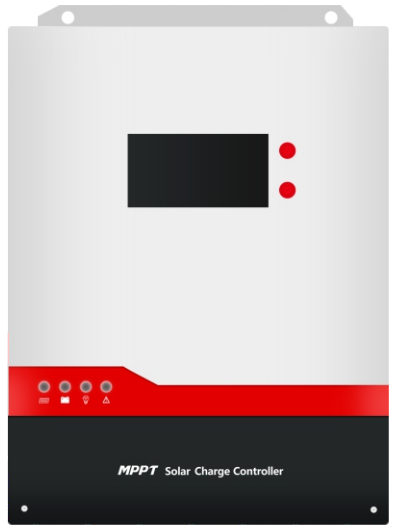
Mode : 104714

MPPT Solar Charge and Discharge Controller

User Manual



Dear User:

Thank you very much for choosing our product!

Safety Instructions

1) The applicable voltage of the controller exceeds the human safety voltage. Please read the user manual in detail and complete the training for safe operation before operation.

2) No parts inside the controller need to be maintained or repaired. The user should not disassemble and repair the controller by themselves.

3) Please install the controller indoors and prevent water from entering the controller.

4) Please install the controller in a well ventilated area, as the temperature of the heat sink will be very high during operation.

5) It is recommended to install a suitable fuse or circuit breaker on the exterior of the controller

6) Be sure to disconnect the solar panel battery and the fuse or circuit breaker near the battery terminal before installing and adjusting the wiring of the controller.

7) After installation, check that all wiring connections are tight to avoid the risk of heat build-up due to poor contact.

WARNING: Indicates that this operation is dangerous and that safety precautions must be taken prior to the operation.

Caution: Indicates that this operation is destructive.

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1. Product Introduction

1.1 Overview

The controller employs the industry-leading PowerCatcher maximum power point tracking technique to track the maximum energy of the solar panel. The MPPT technique enables the controller to quickly and accurately track the maximum power point of the solar panel in any environment and obtain the maximum energy of the solar panel in real time. This can significantly improve the energy utilization of the solar system. It is widely used in off-grid PV systems to manage the work of solar panels and batteries, and serves as the core control component of off-grid PV systems. The controller comes with complete electronic fault detection and protection functions, which can minimize the damage of product components due to installation errors and system failures.

1.2 Features

- With the PowerCatcher MPPT technique.
- It enables full power charging and discharging.
- Parallel charging is supported.
- Active output voltage stabilization ensures good lithium battery activation.
- Temperature compensation is available.
- Several battery types can be preset.
- LCD is equipped for real-time data interaction.
- Complete protections are provided, including over-voltage, over-current, overload, over-temperature, short-circuit and reverse polarity protections.
- Natural heat dissipation and heat dissipation by fan are optional.
- It supports Modbus protocol.

1.3 Appearance and Interfaces

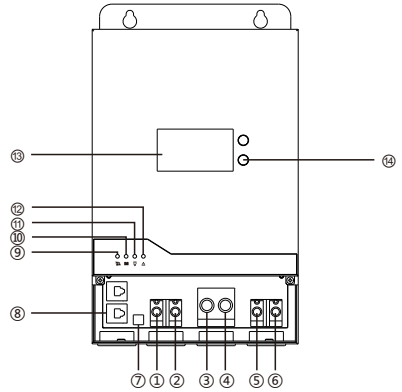
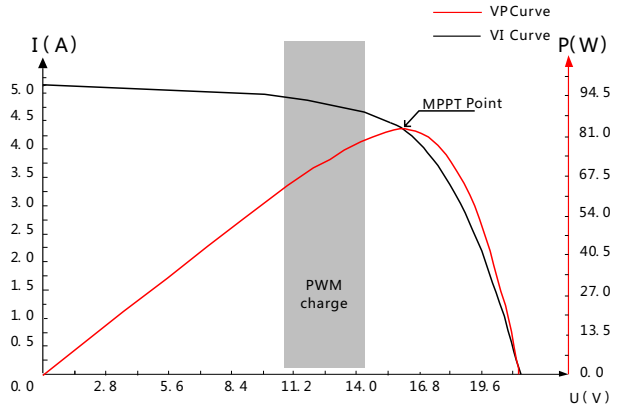


Figure 1-1 Controller Appearance and Interfaces

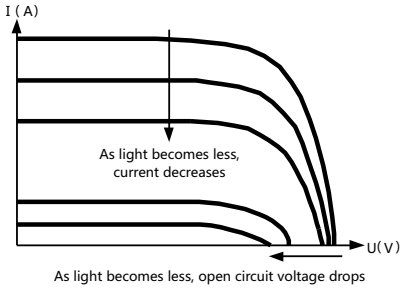
No.	Name	No.	Name
①	Solar panel anode interface	⑧	RS485 isolated communication interface
②	Solar panel cathode interface	⑨	Charge indicator
③	Battery anode interface	⑩	Battery indicator
④	Battery cathode interface	⑪	Load indicator
⑤	Load anode interface	⑫	Fault indicator
⑥	Load cathode interface	⑬	LCD screen
⑦	Temperature sensor interface	⑭	Buttons

2. MPPT Technique Introduction

Maximum Power Point Tracking (referred to as MPPT) system is an advanced charging technique that enables solar panel to deliver more power by regulating the operating state of the electrical modules. Due to the nonlinearity of solar array, there is a maximum energy output point (maximum power point) of the array on its curve. Traditional controllers (switch mode charging technology and PWM charging technology) are unable to maintain charging the battery at this point, and therefore unable to obtain the maximum energy of the panels. But, the solar controllers with MPPT control technique can always track the maximum power point of the array to obtain the maximum energy to charge the battery. Take a 12V system as an example. The peak voltage (Vpp) of the solar panel is around 17V but the battery voltage is around 12V. So, for general charge controllers, the solar panel outputs a voltage of around 12V during charging and does not output its maximum power. MPPT controller can overcome this problem. It constantly adjusts the input voltage and current of the solar panel to achieve the maximum input power. Compared with traditional PWM controller, the MPPT controller can maximize the power of the solar panel, so that it can provide a larger charging current. Generally, the MPPT controller can increase the energy utilization by 15% to 20% compared with the PWM controller.

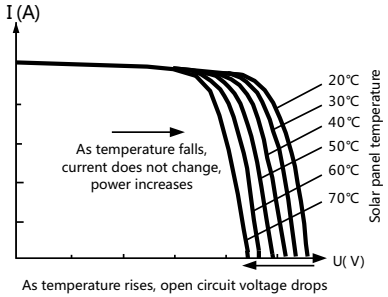


The maximum power point often changes due to different ambient temperature and lighting conditions. Our MPPT controller can adjust the parameters from time to time according to different conditions, so that the system is always near the maximum power point. The entire process is completely automatic and does not require any adjustments by the user.



As light becomes less, open circuit voltage drops

Relationship between the solar panel output characteristics and the light



As temperature rises, open circuit voltage drops

Relationship between the solar panel output characteristics and the temperature

3. Technical Parameters

Parameter name	Values
System voltage	12V/24V/36V/48V
No-load loss	0.5W
Battery voltage	9V~64V
Maximum PV open circuit voltage	150V
Maximum power point voltage range	(Battery voltage+2)~120V
Rated charge current	60A
Rated load current	40A
Solar panel power	800W/12V; 1600W/24V; 2400W/36V; 3200W/48V
Charge conversion efficiency	≤98%
MPPT tracking efficiency	> 99%
Light control ON voltage	5V*n
Light control OFF voltage	6V*n
Light control delay	Day to night: 5min (default) Night to day: 1min
Communication mode	Isolated RS485 :baud rate 9600, data bit8, stop bit1, no check bit; default address 1
Cooling mode	Natural heat dissipation + heat dissipation by fan
Parallel charging	By RS485 communication cables, multiple controllers can work in parallel to control charging
Battery outside temperature sampling	For battery temperature protection and lead-acid battery temperature compensation
Protections	Battery over-charge protection, battery over-discharge protection, battery reverse polarity protection, PV reverse polarity protection, nighttime reverse charge protection, internal over-temperature protection, charge over-current protection, load over-current protection, load short-circuit protection, fan fault protection, etc.
Operating temperature	-10℃ ~ +65℃
Altitude	≤ 3000m
IP rating	IP32
Weight	3.6kg
Dimensions	275*167*90mm

3.1 Default parameters of battery

Battery parameters					
Parameter Set / Battery type	Sealed lead acid battery SLD	Gel lead acid battery GEL	Flooded lead acid battery FLD	Lithium battery LI	User-defined (User)
Over voltage off voltage	16.0V	16.0V	16.0V	16.0V	9~17V
Equalizing charge voltage	14.6V	--	14.8V	--	9~17V
Boost charge voltage	14.4V	14.2V	14.6V	14.4V	9~17V
Floating charge voltage	13.8V	13.8V	13.8V	--	9~17V
Boost recovery voltage	13.2V	13.2V	13.2V	13.2V	9~17V
Over discharge recovery voltage	12.6V	12.6V	12.6V	12.6V	9~17V
Under-voltage alarm voltage	12.0V	12.0V	12.0V	12.0V	9~17V
Over discharge voltage	11.1V	11.1V	11.1V	11.1V	9~17V
Over discharge cutoff voltage	10.6V	10.6V	10.6V	10.6V	9~17V
Over discharge delay	6s	6s	6s	6s	1-30s
Equalizing charge interval	30 days	--	30 days	--	0~250d 0, turn off equalizing charge
Equalizing charge duration	120min	--	120min	--	10-600min
Boost charge duration	120min	120min	120min	--	10-600min
Temperature compensation coefficientmV/℃/2V	-3	-3	-3	--	Lithium battery has no temperature compensation

The parameters of lead-acid batteries listed in the table are those of the 12V system at 25℃; for 24V/36V/48V battery systems, they should be multiplied by 2/3/4.

4. Battery Charge

4.1 Lead-acid battery charge

As shown in Figure 8, the charging stages of lead-acid batteries include: MPPT charge, constant-voltage charge (equalizing/boost/floating charge), current-limiting charge.
The constant voltage charging stage is divided into three stages: equalizing charge, boost charge and floating charge.

➢ MPPT charge

In the MPPT charge stage, the battery voltage has not yet reached the target constant value, and the controller will perform MPPT charge, which enables the solar panel to charge the battery by its maximum energy. When the battery voltage reaches the constant voltage value, it automatically exits MPPT charge and enters constant voltage charge (equalizing/boost/floating charge).

➢ Equalizing charge

Certain types of batteries benefit from regular equalizing charge. Equalizing charge primarily increases the charge voltage of the battery to above the standard charge voltage, and equalizing charge vaporizes the battery electrolyte to balance the battery voltage and complete the chemical reaction. The equalizing charge and boost charge are not repeated in a full charge process to avoid too much gas evolution or battery overheating.

Note:

1) Equalizing charge of FLD lead-acid battery can produce explosive gases, so the battery compartment must be well ventilated.

2) Equalization can increase battery voltage but may compromise the level of sensitive DC loads. It is therefore necessary to verify that the allowable input voltage for all loads in the system is greater than the set value for battery equalizing charge.

3) Overcharging and too much gas evolution may damage the battery pole plate and cause the active material on the battery pole plate to fall off. Excessive equalizing charge voltage or too long equalizing charge may cause a damage to the battery. Please set the relevant parameters according to the specifications of the battery used in the system.

➢ Boost charge

The default duration of boost charge is 2 hours. When the duration reaches the set value, the system will switch to floating charge.

➢ Floating charge

Floating charge is the last stage of constant voltage charge of the lead-acid battery charge cycle, where the controller keeps the charge voltage constant at the floating charge voltage. During this charge stage, the battery is charged with a very low current to maintain full charge state of the battery. When the battery voltage drops below the boost charge return voltage, the system will exit the floating charge stage and re-enter the next charge cycle.

4.2 Lithium battery charge

As shown in Figure 9, the charging stages of lithium batteries include: MPPT charge, constant-voltage charge (boost charge), current-limiting charge.

➢ MPPT charge

In the MPPT charge stage, the battery voltage has not yet reached the target constant value, and the controller will perform MPPT charge, which enables the solar panel to charge the battery by its maximum energy. When the battery voltage reaches the constant value, constant voltage charge will be carried out automatically.

➢ Constant voltage charge (Boost charge)

Boost charge acts as the only constant voltage charge state for lithium battery charging. Only when the battery voltage drops to the boost recovery charge setpoint, the system can exit the constant voltage charge stage and re-enter the next charge cycle.

4.3 Current-limiting charge

Lead-acid, lithium and user-defined batteries all have current-limiting charge functionality throughout the entire charge cycle.

4.3.1 Overpower current limiting

As long as the charge current exceeding the rated value is detected in any charge stage, the system automatically enters current-limiting charge, and the charge current is limited to within the rated range.

4.3.2 Over temperature current limiting

As long as device over temperature is detected in any charge stage, the system automatically enters current-limiting charge.

4.3.3 Fan failure current limiting

When detecting that the fan is blocked or not connected, the controller automatically limits the charge current to 30A or below each, until the fault is restored.

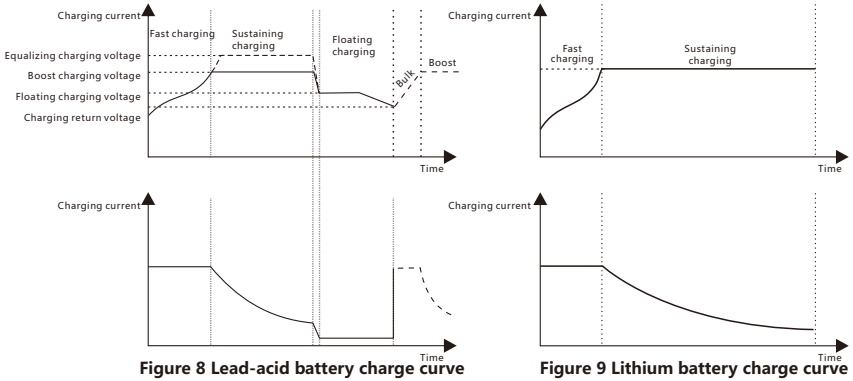


Figure 8 Lead-acid battery charge curve

Figure 9 Lithium battery charge curve

5. System Settings

5.1 Lead-acid battery application

Method 1: Adopt the preset parameters on the controller, which cannot be changed.

Select "FLD/GEL/SLD" battery type on the controller, and the system voltage will be identified automatically.

Method 2: User-defined (USE)

1) Press and hold the "ENTER" button for 2s. The battery icon and settings icon (⚙) light up and the current battery type icon in the lower right corner is blinking.

2) Press the "SELECT" button and select "USE" from the five battery types "USE/FLD/GEL/SLD/LI".

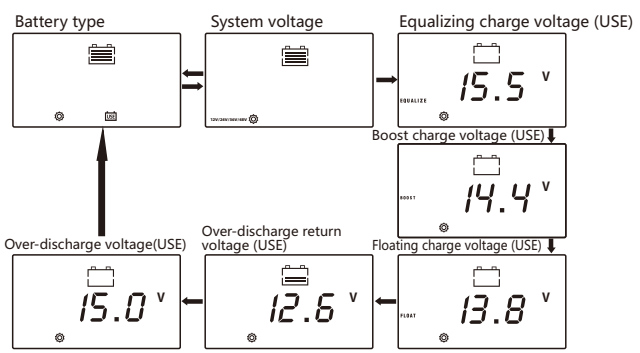
Press "ENTER" to switch between battery type, system voltage, equalizing charge voltage, boost charge voltage, floating charge voltage, over-discharge return voltage, over-discharge voltage, etc. After selecting a setting item, press "SELECT" to adjust the corresponding parameters.

3) Press and hold "ENTER" again for 2 seconds to save and exit.

⚠ **Note:**

Blinking of system voltages "12V/24V/36V/48V" means automatic identification, such as "12V" blinking means that the system voltage set is 12V.

When it comes to system voltage change, a restart is required to take effect.。



5.2 Lithium battery application

Method 1: Select "LI" as the battery type, and the default is lithium iron phosphate battery.

Method 2: Either Lead-acid battery or Lithium battery may be used in USE mode, so the following conditions must be met in order to use Lithium battery in USE mode: (operation is the same as in "5.1")

1) Select the battery type "USE";

2) Set a fixed system voltage and select one from "12V/24V/36V/48V";

3) Set the equalizing charge voltage, floating charge voltage and boost charge voltage to the same value.

If two of the above conditions are met, the system will automatically identify the battery as lithium battery, and provide lithium battery activation and lithium battery charge control functions.

5.3 System reset

Press and hold the ENTER button for 10 seconds, and the LCD screen will display F01. Release the button to restart the controller.

5.4 Restore to default settings

Press and hold the ENTER button for 20 seconds, and the LCD screen will display F02. Release the button to restore to default settings and restart the controller.

5.5 Menu auto page turning, backlight settings

1) Press and hold "SELECT" for 2 seconds to enter menu auto page turning;

2) Press and hold "SELECT" for 7 seconds. The backlight blinks twice before the system enters menu auto page turning, and then the backlight is always on;

Menu auto page turning: each page stays for 3 seconds, and the setting will not be saved when power off.

When a button is pressed, the system immediately exits the auto page turning and the backlight is off.

5.6 Parallel charge settings

Parallel charge function refers to a unified charging of a battery pack by multiple controllers, each of which has its own independent solar panel. The controllers are connected to each other by RS485 communication cables, and the master synchronizes the charging state and stage, target constant voltage value and other parameters to the slave. Parallel charge can break through the power limitation of single controller, and multiple controllers in parallel can meet the need for greater charge power.

1) Simultaneously press and hold the "ENTER" and "SELECT" buttons on the LCD screen to bring up the parallel menu.

At this point, the menu can only be viewed. Displaying P-XX means parallel mode, and C-XX means communication mode, where XX is the device communication address;

2) Press and hold "ENTER" for 2 seconds to enter the settings mode, and the gear-shaped settings icon blinks;

3) Press ENTER to cycle through parallel mode P-XX and communication mode C-XX;

4) Then, press "SELECT" to increment the address (Before the number flashing is off, press "ENTER" to increment the address by 1; pressing "ENTER" after the number is off is to adjust the parallel and communication mode);

5) After setting is complete, wait for5seconds without pressing any button to automatically save the setting and go back to the main interface.

Notes:

P(Parallel) denotes setting theRS485 communication port for parallel charge purpose;

C(Communication) denotes setting theRS485 communication port for common communication purpose;

XX: denotes device address 00~99.

Set to communication mode, communication address 01

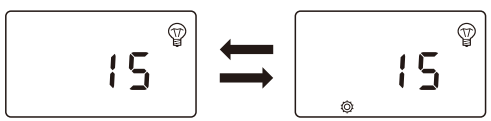
Set to parallel mode, communication address 01

Set to parallel mode, communication address 02

5.7 Load output

5.7.1 Load mode settings

1) Press the "SELECT" button to switch the menus to load mode (from the main menu down to the 9th menu);
2) Press and hold "ENTER" for 2 seconds to light up the settings icon ( ), and enter the load settings mode;
3) Press and hold "ENTER" again for 2 seconds. The settings icon ( ) blinks and the load mode number blinks;
4) Press "SELECT" to adjust the load mode cyclically (0-17).



Load mode menu　　Go to load mode settings

Load operating mode is as follows:

Number on LCD screen	Load mode name	Description
0	Only light control (Turn on load at night, and off in the daytime)	When there is no sunlight, the solar panel voltage is smaller than the light control ON voltage. When the duration is longer than light control delay that is 5 minutes by default, the load is turned on; When there is sunlight, the solar panel voltage is greater than the light control OFF voltage and the controller turns off the load after a 1 minute delay.
1~14 hours	Light and time control for 1~14 hours	When there is no sunlight, the solar panel voltage is smaller than the light control ON voltage. When the duration is longer than light control delay that is 5 minutes by default, the load is turned on. After the working time reaches the set value (light and time control time), the load is turned off. When sunlight comes out before the light and time control time is up, the solar panel voltage is greater than the light control OFF voltage and the controller turns off the load after a 1 minute delay.
15	Manual mode (default)	This mode allows the user to turn the load on/off with a short press on the button (independent of day and night).
16	Commissioning mode	The mode is used for system commissioning. When there is a light signal, the load is immediately turned off, and when there is no light signal, the load is immediately turned on. This facilitates checking the system for right installation during installation and commissioning.
17	Steady on mode	Suitable for 24H uninterrupted power supply applications

5.7.2 Load short circuit protection settings

In some applications that are particularly prone to interference or for some inductive or capacitive loads that may have a high current at the moment of power on, and thus may trigger the controller's load short circuit protection and cause the load to fail to turn on, you can choose to disable the load short circuit protection.

1. Setting method:

1) Press the "SELECT" button to switch the menus to load mode interface;
2) Press and hold the "ENTER" button for 2 seconds to light up the settings icon ( ), and enter the load settings mode;
3) Press the "ENTER" button to switch the menu from load mode to load short circuit protection enable/disable interface (Scn/ScF);
4) Press and hold the "ENTER" button for 2 seconds, and Scn/ScF blinks;
5) Press the "SELECT" button to switch between "ScF and Scn". After 5 seconds without pressing any button, the setting will be saved automatically.

Note: ScF is to disable load short-circuit protection, Scn is to enable load short-circuit protection, and the default is Enable.

Enable load short-circuit protection

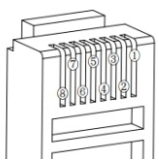
Disable load short-circuit protection

6. Battery Temperature Sampling

By connecting a temperature sensor to the interface ⑦, the battery's real-time temperature can be sampled. The temperature defaults to 25℃ when the temperature sensor is not connected. Connect a temperature sensor and sample the battery temperature for high and low temperature protection for the battery or temperature compensation for charge voltage of lead-acid battery (no temperature compensation for lithium battery).

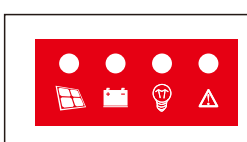
7. RS485 Communication Interface

The controller has 2 isolated RS485 communication interfaces, which can be set to communication mode or parallel mode.
7.1 Set to communication mode: perform data monitoring, parameters settings and other operations for the controller through the port.
7.2 Set to parallel mode: allows users to use parallel cables to connect multiple controllers via their RS485 interfaces to perform parallel charge. See 5.6 for details.
7.3 Communication interfaces are defined as follows:



No.	Definition
①	Isolated power supply positive - 5.0V
②	D+
③	D-
④	Isolated power supply ground

8. Indicators



①	Charge stage indicator
②	Battery status indicator
③	Load status indicator
④	Fault status indicator

8.1 Charge indicator

Indicator status	Charging state
Steady on	MPPT charge
Slow flash (on for 1s, off for 1s, a cycle of 2s)	Boost charge
Single flash (on for 0.1s, off for 1.9s, a cycle of 2s)	Floating charge
Quick flash (on for 0.1s, off for 0.1s, a cycle of 0.2s)	Equalizing charge
Double flash (on for 0.1s, off for 0.1s, on again for 0.1s and off for 1.7s, a cycle of 0.2s)	Current-limiting charge
Off	Charge is not turned on

8.2 Battery indicator

Indicator status	Battery status
Steady on	Battery is normal
Slow flash (on for 1s, off for 1s, a cycle of 2s)	Battery over-discharge
Quick flash (on for 0.1s, off for 0.1s, a cycle of 0.2s)	Battery over voltage

8.3 Load indicator

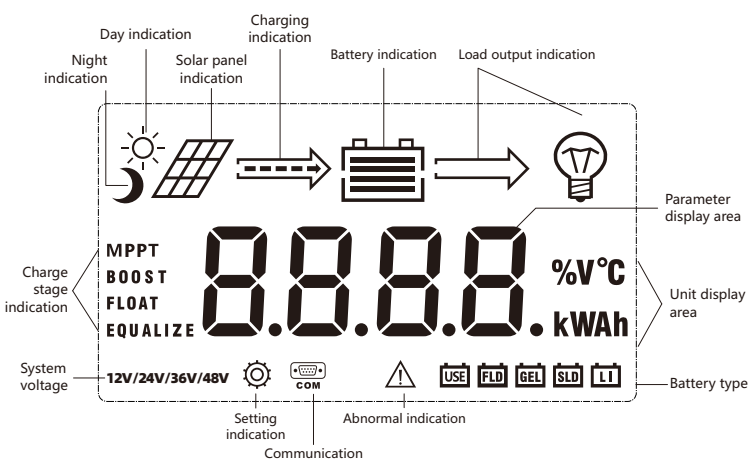
Indicator status	Load status
Off	Load has been turned off
Steady on	Load output is normal
Quick flash (on for 0.1s, off for 0.1s, a cycle of 0.2s)	Overload/short circuit

8.4 Fault indicator

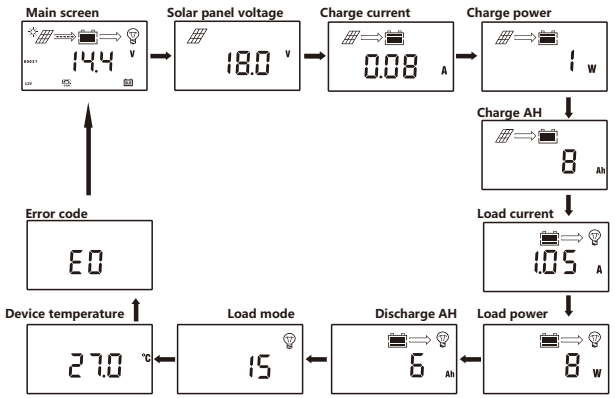
Indicator status	Fault status
Off	System is normal
Steady on	System failure

9. Menu Display

9.1 Menu diagram



9.2 Menu display



10. Error Codes

LCD	Description	Controller action
E0	System is normal	No action
E1	Battery over-discharge	Turn off load output; when the battery voltage rises to the over discharge return voltage, the over discharge is removed, and the load output resumes
E2	Battery over-voltage, battery icon indicator flashing fast	Turn off charging; check the cause of battery over voltage, and when voltage drops, charging automatically resumes
E3	Battery under-voltage warning	The battery voltage is lower than the under-voltage warning threshold. Only alert is given, with no action
E4	Load short circuit	Turn off load output
E5	Load over current	Delay to turn off load at multiples of rated current
E6	Controller internal over temperature	The internal temperature of controller is too high, MPPT controller starts charging with reduced power; when the temperature is below a certain value, charging automatically resumes
E7	Battery charge over temperature protection	Turn off charging, and it will automatically resume when the temperature is below a certain value
E8	Solar panel input power excessive, charge over current	MPPT controller charges with limited current
E10	Solar panel over voltage	Solar panel over voltage; turn off charging, and it will automatically resume when the temperature is below the safety value
E13	Solar panel reverse polarity	Turn off charging and discharging
E15	Battery not connected or lithium battery feed	As long as the solar panel voltage meets the charging conditions, the lithium battery has constant voltage output, and the lead-acid battery has no voltage output, this error returns to normal after battery is connected

E16	Battery discharge high temperature protection	Turn off load output
E17	Battery discharge low temperature protection	Turn off load output
E18	Overcharge protection	Turn off charging
E19	Battery charge low temperature protection	Turn off charging
E24	Fan failure	Fan is not detected and the maximum charge and discharge current of the system is 30A
E30	System has disabled charging and discharging via communication settings	This function can be set through the RS485 communication port to the relevant registers, and is enabled by default

11. Common Troubles and Handling Methods

Troubles	Handling methods
Indicators, and LCD screen do not light up	Check if the battery and solar panel are properly connected, and if the LCD screen cable is poorly connected
Solar panel has voltage, battery terminal has no voltage output, but the code E1 is displayed	No battery is detected on the lead-acid battery terminal, there is no voltage output at both ends of the battery, it is back to normal after the battery is connected
With 12V/24V/36V/48V normal voltage battery connected, the battery icon on the LCD screen flashes slowly and the code E1 is displayed	Check if the system voltage is set to the battery, or if it is set to automatically identify and restart the controller; after setting system voltage, for safety purposes, the system should be restarted to take effect.
Controller does not charge	Check if wiring is correct, check if the solar panel voltage exceeds the rated value and if the battery is over-voltage, and check LCD error codes for internal over-temperature, external over-temperature, external lithium battery low temperature, lead-acid battery open circuit, presence of E10, etc.
Battery icon on the LCD screen flashes slowly and the code E1 is displayed	Check if the battery is over discharged and if the system voltage is set incorrectly
Charge and discharge current is only 30A. Why?	Because the system adopts the heat sink + air cooling technology, when the system detects a fan error, it automatically limits the maximum charge and discharge current to 30A
Fault codes present	Please refer to the "Error Codes" table for other errors with error codes
Other problems or anomalies that are difficult to resolve	Try F01 reset Restore the factory settings F02 and set the parameters according to the system configuration again. Be cautious!

12. Product Installation

12.1 Installation considerations

- Be very careful when installing the battery, and wear protective goggles when installing FLD lead-acid battery. Once in contact with the battery acid, rinse the contact part with water in time.
- Avoid placing metal objects in the vicinity of the battery to prevent a short circuit.
- Acidic gases may be generated when the battery is charged, so make sure the environment is well ventilated.
- Flammable gases may be generated by the battery, so keep away from sparks.
- When installing outdoors, avoid direct sunlight and rainwater infiltration.
- False connection points and corroded wires may generate great heat that may melt the wire insulation, burn the surrounding material, or even cause fire, so make sure that the connectors are tightened, and that the wires are secured with ties to avoid loose connection due to shaking of the wires when the system is moved.
- The voltage at the output terminals may exceed the human safety voltage when connecting the system, so use insulated tools and keep your hands dry.
- The battery terminals on the controller can be connected either to a single battery or to a battery pack. The subsequent instructions in this manual are for use with a single battery, but they also apply to a system with a battery pack.
- Please observe the battery manufacturer's safety recommendations.
- The system connection wires should be selected according to the current density of not less than 5A/mm^2.
- Ground the controller via its ground terminal.
- Do not connect the battery reversely during installation, as this may cause irreversible damage!

12.2 Installation steps

Wiring and installation methods must comply with national and local electrical code requirements.

Step 1: Choose installation site: avoid installing the controller in place where it is exposed to direct sunlight, high temperature and water ingress, and make sure the area around the controller is well ventilated.
Step 2: Fix the screws for hanging: mark the mounting location according to the size of the controller, drill two mounting holes in the two marks, and fix the screws in the two mounting holes.
Step 3: Fasten the controller: align the fixing holes of the controller with the 2 screws and then hang it up.
Step 4: Open the controller front cover, connect wires, and close the front cover.

13.Protections

- **Device internal over temperature protection**
  When the internal temperature of the controller exceeds the set value, the charge power will be automatically reduced or even charging is turned off to further slow down the internal temperature rise of the controller.
- **Battery over temperature protection**
  Battery over-temperature protection requires an external battery temperature sampling sensor. When it detects an over temperature of the battery, charging will be stopped. When the battery temperature drops to 5 degrees lower than the set value, and lasts for 2 seconds, charging automatically resumes.
- **Input over power protection**
  When the solar panel power is greater than the rated value, the controller will limit the charging power within the rated power range to prevent excessive current from damaging the controller, and the controller will enter current limiting charge mode.

- **PV input terminal over voltage**
  When the voltage at the PV array input terminal is too high, the controller will automatically cut off the PV input.
- **PV input reverse polarity protection**
  When the polarity of the PV array is reversed, the controller will not be damaged. After correcting the wiring error, it will continue to work properly.
- **Night reverse-current protection**
  It prevents the battery from discharging at night via solar cells. Special note: Battery reverse polarity protection is not available.

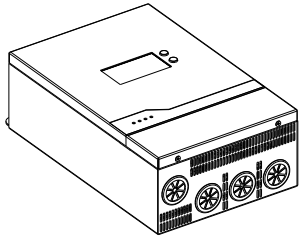
14. System Maintenance

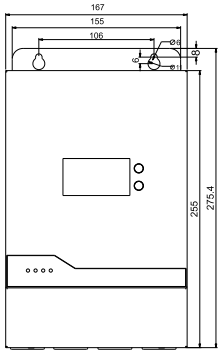
The following items are recommended to be checked periodically for the controller to maintain optimum performance for a long time.

- Make sure the airflow around the controller will not be blocked and remove any dirt or debris from the heat sink.
- Take corrective actions in a timely manner in the case of any abnormal malfunction or error alert.
- Check the terminals for signs of corrosion, insulation damage, high temperature or burning/discoloration, enclosure deformation, and if so, promptly repair or replace.
- Check for exposed, damaged, insulation performance deteriorated wires, which should be timely repaired or replaced.
- Check for dirt, nesting insects and corrosion, and if so, clean up in time.

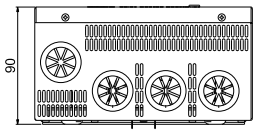
⚠ **Warning:** risk of electric shock! Make sure that all power to the controller is disconnected when performing the above operations, and then check or operate accordingly! Do not operate without authorization if you are not a professional.

15. Product Dimensions



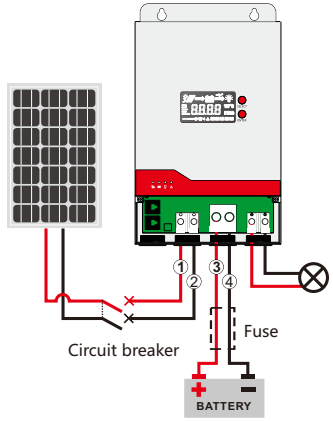


Overall dimensions: 275*167*90mm
Mounting holes spacing: 106mm
Mounting hole diameter: φ6mm



16. System Wiring Diagram

16.1 Stand-alone application



16.2 Parallel application