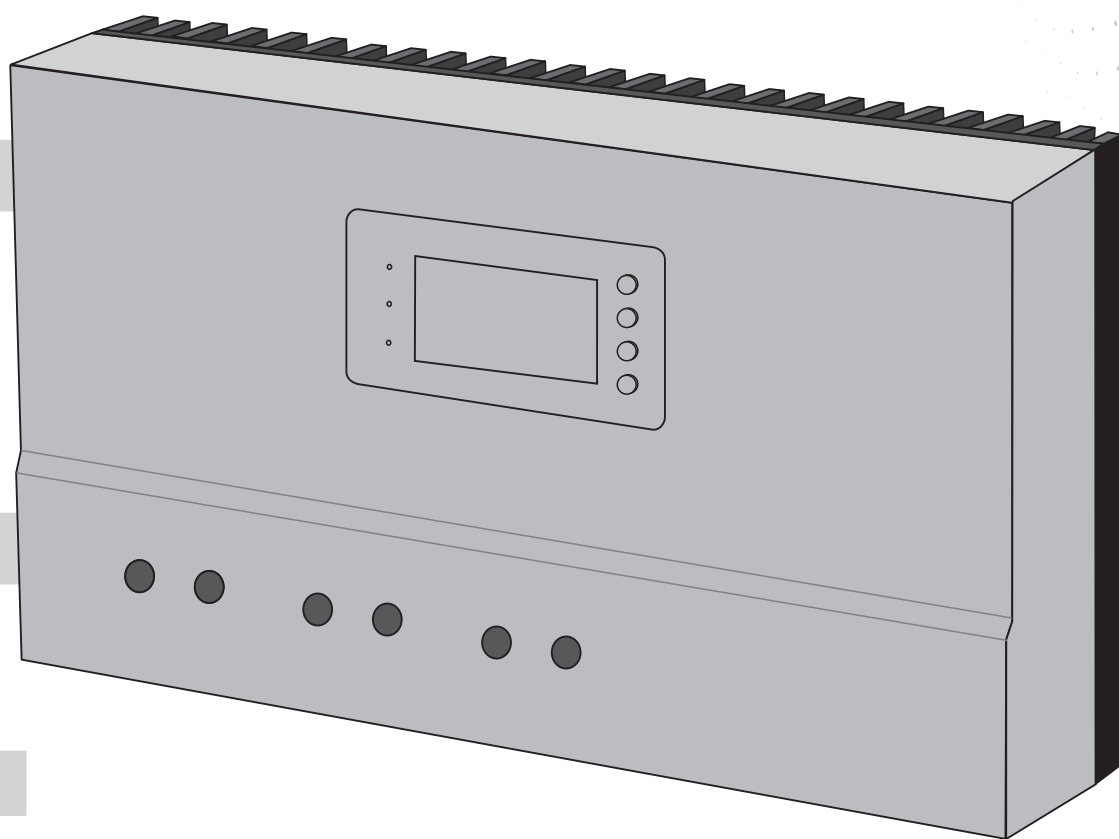


USER MANUAL



Intelligent photovoltaic MPPT controller

- Please read this user manual carefully before use and keep it properly.
- Please refer to the actual product, the picture is for reference only.

content

1.0 Important safety instructions

1.1 Express one's thanks.....	1
1.2 Notice to Operation.....	1
1.3 Safety warning note	1

2.0 Product introduction

2.1 Product overview	2
2.2 Product characteristics	2
2.3 Product list.....	2
2.4 Product size	2
2.5 Structure specification	3
2.6 RS485 pin definition.....	3
2.7 Specification parameter	4

3.0 Install

3.1 Precautions before installation.....	5
3.2 Installation procedure	6
3.3 Power Failure.....	8

4.0 Settings and Operations

4.1 Series rules of photovoltaic modules	9
4.2 PV module input total power.....	10
4.3 Battery system voltage and its type	10
4.4 DC load output voltage system and maximum current.....	11
4.5 Status Indicator	11
4.6 Menu introduction	11

5.0 Common Faults and Troubleshooting

5.1 Common Faults	12
-------------------------	----

6.0 Product protection function and system maintenance

6.1 Protection Function Description.....	13
6.2 System Maintenance	13

1.0 Important safety instructions

1.1 Express one's thanks

Thank you for buying our products and for your trust and support.

In this product manual, we are committed to providing you with accurate and clear usage guidelines and relevant information to help you better understand and use our products.

1.2 Notice to Operation

Before using this product, please read this manual thoroughly to understand the correct and safe operation methods. By using this product, you agree to and fully read and understand all contents of this manual. Do not use this product before carefully reading the instructions and understanding the performance of this product; We are not responsible for any financial loss or personal injury arising from operations that do not comply with the provisions of this Manual. In order to continuously optimize our products, we reserve the right to adjust the content of the manual. It also retains all relevant intellectual and industrial property rights, including Copyrights, patents, trademarks and designs. This manual will be updated from time to time without prior notice. If you find any conflict between your product and this manual, or have any questions about the product or this manual, please contact us for consultation and modification. We reserve the right of final interpretation of this manual.

1.3 Safety warning note

We take safety very seriously and recommend that anyone who is in close contact with our products, such as installing, operating, maintaining or servicing this product, use caution, follow common sense, and follow the safety information on this manual and machine installation stickers to ensure the safety of people and products and reduce safety risks.

The following information is displayed on the instructions or product labels: A hazard or warning label indicates a potentially hazardous or hazardous situation which, if not avoided, will result in death or serious injury. Extra care and attention should be paid to the safety of you or the product.

	Reminder: indicates suggestions and prompts to the operator.
	Note: Indicates that this operation is destructive.
	Warning: indicates that this operation is dangerous. Make safety preparations before performing this operation.

2.0 Product introduction

2.1 Product overview

This product can detect the power generation of solar panels in real time, and track the maximum voltage current value (VI), so that the system can charge the battery at the maximum power output. It is used in off-grid photovoltaic system to coordinate the work of solar panels, batteries and loads, and is the core control component of off-grid photovoltaic system.

The controller has a comprehensive electronic fault self-test function and powerful electronic protection function, which can avoid the damage of product components due to installation errors and system failures to the greatest extent.

2.2 Product characteristics

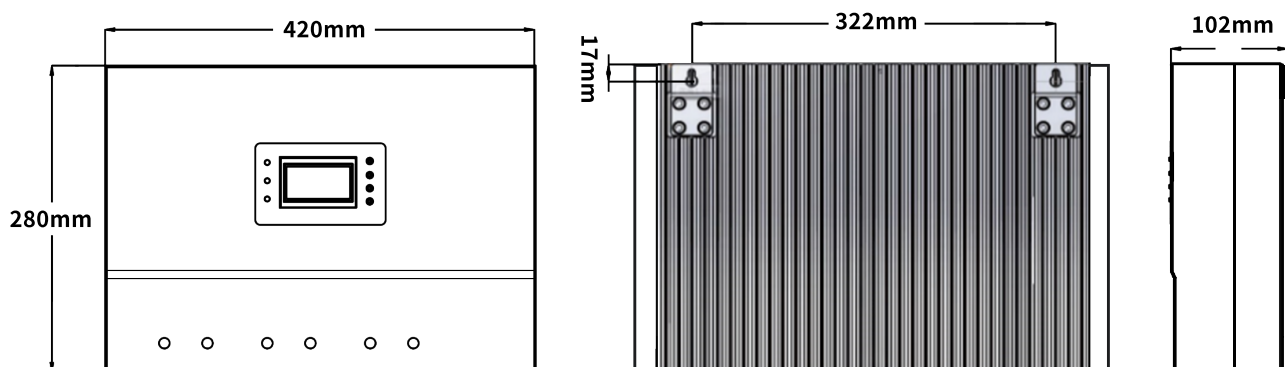
- ◆ MPPT efficiency $\geq 99.5\%$, the average conversion efficiency of the machine 98%
- ◆ Hd LCD HD backlight display
- ◆ Automatic voltage identification of battery system
- ◆ Can customize a variety of batteries (including lithium batteries) charging
- ◆ Supports remote monitoring by host computer and APP
- ◆ Dual RS485 communication, unified integrated management and secondary development
- ◆ Both natural cooling and air cooling can be customized
- ◆ Support multiple parallel communication, unified integrated monitoring
- ◆ A variety of protection functions, over voltage and over current, reverse protection, charging protection and so on

2.3 Product list

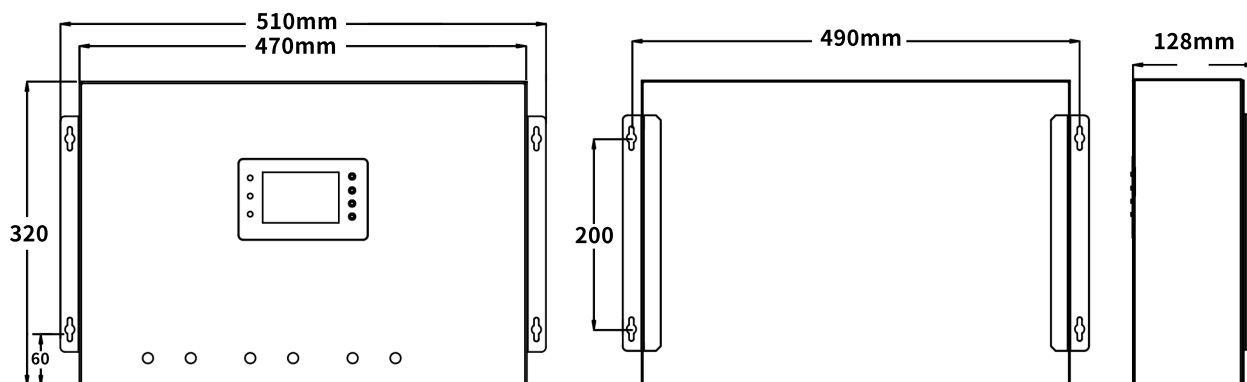
1	Controller *1	4	Accessory package (plastic expansion particles, screws) *1
2	Temperature sensing line *1	5	Instructions *1
3	RS485-USB Communication Cable (optional)		

2.4 Product size

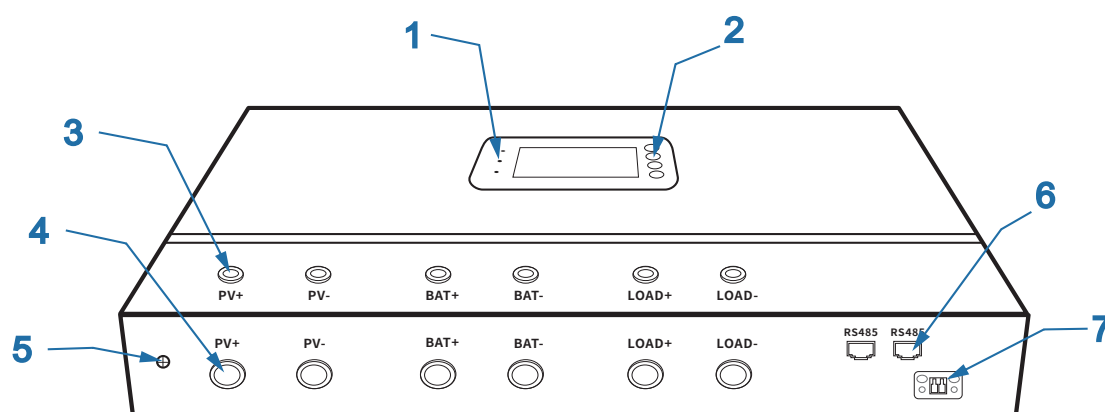
Naturally cooled type



Fan type



2.5 Structure specification

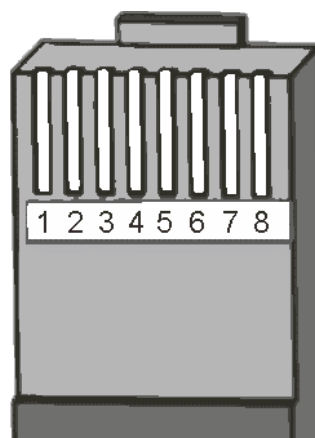


1	Status light	5	Ground wire
2	Operating key	6	RS485 communication cable port
3	Bolt hole for cable connection	7	Temperature sensing wire interface
4	Cable access hole		

2.6 RS485 pin definition

The communication port of the controller can match our RS485-USB communication line to achieve PC monitoring software communication, and can also match our WIFI module products to achieve remote APP cloud monitoring.

S/N	Feature
1	RS485-A
2	RS485-B
3	—
4	—
5	GND
6	GND
7	+5V
8	+5V



Reminder: When users work with multiple parallel devices, the communication port is occupied, and the PC side monitoring and WIFI APP remote monitoring cannot be performed at this time (if used, PC monitoring software and APP may obtain garbled data).

2.7 Specification parameter

Product item		M48L80	M48L100	M48L120	M48H80	M48H100	M48H120	M96H50
MPPT efficiency		≥ 99.5%						
Standby power consumption		4W~5W						
Heat-Dissipating method		Natural cooling		Natural cooling+Air cooling	Natural cooling	Natural cooling+Air cooling		Natural cooling
System voltage		12V/24V/36V/48V Auto			48V			96V
Max.PV input voltage(Voc)*		150Vdc			300Vdc			
Start-up charging voltage		Real-time battery voltage +3V			Real-time battery voltage +10V			
Low input voltage protection		Real-time battery voltage +2V			Real-time battery voltage +5V			
Over voltage protection / Recovery		150Vdc			300Vdc			
Reted PV Power**	12V	1040W	1300W	1560W	——	——	——	——
	24V	2080W	2600W	3120W	——	——	——	——
	36V	3120W	3900W	4680W	——	——	——	——
	48V	4160W	5200W	6240W	4160W	5200W	6240W	——
	96V	——	——	——	——	——	——	5200W
Rated charge current		80A	100A	120A	80A	100A	120A	50A
Temperature compensation		-3mV/°C /2V						
Charge method		3 stages: CC (Constant current) - CV (Constant voltage) - CF (Floating charge)						
Output voltage stability accuracy		≤ ±0.2V						
Load voltage		Same as battery voltage						
Rated load current		80A	100A	120A	80A	100A	120A	50A
Load control mode		On/Off , PV voltage control mode, Dual-time control mode, PV + Time control mode						
Low voltage protection		10.5V (default), 11V (restored), settable(9V-15V)						
Setting method		PC software / APP / Controller						
Display		HD LCD backlight display						
Communication		"Dual RJ45 port / RS485 / support PC software monitoring / support WiFi module for APP cloud monitoring / support centralized parallel monitoring"						
Protections		"Input & output over-volt / low-voltage protection, reverse polarity protection, over-heating protection, battery shedding protection etc."						
Operating ambient temperature		-20℃ ~+50℃						
Storage temperature		-40℃ ~+70℃						
IP(Ingress protection)		IP31						
Altitude		0~3000m						
Max. Witing size		50m m²						
N.weight /G.weight		7.4 / 9 (KG)		12/13 (KG)	7.4 / 9 (KG)	12/13 (KG)		7.4 / 9 (KG)
Product size /Packing size (mm)		420x280x110 / 510x368x225		470X320X128 / 610x450x265	420x280x110 / 510x368x225	470X320X128 / 610x450x265		420x280x110 / 510x368x225

*The voltage of the PV array cannot exceed this limit.

**These power limits refer to the maximum power that the MPPT controller can handle. High power arrays can be used without damaging the controller.

2.7 Specifications of cables and circuit breakers/air switches

Since PV array output can vary due to the PV module size, connection method or sunlight angle, the minimum wire can be calculated by the I_{sc} of PV array. Please refer to the value of I_{sc} in PV module specification. (When the PV modules connect in series, the I_{sc} is equal to the PV module's I_{sc}. When the PV modules connect in parallels, the I_{sc} is equal to the sum of PV module's I_{sc}.) And in order to facilitate the opening and closing of the machine and safety, it is recommended to install the circuit breaker. Please refer to the specification selection of the next table wire and circuit breaker.

Model	Rated charge current	Rated discharge current	Battery wire (mm ² /AWG)	Load wire (mm ² /AWG)	Breaker
50A	50A	50A	10/7	10/7	>100A
60A	60A	60A	16/6	16/6	>100A
70A	70A	70A	20/5	20/5	>125A
80A	80A	80A	26/3	26/3	>125A
100A	100A	100A	34/2	34/2	>150A

3.0 Install

3.1 Precautions before installation

➤ Installation position

- ◆ Install the controller indoors, and ensure that the installation location is dry, ventilated, and convenient for disassembly and maintenance.
- ◆ Do not install on flammable building materials; Do not install on highly flammable materials; Do not install in hazardous areas where there is a risk of explosion.
- ◆ Do not expose the equipment to harsh environments such as damp, flammable and explosive, or large accumulation of dust.
- ◆ Never install the controller in a case with an open/liquid-rich battery.
- ◆ The temperature of the controller may exceed 40 ° C during operation. Please install the controller in a position that is not accessible to non-professionals.
- ◆ Do not install in direct sunlight, direct sunlight causes the body temperature rise, affecting the product's own heat dissipation effect, resulting in product damage.

➤ Safety information

- ◆ Wear insulation tools for installation.
- ◆ Disconnect all power to the controller before installing or adjusting it.
- ◆ It is recommended that more than two people cooperate with the operation and installation. If an accident occurs, ask the nearby people to help.
- ◆ The controller must be installed by qualified technicians or personnel trained in safety installation in accordance with the electrical regulations of the country where it is located.

➤ Proper use

- ◆ This controller is only used for solar power generation. Connecting to any other type of power source (such as a wind turbine or generator) may void the warranty.
- ◆ There are no user repairable parts in the controller, do not disassemble or attempt to repair the controller.

- ◆ This controller is only used for solar power generation. Connecting to any other type of power source (such as a wind turbine or generator) may void the warranty.
- ◆ There are no user repairable parts in the controller, do not disassemble or attempt to repair the controller.
- ◆ When maintaining the product, disconnect the internal circuit breaker of the product before performing related operations.
- ◆ If the indicator light is not on for the first time, cut the fuse or circuit breaker immediately and check whether the line is connected correctly.
- ◆ When the controller is in the normal charging state, do not disconnect the battery; otherwise, the DC load may be damaged.
- ◆ When the controller is running and charging, do not let the battery fall off (including manually shutting off the battery circuit breaker or shutting down the battery circuit breaker due to too small specifications or overheating). (It is recommended to use a circuit breaker with a power higher than 1.3 to 1.5 times the rated current.)
- ◆ It is recommended that you connect an insurance or circuit breaker to the input end, load end, and battery end to prevent the risk of electrical spark and electric shock during cable connection, and prevent the difficulty of disconnecting the system circuit when a fault occurs.
- ◆ The operating voltage of the controller is high. When installing the system, ensure that the chassis is properly grounded (grounding screws are installed at the bottom of the chassis) to prevent electric shocks and other abnormal conditions.

3.2 Installation procedure

➤ Step 1: Unpack and check

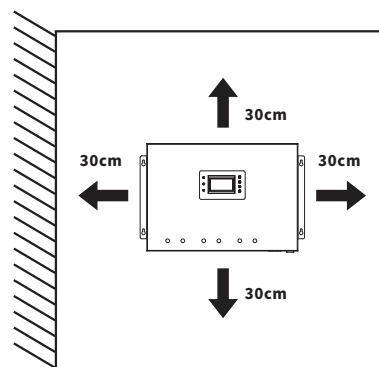
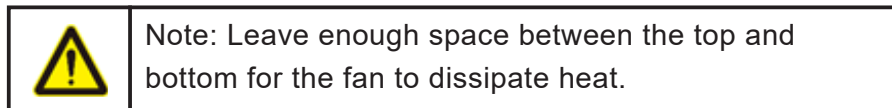
Check the controller for transport damage; Check whether the specifications are consistent with the order.

➤ Step 2: Check the controller parameter limits

Ensure that the solar array open circuit voltage (Voc) under maximum temperature compensation does not exceed the rated voltage value of the controller model. Multiple controllers can be mounted in parallel on the same battery pack for greater charging current. Each controller in parallel must be connected to an independent solar panel.

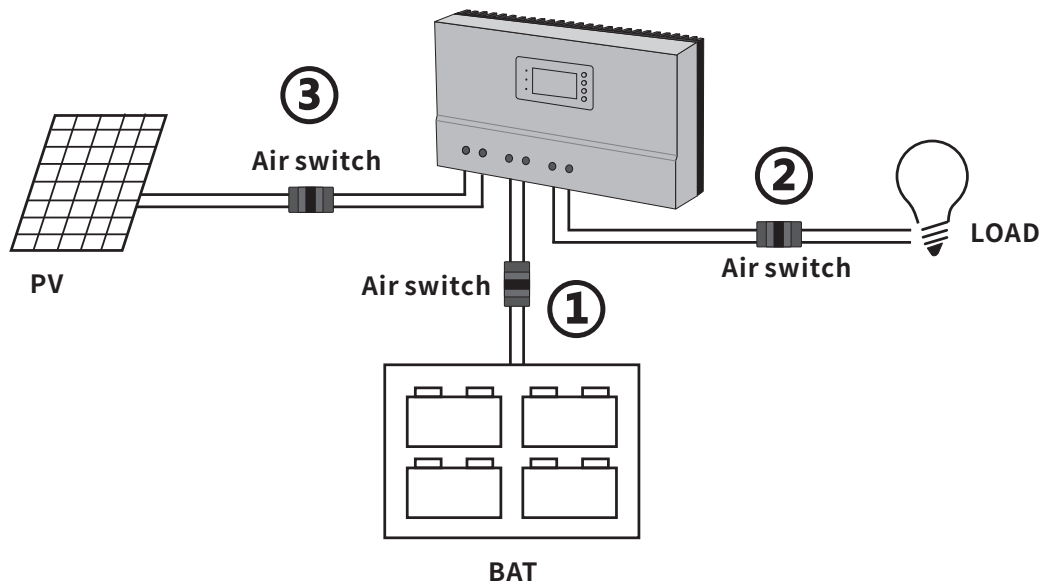
➤ Step 3: Determine the installation space

To ensure space for air circulation, leave at least 30 cm (11.8 in) of space above and below the controller, and do not install it in a closed box. As shown at right



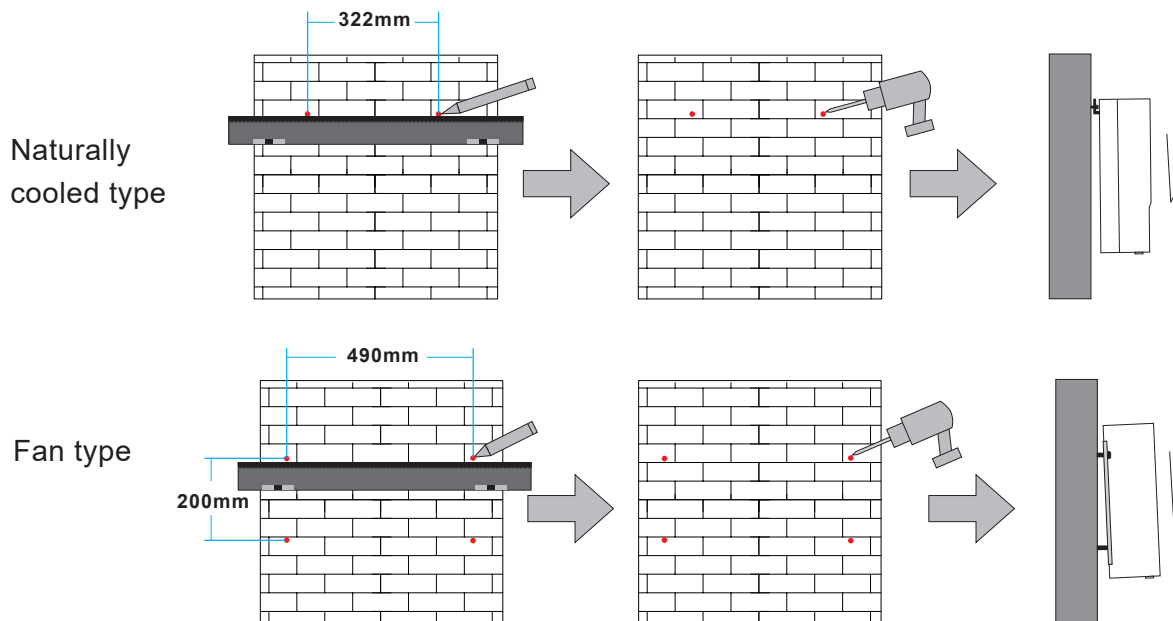
➤ Step 4: Wiring sequence

Connect the cables with circuit breakers to the positive and negative extremes on the controller in sequence. Ensure that the circuit breaker is off before connecting the cables. (As shown below)



➤ Step 6: Secure the controller

According to the specifications and dimensions, use a level to mark the nail holes at the installation position with a marker. Use a drilling tool to drill holes with a diameter of 6mm and a depth of about 6cm on the mark. Fill the accessory bag with plastic expansion particles, insert the plastic expansion particles with self-tapping screws to expose a certain distance, and then align the mounting ears of the controller with the screws to secure the installation.



➤ Step 7: Power on step

Before powering on the controller, check whether the positive and negative poles of the PV input and BAT battery output are correct and whether the connection is secure. Otherwise, the controller may work abnormally or be damaged by misconnection.

- 1, first close the circuit breaker connected to the battery ①, ensure that the controller is connected to the battery (the controller LCD will display the content), then you can set the output work related Settings;
- 2, if you need DC output control load, then first set the output control mode, and then open the DC output circuit breaker ②;
- 3, open the solar panel PV input circuit breaker ③, if the PV input voltage in the controller charging working range, then the controller will enter the charging state;

	Reminder: ① After the circuit breaker is closed, if the controller does not run, it may be that the battery has no power; After closing the circuit breaker ③ , it will be powered on normally by the input of the solar panel.
	Reminder: This controller prevents nighttime reverse current leakage, so serial diodes are not required in the system.
	Note: The photovoltaic input should not be incorrectly connected to the output power line of the controller when wiring, otherwise the internal circuit of the controller may be damaged and the warranty will be invalid.
	Note: Installation must comply with electrical code requirements. Select the appropriate circuit breaker and fuse specifications according to the application requirements.
	Warning: Ensure that the connection is secure and secure with cable clips to prevent the cable from shaking and overheating, which may cause danger.
	Warning: Risk of electric shock. Before contact, test the impedance between all terminals and ground. If the system needs to connect an inverter, connect the inverter directly to the battery, do not connect the inverter to the controller load terminal.
	Warning: The negative power terminals of the controller are interconnected (common negative). If necessary, ground according to instructions, local codes and regulations.

3.3 Power Failure

Disconnect the circuit breakers ③ , ② and ① in sequence, and only after the controller is powered off can the controller be maintained.

	Warning: 1. If an inverter needs to be connected to the system, connect the inverter directly to the battery, rather than the controller load. 2. When the controller is in the normal charging state, do not disconnect the battery connection; otherwise, the DC load may be damaged. Therefore, the damage to the controller is not covered by the warranty.
---	---

4.0 Settings and Operations

4.1 Series rules of photovoltaic modules

Since the types of photovoltaic modules on the market are different, it is particularly important that the controller, as the core component in the photovoltaic system, can be suitable for various types of photovoltaic modules and can maximize the conversion of solar energy into electricity. Therefore, according to the open circuit voltage of the MPPT controller (VOC) and maximum power point voltage (VMPP) can be used to calculate the number of photovoltaic modules in series suitable for different types. The following is a table of the quantity of photovoltaic modules in series, for reference only.

PV_{input} <DC150V Prohibit the total input voltage greater than 150V								
System Voltage	36cell Voc<23V		48cell Voc<31V		54cell Voc<34V		60cell Voc<38V	
	Max.	Best	Max.	Best	Max.	Best	Max.	Best
12V	6	2~3	4	2	4	2	3	1
24V	6	3	4	2	4	2	3	2
36V	6	4	4	3	4	3	3	2~3
48V	6	5	4	4	4	4	3	3
System Voltage	72cell Voc<46V		96cell Voc<62V		Thin-Fim Module 80V<Voc<150V			
	Max.	Best	Max.	Best	Max.		Best	
12V	3	1	2	1	1		1	
24V	3	2	2	1	1		1	
36V	3	2	2	1	1		1	
48V	3	3	2	2	1		1	

PV_{input} <DC300V Prohibit the total input voltage greater than 300V								
System Voltage	36cell Voc<23V		48cell Voc<31V		54cell Voc<34V		60cell Voc<38V	
	Max.	Best	Max.	Best	Max.	Best	Max.	Best
48V	13	5~8	9	4~6	8	4~6	7	3~5
96V	13	10~12	9	7~8	8	6~8	7	6~7
System Voltage	72cell Voc<46V		96cell Voc<62V		Thin-Fim Module 80V<Voc<100V			
	Max.	Best	Max.	Best	Max.		Best	
48V	6	3~4	4	2~3	3		2	
96V	6	5~6	4	4	3		3	



Note: The above parameter values are calculated under standard test conditions (STC: standard test condition 25°C , air quality AM1.5, 1000W/square meter).

4.2 PV module input total power

This series of MPPT controllers has a charging current limit function, that is, the controller can limit the charging current within the rated charging current range of the controller, and the controller can obtain a maximum power that is not greater than the rated charging current of the controller, so even if the PV side of the controller If the input power exceeds the rated charging power of the controller, the controller will charge the battery according to the rated charging current of the controller. For example, if the rated power is 60A controller for 96V system, no matter how big the input solar panel is, the charging current will not exceed 60A.

The actual operating power of the PV array meets the following conditions:

- 1) When the actual power of the photovoltaic array is less than or equal to the rated charging power of the controller, the maximum charging power of the controller is the actual power of the photovoltaic array.
- 2) When the actual power of the photovoltaic array > the rated charging power of the controller, the controller works according to the power of the rated charging current. If the power of the photovoltaic array is greater than the rated charging power of the controller, the charging time at the rated charging current will be prolonged, so more energy can be obtained to charge the battery. At the same time, when the sun is strong, the current limiting effect will also cause the solar panel waste;



Note: Please refer to the specification table for the rated power of different types of products!

4.3 Battery system voltage and its type

- 1) The default of lead-acid battery is to automatically identify whether the current battery voltage is normal (Auto), and the user can also directly set the system voltage of the battery. Features of automatic identification: it can detect whether the battery voltage is within the normal range (12V single-cell battery range is between 9~15V), if it cannot be recognized normally, it will not be charged; the characteristics of the specified battery system voltage: regardless of the current battery voltage is how much will work at the specified system voltage.
- 2) The lithium-ion battery mode will default to a set of working parameters for commonly used lithium iron phosphate batteries. It is recommended that users reset the parameters according to their own lithium battery type and battery pack string number to avoid damage to expensive charging parameters due to wrong charging parameters. Battery.
- 3) The controller has set 3 kinds of conventional battery parameters in the following table for lead-acid batteries. If you need to charge other special batteries, please select the "User" type and then set it through the APP or host computer software; (voltage parameters are all 12V system parameters at 25°C, 96V system parameters*8, 192V system parameters*16, 216V system*18, 240V system*20)

Battery Type	Constant Voltage	Floating Voltage
Flooded	14.6V	13.8V
Sealed	14.4V	13.8V
Gel	14.2V	13.8V
User (setting)	C(9V~15V)	F(9V~15V)

4.4 DC load output voltage system and maximum current

The controller has the DC LOAD output function, and its output voltage range is the same as the working voltage of the battery. If the voltage of the battery is 100.8V, the current DC output voltage is 100.8V.

4.5 Status Indicator

Indicator/button	Instructions
ALARM (red)	Charging conditions do not meet, controller standby (refer to the fault code to troubleshoot problems)
CHANGE(blue)	The controller is in charge working state
LOAD(green)	DC Load running status
UP	Page up or add value
DOWN	Scroll down or reduce the value
ENTER	Confirm/enter
ESC	Exit/Data save

Charge indicator light instruction

This controller have 3 mode :

Constant charging stage (CC Mode) ,Constant voltage charging stage (CV Mode) , Floating charge Stage (CF Mode) :

In CC Mode, the blue light will flash for every second.

In CV Mode, the blue light will flash for every 3 second.

In CF Mode, the light will keep on.

4.6 Menu introduction

Main menu	Display contents	introduction
Work Status	Fault	Normal work will display No Fault. Off normal work will display related Fault: BatOVP: battery overcharge protection PVOVP: PV input over voltage protection ChgOCP: over Charge current protection LoadOCP: load output over current protection BatOTP: battery over temperature protection CHGOTP: MPPT internal over temperature protection PVUVP mean: PV input low voltage protection
Work Status	Charging mode:	CC or CV or CF
	PV Volt	PV input voltage
	Bat Temp	After accessing the battery temperature line, the real-time temperature of the battery pack will be displayed.
	HS Temp	Temperature of heat sink
	Load Current	DC load output current
	Charge Current	Charging current
	Charge Power	Charging power
	Charge Volt	Charging voltage

Main menu	Display contents		introduction
Setting	Load Set	Load:	DC Load control mode: 1.ON/OFF mode 2.Light Ctrl mode 3.FT1-LigCtr-X :Fix-time control mode: Load:FT1-LigCtr-X Shut down after X hours in the dark Ctr2:FT2-LigCt-X Turn on X hours before daylight 4.D-Time Ctrl Dual period control mode
	Time&Date Set	Time	Time Set
		Date	Date Set
	Bat Type Setting	Type:	Selection of battery type (GEL,SEL,FLD,USER)
		Num:	Machine category selection (0 represents common, 1 represents host).
		Bulk Volt:	Bulk Volt Set
		Float Volt:	Float Volt Set
		MaxChgCurr:	Set the Max. charge current
Information	96V 60A		Controller model
	96V BAT CHG SYS		System voltage
	Load:		DC output control mode after user set
	TOTAL:		Total energy from this machine
	Firmware :		Firmware Ver.
	Bat :		Battery Type display

5.0 Common Faults and Troubleshooting

5.1 Common Faults

Unable to charge fault solution:

Check whether the solar panels are in good contact and whether the array is blocked or damaged;
Check whether the input voltage of the controller is normal, and ensure that the controller is connected correctly;
Check the battery status and replace it if necessary.

Show troubleshooting:

Restart the controller and check whether it is normal.

If the display is damaged, contact the manufacturer for replacement or repair;

If the internal circuit of the controller is damaged, contact the manufacturer for replacement or maintenance.

Communication failure resolution:

Check whether the data cable is damaged, and contact the manufacturer for replacement or maintenance;

Ensure that the communication interface is properly connected and not loose or damaged;

Check communication protocol Settings to ensure they match other devices.



Warning: There are no user repairable parts in the controller, do not disassemble or attempt to repair the controller yourself.



Warning: Inputs and outputs are not electrically isolated and may be energized using dangerous solar voltages. Under certain fault conditions, the battery may be overcharged. Before contact, take protective insulation measures.

6.0 Product protection function and system maintenance

6.1 Protection Function Description

➤ **Waterproof and dustproof protection: IP31**

Waterproof grade: 3, dust grade: 1

➤ **Battery reverse protection**

After the positive and negative terminals of the battery are reversed, the system does not work and will not burn out the controller.

➤ **Photovoltaic input short circuit protection**

When the input end of the photovoltaic array is short circuited, the controller disconnects the charging. When the short circuit is cleared, the charging will automatically resume.

➤ **Photovoltaic input reverse protection**

When the photovoltaic array polarity is reversed, the controller will not be damaged, and will continue to work normally after correcting the wiring error.

➤ **Internal overtemperature protection**

When the internal temperature of the controller reaches the specified threshold, the power is automatically reduced.

➤ **Radiator temperature limit**

When the heat sink temperature exceeds the maximum threshold, the controller automatically power off and stops running.

➤ **Battery drop protection**

When the battery is in the overcharge state, the charging circuit will automatically fall off and disconnect, preventing overcharge and extending the battery life.



Note: There is no GFDI (Ground fault detection device) inside the controller.

6.2 System Maintenance

- ◆ In order to maintain the best performance, it is recommended to inspect the project more than twice a year.
- ◆ Ensure that the air flow around the controller is not blocked, and clear dust and blockage from the ventilation holes of the chassis.
- ◆ Check all exposed wires for insulation damage caused by sun exposure, friction with other objects around, dry rot, insects or rodents. Wires need to be repaired or replaced as necessary.
- ◆ Verify that the indicator is consistent with the device operation. Please note any faults or errors displayed and take corrective action if necessary.
- ◆ Check all terminals for signs of corrosion, insulation damage, high temperature, or burning/discoloration, and tighten the terminal screws.
- ◆ Check for dirt, nesting insects and corrosion and clean as required.



Warning: Electric shock danger! When performing the above operations, ensure that all power supplies of the controller are disconnected, and then perform the corresponding check or operation!

