40A d.c.	40A d.c.	40A d.c.	40A d.c.
Number of MPP Tracker	1					
PV controller						
AC OUTPUT						
Wave	Square wave					
Nominal Output Voltage	230V a.c.					
Frequency Range	50 Hz/60 Hz					
Nominal Output Current	4.3A a.c.	8.7A a.c.	13.0A a.c.	17.4A a.c.	21.7A a.c.	26A a.c.
Maximum Conversion Efficiency (DC/AC)	99%					
AC Bypass						
GRID INPUT						
Acceptable Input Voltage Range	90 - 280V a.c.					
Frequency Range	50 Hz/60 Hz					
Rating of AC fuse	40A a.c.					
GENERAL						
Dimension, D x W x H (mm)	308 x 188 x 100					
Net Weight (kgs)	3.4					
INTERFACE						
User Interface	LED					
External temperature sensor	Yes					
Communication	WIFI					
ENVIRONMENT						
Humidity	0 ~ 100% RH (No condensing)					
Operating Temperature	-30°C to 60°C					
Enclosure	IP 65					

Notice:

1. The MPPT water heating controller is only suitable for heating resistance heating components through solar power, and the controller load can only be used to connect resistance equipment or AC heaters.

2. Each mode has load-specific requirements, for example, the load should not be higher than 230V/6000W, and the resistance value isn’t less than 8.8 ohms.

TROUBLE SHOOTING

The fault codes and troubleshooting methods of the controller are detailed in the table below. The model you purchased may only contain some of the fault information. When the controller malfunctions, you can query the corresponding information by the fault codes on the mobile App or LCD.

Warning Code

Warning Code	Warning Event
50	Over load warning
51	Power limit warning
52	Fan lock warning
53	controller power derating
54	PV is weak
55	Water temperature high warning
56	controller over temperature warning

Faults Code

Fault Code	Fault Event
F01	Water temperature detection fail
F02	Water over temperature
F03	controller temperature detection fail
F04	controller over temperature
F05	Output short circuited
F06	Output voltage abnormal
F07	Output voltage is too low
F08	Bus voltage is too low
F09	Bus voltage is too high
F10	Bus soft start failed
F11	controller soft start failed
F12	controller negative power
F13	Main relay failed
F14	Over current controller
F15	Over load time out
F16	Line fail
F17	Self-test failed
F18	Eeprom fail
F19	Current sensor failed
F20	PV voltage high
F21	MPPT over current
F22	PV reverse connection

Problem	APP/LED/LCD	Explanation / Possible cause	What to do
No response after power on.	No indication.	PV polarity is connected reversed.	Check if PV and the wiring are connected well.
		DC input protector is tripped.	Check if DC breaker is tripped and DC wiring is connected well.
		AC input protector is tripped.	Check if AC breaker is tripped and AC wiring is connected well.
PV exist but the unit has been operating in AC heating mode.	The fault symbol is solid.	PV voltage below than 60V d.c. or is higher than 500V d.c.	Check PV module configuration.
	The grid symbol is solid.	It is possible that the water temperature sensor is abnormal and the detected temperature is always lower than the temperature value set for AC heating, which is why the AC keeps heating up.	Check the water temperature sensor wiring is connected well.
AC exist but the unit works in PV heating mode.	The fault symbol is solid.	AC voltage below than 90V d.c. or is higher than 280V d.c.	Check the AC input.
	The solar symbol is solid.	It is possible that the water temperature sensor is abnormal and the detected temperature is always lower than the temperature value set for PV heating, which is why the PV keeps heating up.	Check the water temperature sensor wiring is connected well.
Red LED is on.	Fault code 14	Overload error. The controller is overload 110% and time is up.	Reduce the connected load by switching off some equipment.
	Fault code 05	Output short circuited.	Check if wiring is connected well and remove abnormal load.
	Fault code 02	Water temperature is over 100°C.	Check if the external temperature sensor is abnormal.
	Fault code 04	Internal temperature of controller component is over 100°C.	Check for poor ventilation around the controller.
	Fault code 06/07	Output abnormal	Restart the unit, if the error happens again, please return to repair center.
	Fault code 01/03/10/11/13/17/18/19	Internal components failed.	Restart the unit, if the error happens again, please return to repair center.
	Fault code 12	Surge.	Restart the unit, if the error happens again, please return to repair center.
	Fault code 21	DC/DC over current or surge.	
	Fault code 14	Over current or surge.	
	Fault code 08	Bus voltage is too low.	
	Fault code 09	Bus voltage is too high.	
	Fault code 20	Solar input voltage is more than 500V d.c.	Check PV module configuration.

Notice:

1. Confirm whether the controller is installed firmly and whether the surrounding environment is clean enough.
2. Confirm that there is good ventilation around the controller, and clean the dust and debris on the surface of the controller.
3. Check whether the external power cord is damaged due to aging, rubbing, insects or small animals biting, Insulation skin, etc. If damaged, please replace it in time.
4. Check whether the external power cord is loose, and tighten the loose power cord further.
5. Check that the LED indications are consistent with the operation of the equipment. If you find any faults or wrong indications, please take immediate measures to correct them.
6. Check whether all grounding wires of the system are well grounded.

Warranty Service Regulations and Repair Process

Warranty Service Regulations

Within two years from the date of production, all non-human being performance failures of the controller occurred. Please contact your local dealer to provide warranty service. Non-warranty regulations The following situations (but not limited to the following situations) are not covered by the warranty service :

(1) Human being-made damage caused by accident, negligence, improper installation or improper use.
(2) Damage caused by solar cell voltage, power or load current exceeding the rated value.
(3) The controller is damaged due to the selection of over- specification heating rods.
(4) Modify or repair the product without authorization.
(5) Damage occurred during transportation.
(6) Damage caused by natural disasters such as lightning and extreme weather.
(7) Damage caused by irresistible factors such as fire and flood.

It is specially stated that the scope of use of the controller defined in the specification is unique, and any over-range application promise without the authorization of the manufacturer will not be recognized by the manufacturer. Without the authorization of the manufacturer, anyone has no right to make any modification or extension of the warranty. The manufacturer is not responsible for the economic losses caused by this.

Repair Process

Before applying for warranty, please read the product manual carefully again, especially the troubleshooting part. Please contact the local authorized dealer or agent, the local dealer can often solve the warranty problem quickly.

Please provide the following information:

(1) The name of the business or company at the original invoice.
(2) Full model and serial number (SN is the 16-digit number on the product label).
(3) Failure behavior, including LED screen display content.
(4) Software version, equipment installation time, fault occurrence time, fault frequency.
(5) The maximum power, open circuit voltage, maximum power point voltage, short-circuit current and AC heating rod power and resistance value of the solar panel, and DC heating rod power and resistance value.
(6) Equipment installation environment, such as: weather conditions, whether the components are covered, shadowed, etc. It is recommended to provide photos, videos and other related documents to help analyze the problem in the installation environment.

After the warranty is approved, please mail the controller to the designated repair point and provide the shipping documents to your dealer. Please keep in touch with the dealer. After the controller is repaired, it will be returned to the original address on the shipping receipt provided by you.

Notice:

Tearing or altering product labels, seals, and machine serial numbers will cause the controller to be out of warrant.