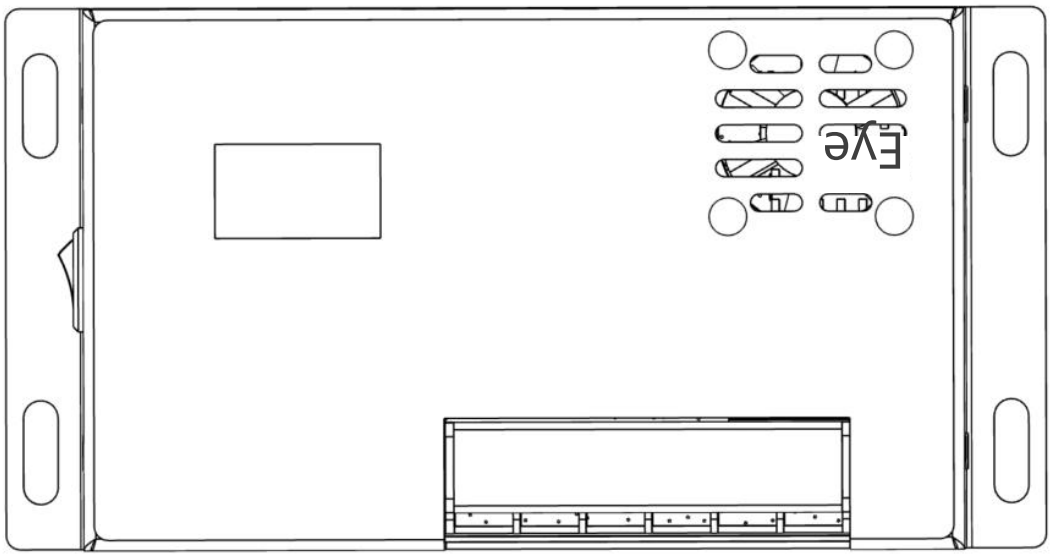
SUNOPEN

M P P T Solar Charging Controller User Manual

M12PA Model

Applicable **12V** Platform Battery NCM, Lithium Iron, Lead Acid, Custom Step-down Version

Ultra-detailed, ultra-smooth six-stage charging, stable battery protection, enhancing battery life and cycles



Manual Version: V1.6 Changes may occur without prior notice. Please contact sales for the latest electronic documentation.

Thank you very much for choosing our products!

Safety Instructions

1. Since the operating voltage of this controller exceeds the safe voltage for humans, please read the instruction manual in detail and complete safety training before operating this controller.

2. There are no components inside the controller that require maintenance or repair; users should not disassemble or repair the controller on their own.

3. Please install the controller indoors to avoid exposure of components and prevent water from entering the controller.

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

5. It is recommended to install a suitable fuse or circuit breaker outside the controller.

6. Before installing and adjusting the wiring of the controller, be sure to disconnect the connection of the photovoltaic array and the fuse or circuit breaker near the battery terminals.

7. After installation, check that all wiring connections are secure to avoid risks caused by loose connections leading to heat accumulation.

Warning: Indicates a danger associated with this operation; safety preparations must be made before proceeding.

Note: Indicates that this operation may be destructive.

Tip: Indicates suggestions and tips for the operator.

Catalog

1.1 Product Overview

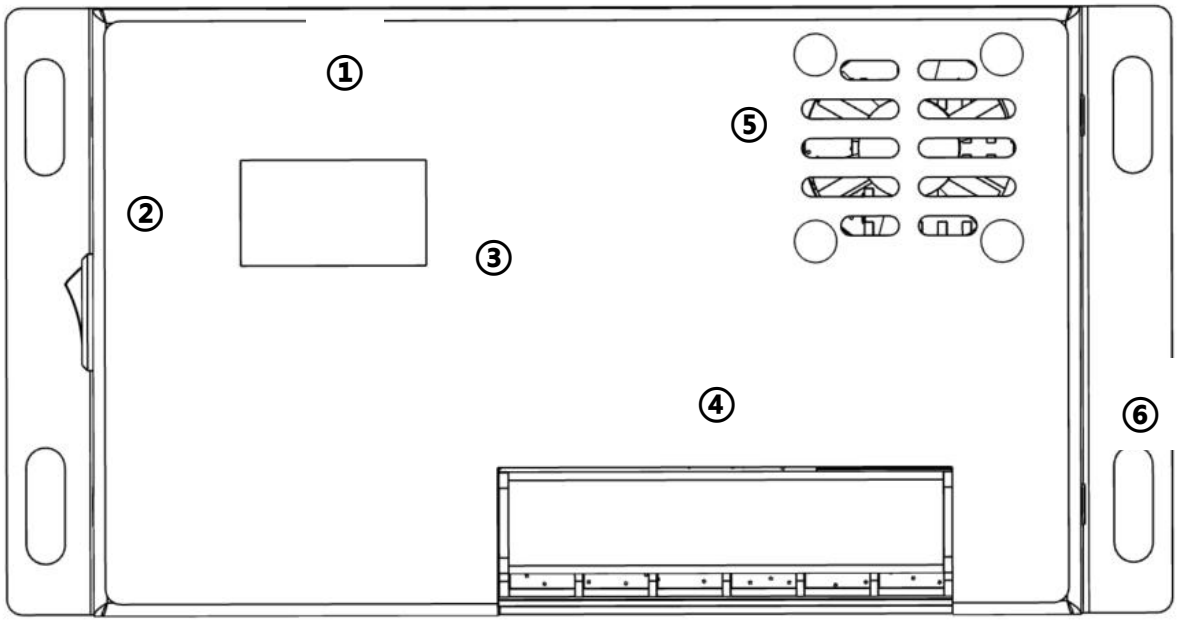
The M12PA controller utilizes industry-leading MPPT (Maximum Power Point Tracking) technology to achieve maximum energy tracking from solar panels, enabling it to quickly and accurately find the maximum power point of solar cells in different environments, and to obtain the maximum energy from solar panels in real-time, significantly improving the energy utilization efficiency of solar systems. It is widely used in off-grid solar photovoltaic systems to manage the operation of solar panels, batteries, and loads, serving as the core control component of the off-grid photovoltaic system. The controller is equipped with comprehensive software and hardware fault detection and protection functions to minimize damage to product components caused by installation errors and system failures.

1.2 Product Features

- Employs MPPT maximum power tracking technology with a tracking efficiency of up to 99.9%.
- Proprietary technology utilizes a 6-stage charging method while achieving maximum power point tracking. Each stage transitions smoothly, providing ultimate battery protection.
- Supports simultaneous full-power charging and discharging.
- Compatible with various battery types, including sealed, gel, open, lithium, and custom batteries.
- Supports lithium battery and lead-acid activation.
- Supports charging current settings.
- Supports load cutoff hysteresis voltage setting, float charge full voltage hysteresis recharge voltage, supports load short circuit time setting, battery over-voltage and under-voltage custom settings. (Both upper computer and Bluetooth can be set)
- Support for full charging settings.
- Support for temperature compensation feature.
- Support for parallel charging.
- Support for multiple load operating modes.
- Support for starting capacitive and inductive loads.
- Support for saving historical data.
- Support for RS485 communication using standard Modbus protocol, with configurable baud rate (default 9600bps).
- Support for TTL communication using standard Modbus protocol, with configurable baud rate (default 9600bps).
- Support for Bluetooth and Ethernet communication functions (optional).
- Equipped with comprehensive protection mechanisms for overvoltage, overcurrent, overload, overheating, short circuit, etc., during charging and discharging.
- Using high-quality aluminum heat sinks, air cooling, and high-temperature derating treatment to ensure reliable and efficient operation in various working environments.

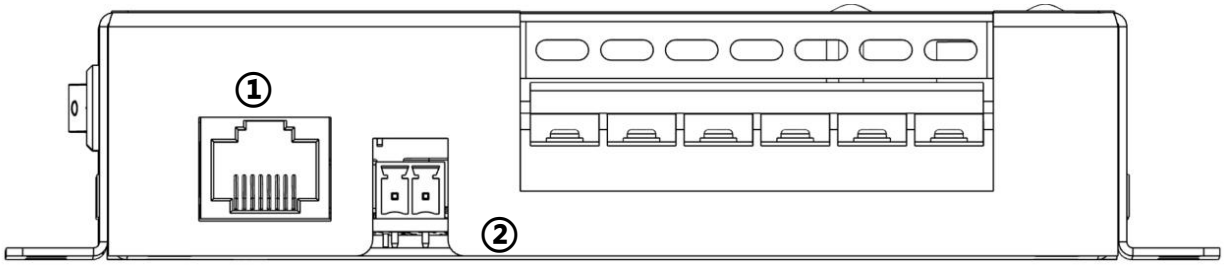
1.3 Appearance and Interface D

Front Interface Introduction



NO.	Function Description	Remarks
①	Battery type selection, Chinese-English switch, interface switch with toggle switch	For details, see the toggle switch chapter
②	Start button	Side boat-type switch
③	Display screen interface	
④	Load interface; battery interface; photovoltaic input interface	Interface KF2EDGR
⑤	Fan Outlet	Do Not Block
⑥	Ground Screw Hole Position	

Side Interface Introduction



Serial Number	Function Description	Remarks
①	RS485 Communication Interface	Pin definitions refer to other sections
②	Battery Temperature Monitoring Interface, external NTC B3950 10K temperature sensor	No Battery Temperature Monitoring when not connected

The M12PA series Maximum Power Point Tracking (MPPT) system is an advanced charging technology that adjusts the working state of the electrical modules to enable solar panels to output more electrical energy. Due to the nonlinear characteristics of the solar panel array, there exists a maximum power point (MPP) along its curve; traditional PWM charging technology cannot maintain charging at this point, and therefore cannot capture the maximum energy from the solar panels. However, solar controllers equipped with MPPT technology can constantly track the maximum power point of the array to charge the battery with the maximum energy. For example, in a 12V system, the peak voltage (Vpp) of a solar panel is typically around 18V, while the battery voltage is around 12V. General charging controllers operate with the solar panel voltage at around 12V during charging, failing to fully leverage the maximum power.

MPPT controllers can overcome this issue by dynamically adjusting the input voltage and current of the solar panels to achieve maximum input power. Compared to traditional PWM controllers, MPPT controllers can harness the maximum power of solar panels, allowing for greater charging current. Generally, MPPT technology can improve energy utilization by 20% to 30% compared to PWM controllers.

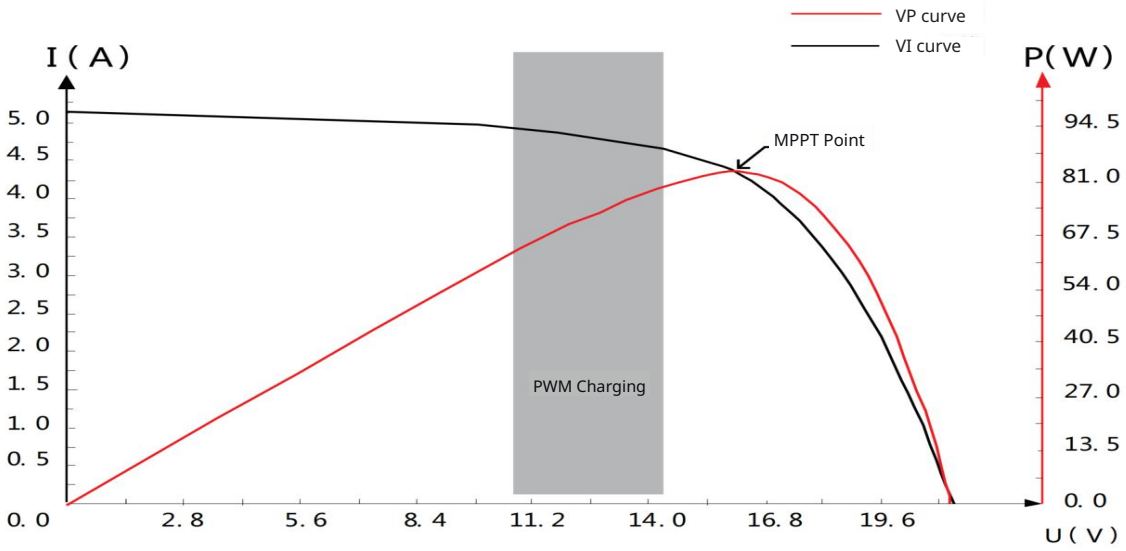


Figure 1-2: Characteristics Curve of Solar Panel Output

Due to varying environmental temperatures and light conditions, the maximum power point can frequently change. Our MPPT controller can adjust parameters in real-time based on different conditions to keep the system near the maximum operating point. The entire process is fully automated, requiring no adjustments from the user.

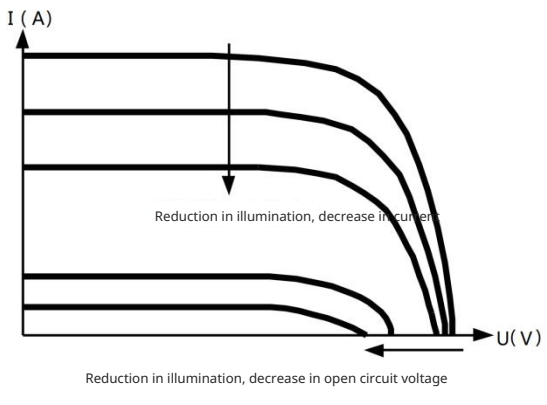


Figure 1-3: Relationship Between Solar Panel Output and Illumination

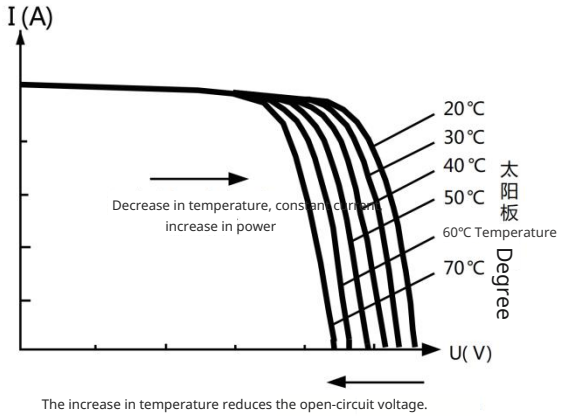


Figure 1-4: Relationship Between Solar Panel Output and Temperature

2. Technical Parameters

Product Model	**M12PA**
Static Power Consumption	≤30mA
Battery Type	Lithium Polymer / LiFePO4 / Lead-acid / Gel / Other batteries (Users can configure independently via the upper computer)
Battery Voltage	12V Platform
System Mode	Step-down
Rated Battery Charging Current	13.5A
Maximum PV Input Current	10A
Maximum Solar Panel Power	180W
Max: PV Open Circuit Voltage (Voc)	16V~30V (Tolerance 0.5V)
Recommended PV Power Point Voltage (Vmp)	16V~24V (Recommended)
System Maximum Withstand Voltage	36V (±2%) Overvoltage Will Damage the System
MPPT Tracking Efficiency	>99.9%
MPPT tracking rate	<1ms
Charge conversion efficiency	>96%
Rated load current	10A
Load operating mode	Manual mode, automatic mode (users can configure independently according to the upper computer)
Charging operation mode	Activation/trickle/constant current/constant voltage
Battery charging temperature control can be set	√
Temperature Protection	√
Activate Battery	√
Load Overload/Short Circuit Protection	√
TTL Communication	√
RS485 Communication	Non-Isolated Type (Standard) / Isolated Type (Optional)
External 12V Power Supply (<300mA)	√
Display Screen	√
Support SOC display	√
Charging power can be set	√
Battery model string length can be configured	√
Support Bluetooth (optional expansion)	√
Support Ethernet (optional expansion)	√
Set auto-save	√
Supported baud rate types	4800/9600/14400/19200/38400/56000/57600 default 9600 (replacement requires host computer configuration)
Backlight adjustment function	Automatically turn off the screen after a few minutes, the wake-up mechanism power button switch operates in a loop (maintaining the original state)
Protection Functions	PV over-voltage protection, PV reverse connection protection, PV short circuit protection, night reverse charge protection, input power limit protection, over-temperature protection, load short circuit protection, load overload protection, battery over-voltage/over-discharge protection,battery reverse connection protection (no fuse blowing)
Operating Environment Temperature Range	- 35℃~65℃ (under good ventilation, no derating within 45℃)
Protection Level	IP32
Cooling Method	Natural cooling, air cooling
Dimensions	Length x Width x Height 79x150x31mm
Weight	0.36kg
Lithium iron phosphate battery support	4 Series
Ternary lithium battery support	3, 4 series
Lead-acid/gel battery support	1 Series
Other batteries	User-defined under-voltage and over-voltage points (set via host computer 8.4V~16.8V)
Host computer/Bluetooth parameter settings	Set the battery over-voltage point, set the battery under-voltage point, set the load short-circuit time, set the load disconnect threshold voltage, set the float charge full battery recovery charging voltage, set the maximum charging power, set the baud rate and other parameters. (Reasonable settings improve the experience of the photovoltaic system.)

3. Dip Switch and Power On/Off Instructions

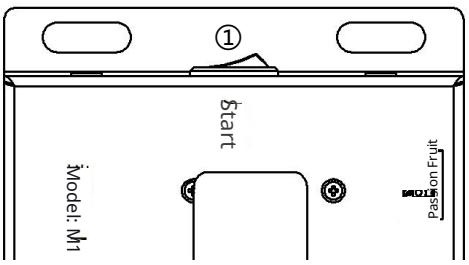
3.1 Dip Switch Usage Instructions (Please select the battery type carefully from the start)

Dip (ON: 1) (Switch up 1, down 0)				Type	Over Voltage Protection	Under Voltage Protection	Full Charge Recharge	Load Recovery	Constant Voltage Start	Float Charge Start
1	2	3	4							
0	1	1	X	Triple	Over Voltage	Under Voltage	Full Charge Recharge	Load Recovery	Constant Voltage	Float Charge
				4 Series	16.8V	12.0V	16.4V	12.8V	16.6V	16.8V
1	0	1	X	Lithium Iron	Over Voltage	Under Voltage	Full Charge Recharge	Load Recovery	Constant Voltage	Float Charge
				4 Series	14.4	11.2V	13.6V	12.4V	14.2V	14.4V
1	1	0	X	Lead-acid	Over Voltage	Under Voltage	Full Charge Recharge	Load Recovery	Constant Voltage	Float Charge
				1 Series	14.4	10.5V	13.4V	11.5V	14.35V	14.4V
0	0	1	X	Triple	Over Voltage	Under Voltage	Full Charge Recharge	Load Recovery	Constant Voltage	Float Charge
				3 Series	12.6V	9.0V	12.3V	9.6V	12.45V	12.6V
1	0	0	X	Lithium Iron	Over Voltage	Under Voltage	Full Charge Recharge	Load Recovery	Constant Voltage	Float Charge
				3 Series	10.8	8.4V	10.2V	9.3V	10.65V	10.8V
0	1	0	X	Colloid	Over Voltage	Under Voltage	Full Charge Recharge	Load Recovery	Constant Voltage	Float Charge
				1 Series	13.8	10.5V	13.2V	11.5V	13.75V	13.8V
0	0	0	X	Custom	Over Voltage	Under Voltage	Full Charge Recharge	Load Recovery	Constant Voltage	Float Charge
				Custom	User Settings	User Settings	User Settings	User Settings	User Settings	User Settings
X	X	X	1	Set to English Interface						
X	X	X	0	Set to Chinese Interface						

Note: The float charge will automatically stop charging if it does not reach a full hour; if the float charge exceeds 1 hour, it will directly enter full charge state and will also automatically stop charging.

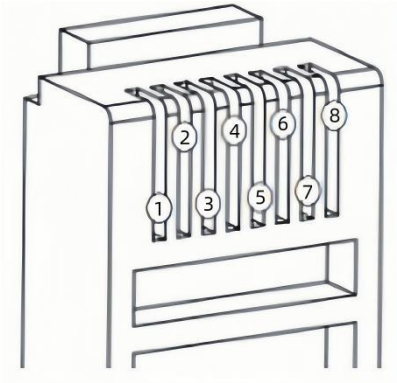
Full charge returns to the recharging state only when the battery voltage returns to the full charge point.

3.2 Device Start Switch Operation Instructions



① To start the device, the switch is off when turned left, and on when turned right.

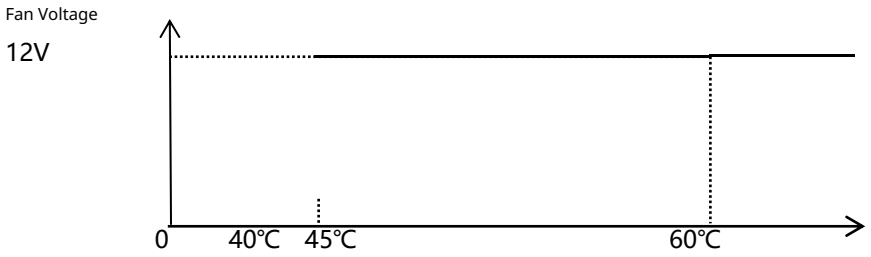
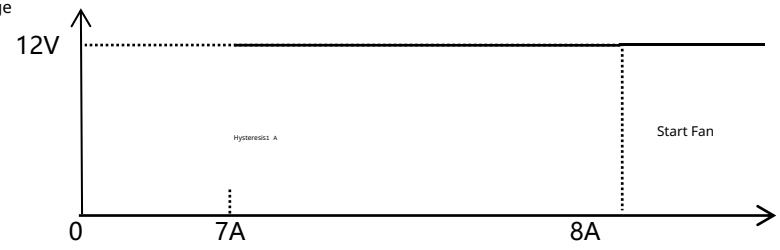
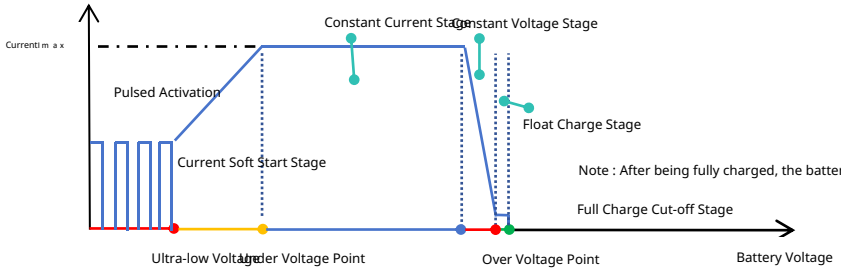
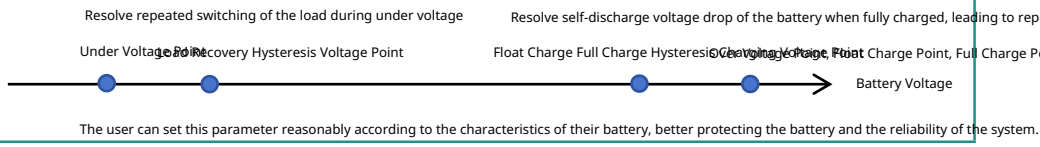
4. TTL Communication, RS485 Communication, and External 12V Output Interface Pin Definition



NO.	Definition
①	485-A
②	485-B
③	12V
④	GND
⑤	Not Used
⑥	Not Used
⑦	TTL-TXD
⑧	TTL-RXD

Note: Maximum 300mA current provided at 12V, exceeding this may damage the interface.

5. Fan Temperature Control and Charging Current Diagram

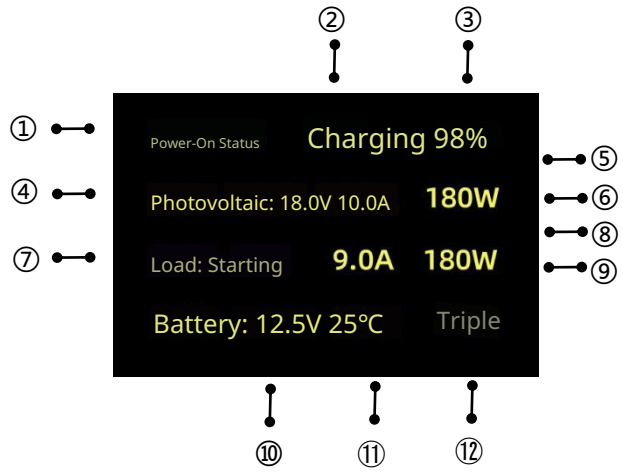
Serial Number	Fan Startup Logic Diagram
During PV Charging	
When PV is not charging, starts with discharge load current	
Use a Six-Section Current Charging	**6** stage charging method, while also ensuring maximum power point tracking. Smooth transition between each stage, providing extreme protection for the battery 
Custom Settings	 The user can set this parameter reasonably according to the characteristics of their battery, better protecting the battery and the reliability of the system.

6. Frequently Asked Questions and Solutions

Phenomenon	Treatment Method
The indicator light and LCD screen do not light up	Check if the connections of the battery and solar panel are correct
The solar panel has voltage, but there is no voltage output at the battery end	Disconnect the battery to check if there is voltage; if there is no voltage, activate the battery in the system settings. (The battery is in an active state, and the system does not support reverse connection protection for the battery)
Battery type and string number modification cannot be performed while MPPT is in operation	Changing the battery type will alter the overvoltage and undervoltage protection points!
The charging power does not reach the rated value	The system employs current limiting and temperature control; Check if the system has reset the charging power;
The load cannot start some devices	The short circuit load time can be set via the upper computer to accommodate different external loads
Other issues or difficult-to-solve anomalies	Go to the settings interface to initiate factory reset. After setting to factory settings, reconfigure the related parameters according to the sy Please proceed with caution!
No response when the battery is connected	Check if the last reverse connection caused the fuse to blow. Replace the fuse or contact the manufacturer for repairs.
The fan is not working	1. Check if there are foreign objects blocking the fan; regularly clean the airflow path. 2. If the fan still does not turn after clearing debris, contact customer service for fan replacement.

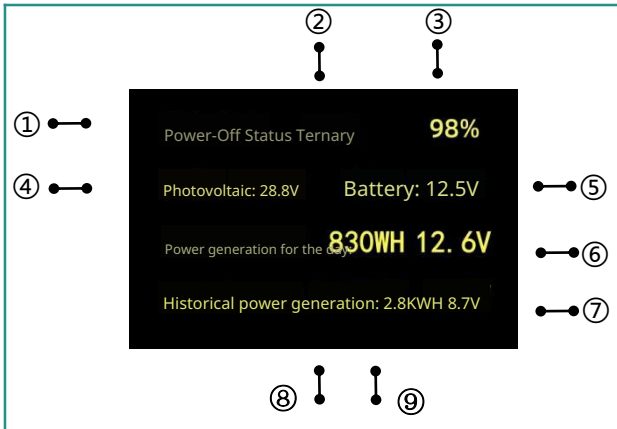
7. Display Interface Introduction

7 . 1System startup display interface



①	Power-on status display
②	The system is in charging state (charging, discharging, protection)
	Battery Charge SOC Display
④	Display the photovoltaic voltage value (over-voltage will flash a warning)
⑤	Display the magnitude of the photovoltaic charging current
⑥	Display the magnitude of the photovoltaic charging power
⑦	Display the load start status (start/stop/short circuit/overload warning)
⑧	Display the magnitude of the load output current
⑨	Display the magnitude of the load output power
⑩	Display the battery voltage (over-voltage/under-voltage will flash a warning)
⑪	Display battery temperature (not connected to NTC, not displayed)
⑫	Display battery selection type (ternary, iron lithium, lead-acid, gel, etc.)

7 . 2Close the system display interface



①	Indicates the current state is shutdown
②	Indicates the current battery selection is of the ternary type
③	Displays the state of charge (SOC) of the battery
④	Displays the voltage value of the photovoltaic system (overvoltage will flash as a warning)
⑤	Displays the voltage value of the battery (overvoltage/undervoltage will flash as a warning)
⑥	Current overvoltage protection設定 point for the battery
⑦	Current undervoltage protection設定 point for the battery
⑧	Displays the day's power generation
⑨	Displays historical power generation

8. Product Installation

8.1 Installation precautions

- When installing the battery, it is essential to be very careful. For the installation of open lead-acid batteries, safety goggles should be worn. If there is contact with the battery acid, please rinse immediately with clean water.
- Avoid placing metal objects near the battery to prevent short circuits.
- Charging the battery may produce acidic gases; ensure that the surrounding environment is well-ventilated.
- The battery may produce flammable gases; please keep away from sparks.
- When installed outdoors, avoid direct sunlight and rain ingress.
- Loose connections and corroded wires can cause significant heating that melts wire insulation, burns nearby materials, and may even lead to fire. Therefore, ensure that connectors are tightly secured, and wires are preferably fixed with cable ties to prevent loose connections when the wires shake during use.
- When connecting the system, the output voltage at the component may exceed the safe voltage for the human body. When operating, be sure to use insulated tools and keep hands dry.
- The battery terminal on the controller can connect to either a single battery or a group of batteries. The subsequent instructions in the manual are for use with a single battery, but they also apply to a system with a group of batteries.
- Please follow the safety recommendations of the battery manufacturer.
- Ground the grounding terminal of the controller.
- During installation, reversing the battery connections is prohibited as it can cause irreversible damage.

8.2 Installation steps

Wiring and installation methods must comply with national and local electrical code requirements. Wiring specifications should be selected based on the rated current, generally at 5A/mm².

Step 1: Choose the installation location.

Avoid installing the controller in places exposed to direct sunlight, high temperatures, and where water can easily enter, and ensure that the area around the controller is well-ventilated.

Step 2: Fix the suspension screws

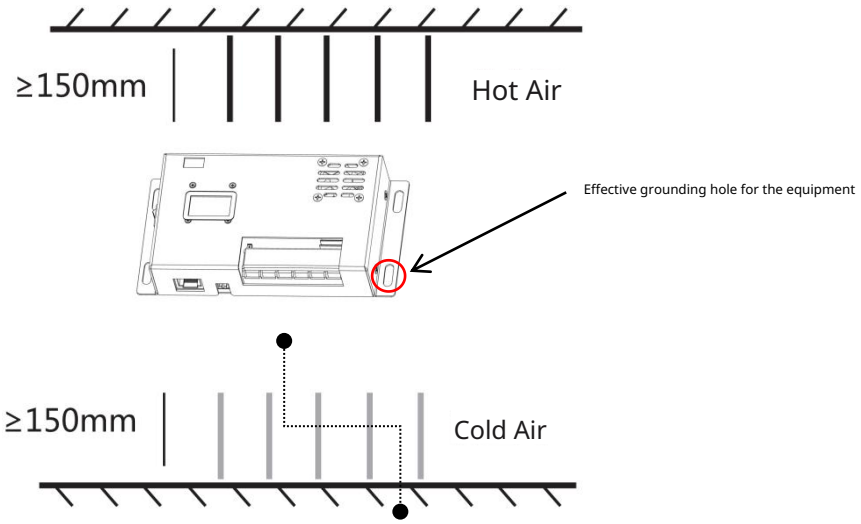
Make marks at the installation position according to the size of the controller. Drill 2 appropriately sized installation holes at the 2 marks, and fix the screws at both installation holes.

Step 3: Secure the controller

Align the fixing holes of the controller with the 2 pre-fixed screws, hang it up, and then secure the two screws at the bottom.

Step 4: Fix the grounding wire

Lock a wire onto the side screw of the controller, and effectively connect the other end of the wire to the ground (it can be buried by tying it to a metal block) to channel leakage, static electricity, and lightning current into the ground.



9. Protection functions

- Overtemperature Protection for Equipment

  When the internal temperature of the controller exceeds the set value, it will automatically reduce the charging power or even shut off during charging, further slowing the rise in internal temperature.

- Overtemperature Protection for Batteries

  The battery overtemperature protection requires an external battery temperature sampling sensor. When it detects that the battery temperature is too high, it will stop charging. Charging will automatically resume when the battery temperature drops to 5 degrees lower than the set value for a duration of 2 seconds.

- Input Overpower Protection

  When the power of the solar panel exceeds the rated power, 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 charging mode.

- High Voltage at the Photovoltaic Input

  If the input voltage of the photovoltaic array is too high, the controller will automatically disconnect the photovoltaic input.

- Photovoltaic Input Reverse Connection 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.

- Nighttime reverse charge protection

  Prevents the battery from discharging through the solar panel at night. Special note: No reverse connection protection function for the battery.

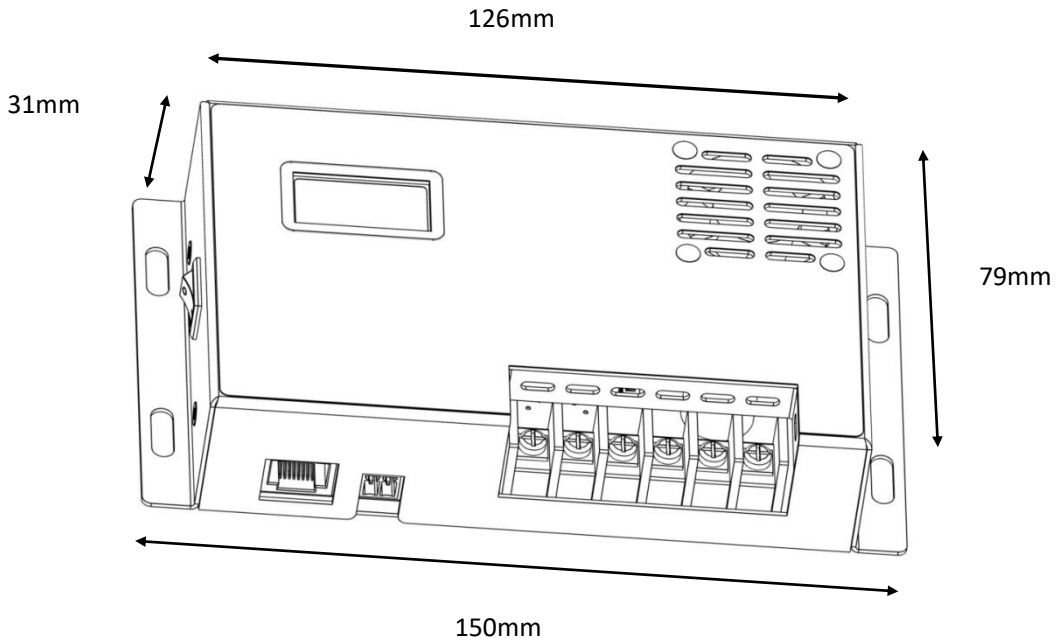
System Maintenance

To maintain the controller's optimal performance for a long time, it is recommended to regularly perform the following inspection items.

- If any abnormal faults or error messages are found, corrective measures should be taken promptly.
- Check whether the wiring terminals have corrosion, insulation damage, high temperature or burning/discoloration signs, or casing deformation, and repair or replace them in time.
- If exposed, damaged, or insulation performance deteriorated wires are found, they should be repaired or replaced promptly.
- If dirt, nesting insects, or corrosion are found, they should be cleaned in time.

Warning: Electric shock hazard! When performing the above operations, be sure to disconnect all power supplies to the controller before carrying out the corresponding inspections or operations! Non-professionals should not

Product Dimension Diagram



12.1 Basic communication configuration

Transmission Mode	RTU	Protocol Standard/Function Code	0x02 Read One or More Input States	Bitwise Read
Baud Rate	Default is 9600bps	This communication protocol is based on <Standard MODBUS Protocol>, where the master continuously requests data from the slave, and the slave responds with request command and responds with data.	0x03 Read Holding Register	Read by 16-bit word
Parity bit	No parity		0x04 Read a Register	Read by 16-bit word
Data bit	8bit		0x05 Write a Coil State	Bit-wise write
Stop bit	1bit		0x06 Write a holding register	Write in 16-bit words
Frame interval	Not less than 3.5 byte times		0x10 Write multiple holding registers	Write in 16-bit words
Frame length	200 bytes	When the communication module detects an error other than a CRC error, it must send back a message to the host, with the highest bit of the function code set to 1; 01 illegal function code, 02 illegal da		
Maximum response time from the device	350 Bytes time			
Minimum polling interval for the host	400 Bytes time	03 Illegal data value 04 service failure		

12.2 Information address

Register address table, read corresponding function code 0x03, set corresponding function code 0x06. The addresses in the table below match the addresses in the actual information frame and do not require any offsets or other conversions.

Address (Decimal)	Meaning	Byte	Read/ Write	Example	Explanation
40000	Device Model	2	R	51221	M12PA
40001	Software Version	2	R	10	V1.0
40002	Hardware Version	2	R	10	V1.0
40003	Maximum power support	2	R	180	180W
40004	Maximum input and output current	2	R	1012	PV:10A, BAT:12A
40005	Photovoltaic	2	R	25	The current system temperature is 25 degrees Celsius.
40006	PV NTC Status	2	R	0	0~7
40007	BAT NTC Status	2	R	0	0~7
40008	Reserved	2	R	Not Used	Reserved
40009	Reserved	2	R	Not Used	Reserved
40010	Reserved	2	R	Not Used	Reserved
40011	Charging Status	2	R	1	0: Not Charging, 1: Charging
40012	Full Charge Status	2	R	1	0: Not Full, 1: Full
40013	Current Load Status	2	R	1	1: Starting, 0: Shutting Down
40014	BUCK Heat Sink Temperature	2	R	50	50℃ (Accuracy 1℃)
40015	Reserved	2	R	Not Used	Reserved
40016	Reserved	2	R	Not Used	Reserved
40017	Reserved	2	R	Not Used	Reserved
40018	Reserved	2	R	Not Used	Reserved
40019	Reserved	2	R	Not Used	Reserved
40020	Photovoltaic input voltage	2	R	2498	24.98V (Accuracy 0.01V)
40021	Photovoltaic input current	2	R	275	2.75A (accuracy 0.01A)
40022	Photovoltaic input power	2	R	100	100W (accuracy 1W)
40023	Photovoltaic heatsink temperature	2	R	20	20 (Accuracy 1℃)
40024	Photovoltaic fault code	2	R	0	See fault table 1
40025	Battery output voltage	2	R	1156	11.56V (Accuracy 0.01V)
40026	Battery output current	2	R	12	None
40027	Battery Output Power	2	R	100	None

40028	Battery radiator temperature	2	R	25	25℃ (Accuracy 1℃)
40029	Battery fault code	2	R	See fault table 2	See fault table 2
40030	Load output current	2	R	18	1.8A
40031	Output power of the load	2	R	125	125W
40032	Fan Startup Status	2	R	0	0: Off 1: On
40033	Historical System ChargingW High Number	2	R	H+L (Unit WH)	Historical Total Power Generation WH
40034	Historical system chargingW value low	2	R		
40035	CurrentS O value	2	R	982	98.2%
40036	Reserved	2	R	Not Used	Reserved
40037	Today's power generation	2	R	855	855WH
40038	M P P Operating Mode	2	R	0	See Function Table 2
40039	Remote Load Switch	2	R/W	0	1: Load On; 0: Load Off
40040	Maximum Voltage for Photovoltaic Access	2	R	300	30.0V
40041	Minimum voltage for photovoltaic access	2	R	130	13.0V
40042	Maximum charging power set by user	2	R/W	100	100W (Limit for maximum photovoltaic charging power setting)
40043	Current battery full charge recovery difference	2	R	1360	13.6V (rechargeable back voltage)
40044	Photovoltaic shutdown temperature setting	2	R/W	70	70℃
40045	Current photovoltaic fan startup temperature	2	R	40	40℃ fan startup
40046	Device communication address	2	R/W	01	Communication address: 01H(01~255)
40047	Battery charging maximum voltage setting	2	R	1440	14.4V (System automatically assigns based on the dip switch)
40048	Battery discharge minimum voltage setting	2	R	1120	11.2V (System automatically assigns based on the dip switch)
40049	Current battery undervoltage hysteresis value	2	R	1240	12.4V (load recovery hysteresis value)
40050	Current battery discharge high temperature setting	2	R/W	60	>60℃ stop load output
40051	Current battery discharge low temperature setting	2	R/W	-10	<-10℃ Stop Load Output
40052	Current Battery Charging High Temperature Setting	2	R/W	45	>45℃ Stop Charging the Battery
40053	Current Battery Charging Low Temperature Setting	2	R/W	0	<0 Stop Charging the Battery
40054	Reserved	2	R/W	Not Used	Reserved
40055	Set battery type	2	R	0	0: Ternary lithium, see Function Table 1
40056	Set number of battery strings	2	R	3	Ternary lithium 3 strings
40057	Power on	2	R	1	0: Disable power generation, 1: Start power generation
40058	Battery activation settings	2	R	0	0: Activate (M12PA model default)
40059	Baud Rate	2	R/W	0	1:9600 (default) 0~7 (4800~115200)
40060	Backlight time	2	R/W	60	Any value triggers the screen to light up
40061	Lock screen	2	R/W	0	M12PA not supported
40062	Reserved	2	R/W	Not Used	Reserved
40063	The user sets the battery overvoltage value	2	R/W	160	16.0V(100~170)
40064	User-set battery undervoltage value	2	R/W	100	10.0V(75~140)
40065	User-set load short-circuit time	2	R/W	100	100*20(us)(Customer adjusts based on external load)
40066	Reserved	2	R/W	Not Used	Reserved
40067	Reserved	2	R/W	Not Used	Reserved
40068	Load cutoff hysteresis voltage setting	2	R/W	1000	1000mV (Hysteresis start voltage setting after load cutoff)
40069	Full charge float voltage differential setting	2	R/W	1000	1000mV (Voltage differential setting for recharge after full charge voltage drops during float char
40070	Pulse activation flag	2	R	1	1: Battery is being activated

13. Detailed List of Attachments

13.1 Function Table

Function Table I (Decimal)		
NMC Battery	Tri-Cell Lithium Battery	0
LFP Battery	Lithium Iron Phosphate Battery	1
PAB Battery	Lead-acid battery	2
GEL Battery	Colloidal battery	3
OTH Battery	Other batteries	5
ERR	Incorrect configuration	8

Function Table II (Decimal)		
MPPT->BAT	Solar Panel to Battery Charging	0

13.2 Fault Table

Fault Table 1 (Decimal)					
OV	Over Voltage of Solar Panel	1	SC	Short Circuit of Solar Panel	128
UV	Under Voltage of Solar Panel	2			
OT	System Over Temperature	4			
TF	Temperature Sensor Fault	8			
OC	Over Current of Solar Panel	16			
OP	Solar panel overload	32			
SF	Current Sensor Fault	64			

Fault Table II (Decimal)					
OV	Battery Overvoltage	1	SF	Battery Current Sensor Fault	128
UV	Battery Undervoltage	2	SC	Battery Short Circuit	256
OT	Battery Over Temperature	4	LOC1	Load Level 1 Over Current	512
UT	Battery Low Temperature	8	LOC2	Load Level 2 Over Current	1024
TF	Temperature Sensor Fault	16	LSC	Load Short Circuit	2048
OC	Battery Overcurrent	32	LSF	Load Current Sensor Fault	5096
OP	Battery Overload	64	PF	Battery Configuration Abnormality	1092
DPF	Charging Dial Fault Code	20384			

Application Wiring Diagram