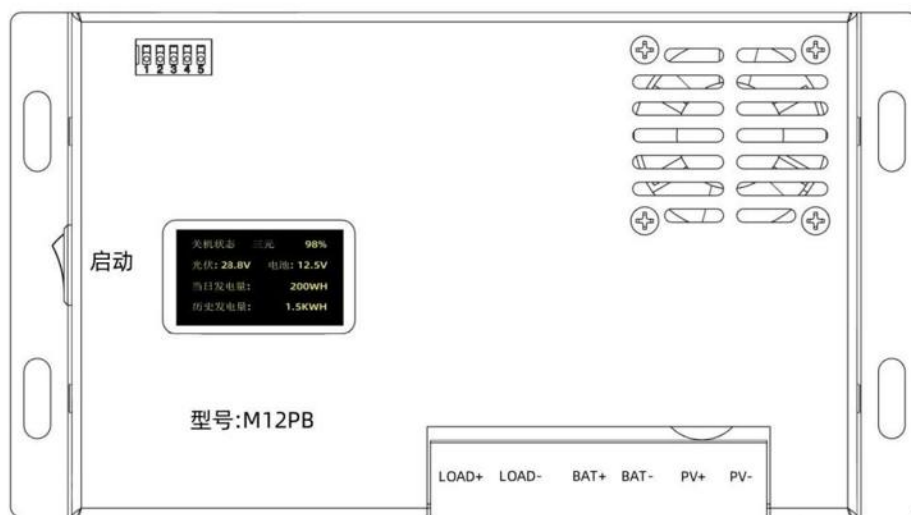
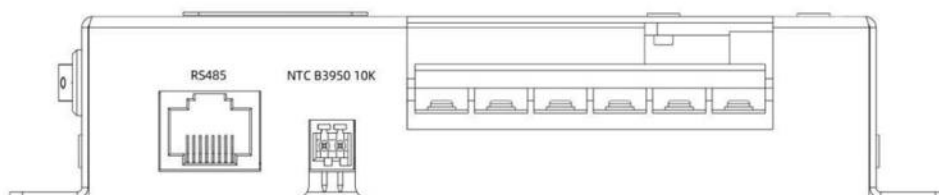


MPPT Solar Charge Controller User Manual

M12PB Model

Step-down



Manual version: V1.1 Subject to change without prior notice, please contact sales to obtain the latest electronic data document

Dear User:

Thank you very much for choosing our products!

安全说明



1. Since the applicable voltage of this controller exceeds the safety voltage of human body, please read the instruction manual carefully before operation and after completing the safety operation training.

before operating this controller.



2. There are no parts inside the controller that require maintenance or repair. Users should not disassemble or repair the controller by themselves.



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



4. Please install the controller in a well-ventilated place. The temperature of the heat sink will be very high during operation.



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



6. Be sure to disconnect the PV array and the fuses or circuit breakers near the battery terminals before installing and adjusting the controller's wiring.



7. After installation, check whether all line connections are tight to avoid heat accumulation and danger due to loose connections.



Warning: Indicates that this operation is dangerous and safety preparations must be made before operation.



Note: This operation is destructive.



Tips: Indicates suggestions and tips for the operator.

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1. 产品简介

1.1 Product Overview

The M12PB controller utilizes industry-leading MPPT (Maximum Power Point Tracking) technology to achieve maximum energy tracking for solar panels. This allows it to quickly and accurately track the maximum power point of solar cells regardless of the environment, enabling real-time capture of the maximum energy provided by the solar panels and significantly improving solar system energy utilization. Widely used in off-grid solar photovoltaic systems, it manages solar panels, batteries, and loads, serving as the core control component. The controller incorporates comprehensive software and hardware fault detection and protection features to minimize damage to components caused by installation errors and system failures.

1.2 Product Features

Utilizes MPPT (Maximum Power Point Tracking) technology, achieving an MPPT tracking efficiency of 99.9%.

Supports simultaneous full-power charging and discharging.

Supports various battery types, including sealed, gel, vented, lithium, and custom batteries.

Supports lithium and lead-acid battery activation.

Supports charge current settings.

Supports full charge settings.

Supports temperature compensation.

Supports parallel charging.

Supports various load operating modes.

Supports starting capacitive and inductive loads.

Supports historical data storage.

Supports RS485 communication using the standard Modbus protocol with a fixed baud rate.

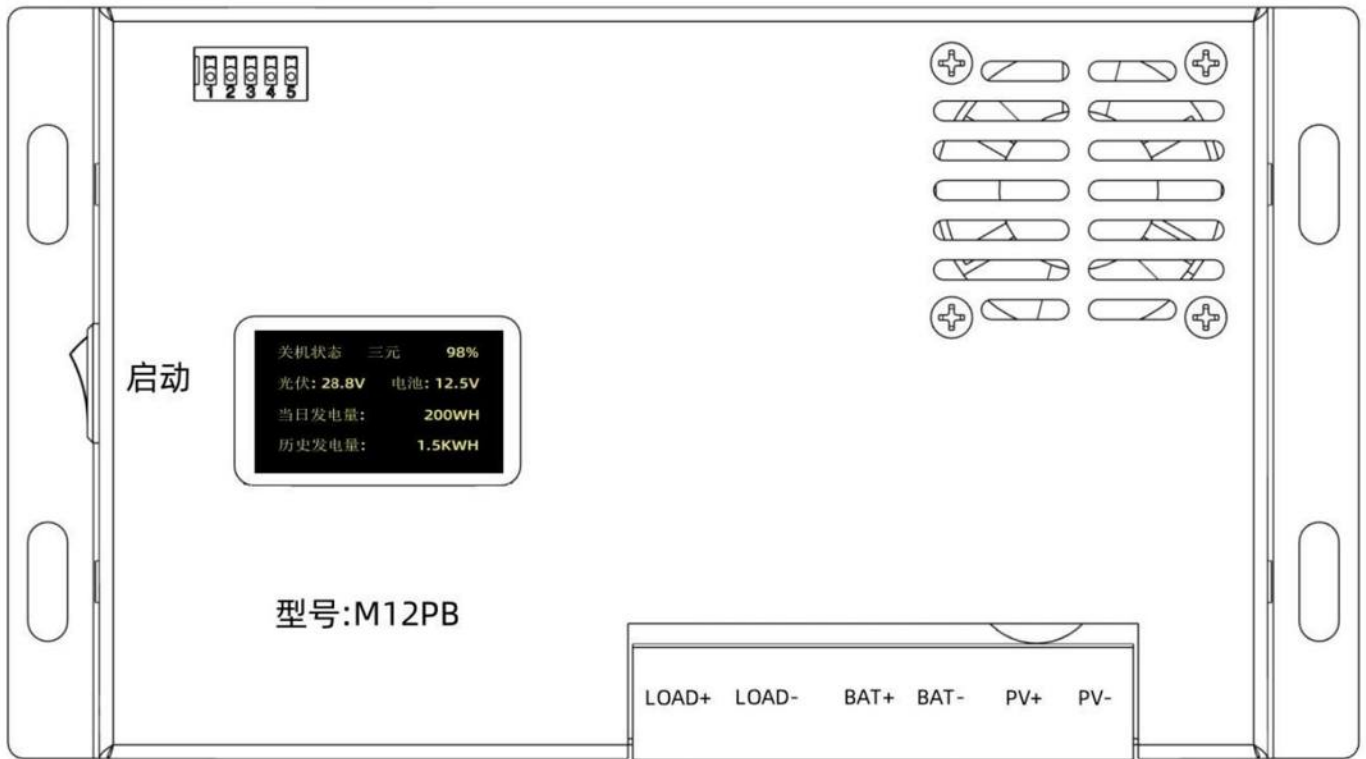
Supports TTL communication using the standard Modbus protocol with a fixed baud rate.

Supports Bluetooth and Ethernet communication (optional).

Features comprehensive charging and discharging protection mechanisms, including overvoltage, overcurrent, overload, overtemperature, and short circuit.

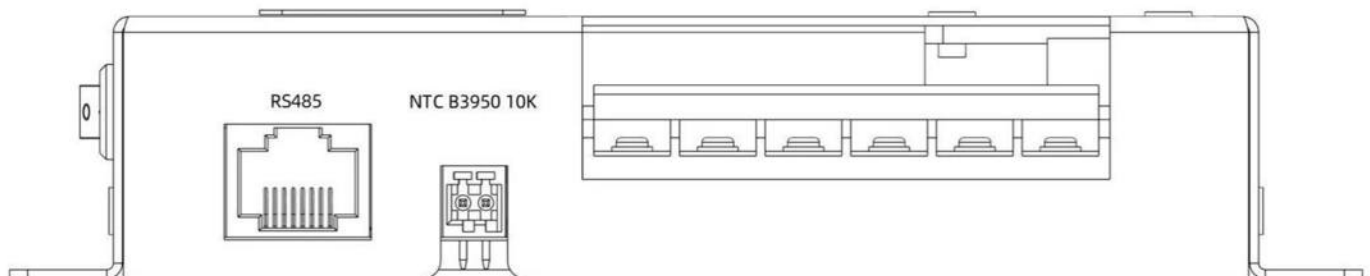
Utilizes a high-quality aluminum heat sink, air cooling, and high-temperature derating to ensure reliable and efficient operation in various operating environments.

Front interface introduction



No.	Function Description	Remark
	Battery type selection, Chinese and English switching, interface switching DIP switch	See DIP switch section for details
	Start button	Display screen
	Side rocker switch	
	interface	
	Load interface; battery interface; photovoltaic input interface	Interface KF2EDGR
	Fan outlet	No blocking
	Earth screw hole	

Side interface introduction



No.	Functional Description	Remark
	RS485 communication interface	Interface pin definitions can be found in other chapters.
	Battery temperature monitoring interface, external NTC B3950 10K temperature sensing resistor is not connected	No battery temperature monitoring

The M12PB series Maximum Power Point Tracking (MPPT) system is a

An advanced charging technology that adjusts the operating state of the electrical modules to maximize the power output of solar cells. Due to the nonlinear nature of solar arrays, there is a maximum power point on their curve. Traditional controller PWM charging technology cannot maintain battery charging at this point, and therefore cannot extract the maximum energy from the panels. However, a solar controller with MPPT control technology can constantly track the array's maximum power point to extract the maximum energy to charge the battery. For example, in a 12V system, because the peak voltage (V_{pp}) of the solar cell is approximately 18V, while the battery voltage is around 12V, a typical charge controller will charge the solar cell at around 12V, preventing it from fully utilizing its maximum power.

The MPPT controller can overcome this problem and adjust the input voltage and current of the solar panel in real time to achieve the maximum input power.

Compared with the traditional PWM controller, the MPPT controller can maximize the power of the solar cell, so it can provide a larger charging current. Generally speaking, the MPPT controller can improve the energy utilization rate by 20% to 30% compared with the PWM controller.

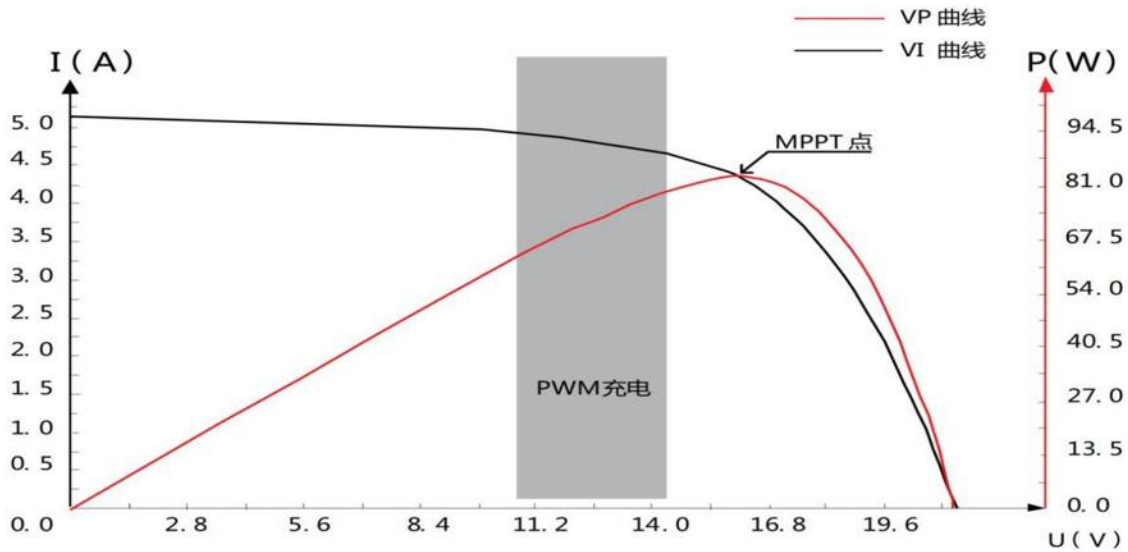


Figure 1-2 Solar panel output characteristic curve

Due to different ambient temperature and light conditions, the maximum power point often changes. Our company's MPPT controller can

Parameters are constantly adjusted under different conditions to keep the system near its maximum operating point. The entire process is fully automatic and does not require any user adjustments.

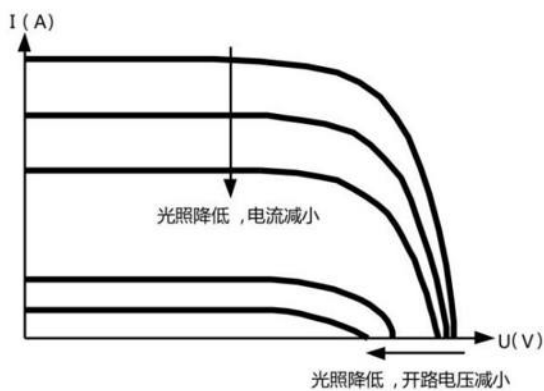


Figure 1-3 Relationship between solar panel output characteristics and sunlight

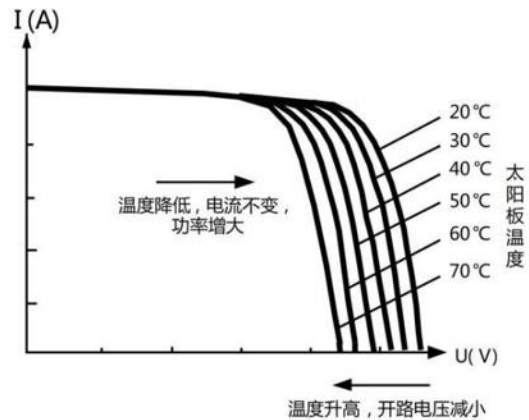


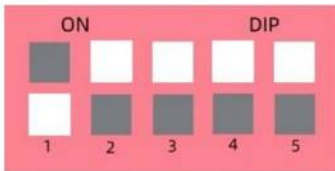
Figure 1-4 Relationship between solar panel output characteristics and temperature

2.技术参数

Product Model	M12PB
Static Power	30mA
Consumption	Ternary/LiFePO4/Lead-acid/Colloid/Other batteries (users can configure independently according to the host computer)
Battery Type	12V Platform
Battery Voltage System Mode	Step down
Rated battery charging	20A
current Maximum PV input	15A
current Maximum solar panel power	300W/18V
PV open circuit voltage	16V~30V
System maximum withstand voltage	35V (±2%) overvoltage will damage the system
MPPT tracking efficiency	>99%
MPPT tracking rate	<10ms
Charging conversion	>96%
efficiency Rated load current	15A
Load working mode	Manual mode, automatic mode (users can configure independently according to the host computer)
Charging working mode	Trickle/ Constant Current/ Constant Voltage
Battery charging temperature control can be set	V
Temperature protection	V
Activate the battery	V
Load overload/short circuit protection	V
TTL communication	V
RS485 communication	V
External power supply (5150mA)	V
Display	V
Support SOC Display charging	V
power Can set battery model and	V
number of strings Configurable Support	V
Bluetooth (external expansion optional)	V
Support Ethernet (external expansion optional)	V
Set the baud rate to save	V
automatically. Support type	4800/9600/14400/19200/38400/56000/57600/115200 Default 9600 (change requires host computer configuration)
and backlight function.	The default backlight is always on (the backlight time is adjustable, set to 0 for the backlight to be always on)
Protection function	PV overvoltage protection, PV reverse connection protection, PV short circuit protection, nighttime reverse charging protection, input power limit protection, over temperature protection, Load short circuit protection, load overload protection, battery overvoltage/overdischarge protection, battery reverse connection protection (fuse blown)
Operating temperature range	-35y~65y (no derating within 45y with good ventilation)
Protection level	IP32
Cooling method	Natural heat dissipation, air cooling
Dimensions	Length, width and height 94.5x170x34mm
weight	0.46kg
Lithium iron phosphate battery	4 skewers
support Ternary lithium battery	3 or 4 strings
support Lead acid/colloid battery	1 skewer
support Sodium battery support	3 or 4 strings
Other batteries	The user can set the undervoltage and overvoltage points (8.4V~16.8V via the host computer)

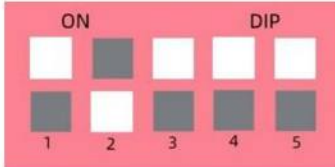
3. 拨码开关及开关机使用说明

3.1 Instructions for using the DIP switch (Please make sure to select the correct battery type before use)



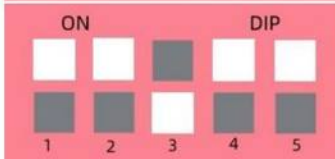
1 dial down, 23 dial up. Representative: Select 4 strings of ternary batteries

Overvoltage protection point: 16.8V Undervoltage protection point: 11.6V (automatically generated by the system)



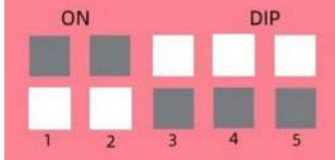
2 dial down, 13 dial up. Means: Select 4-series lithium iron battery overvoltage protection point: 14.4V

undervoltage protection point: 11.2V (automatically generated by the system)



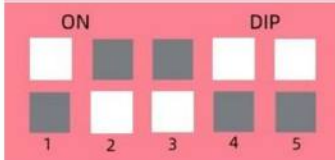
3 dial down, 12 dial up. Representative: Select 12V lead acid or 12V gel battery Overvoltage protection point: 14.4V Undervoltage

protection point: 10.5V (automatically generated by the system)



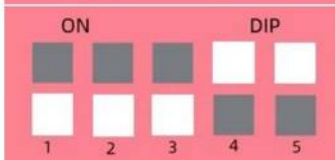
12 dial down, 3 dial up. Means: Select 3 strings of ternary batteries. Overvoltage protection point: 12.6V

Undervoltage protection point: 8.7V (automatically generated by the system)



23 dial down, 1 dial up. Means: Select 3 iron lithium battery overvoltage protection point: 10.8V undervoltage

protection point: 8.4V (automatically generated by the system)

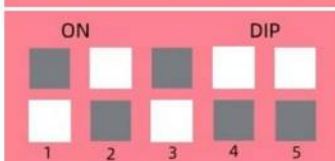


123 dial all down, represents the custom battery, overvoltage and undervoltage need to be set by the customer through the host computer

overvoltage protection point: 10V undervoltage protection point: 10V (automatically generated by the system), this function needs to be changed by the customer through the host computer

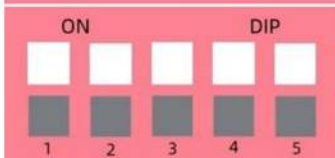


123 Dial up to view all alarm information (using this function the system will automatically stop charging)

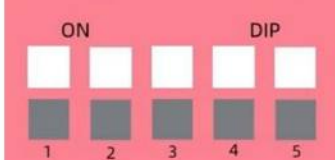


13 dials down, 2 dials up, you can view the system temperature information and battery temperature information (using this function, the system

automatically stops charging). If you need to change the protection value, the user needs to configure it on the host computer.

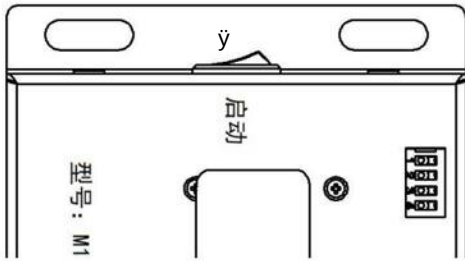


4. Turn the dial up to "English interface", 4. Turn the dial down to "Chinese interface"



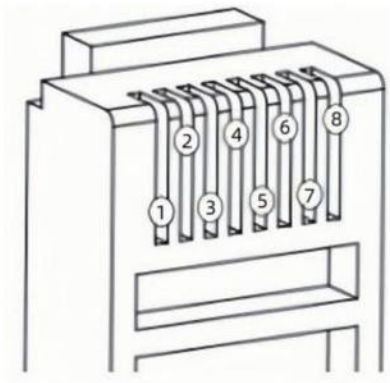
5. Turn the dial up to activate the battery, and turn the dial down to deactivate the battery.

3.2 Instructions for using the device startup switch



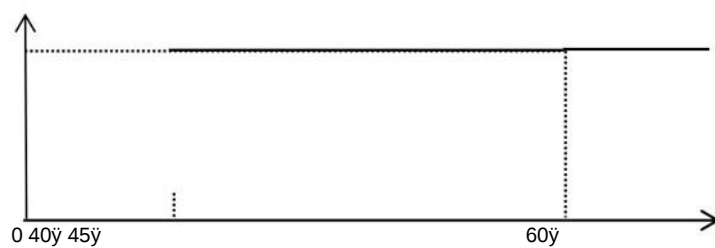
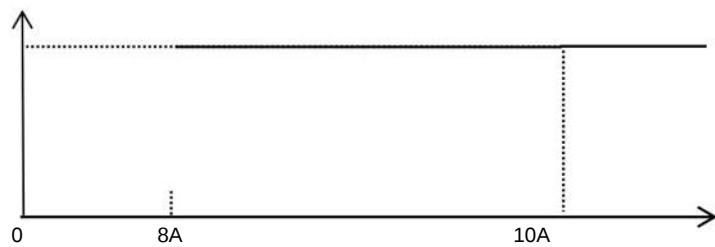
y Start the device, turn the switch to the left to turn off, and to the right to turn on.

4.TTL 通讯、RS485 通讯、外扩 12V 输出接口针脚定义

	No. y	definition
		485-A
	y	485-B
	y	12V
	y	GND
	y	Not used
	y	Not used
	y	TTL-TXD
	y	TTL-RXD

Note: 12V provides a maximum current of 150mA. Exceeding this current will likely damage the interface.

5.风扇温度控制

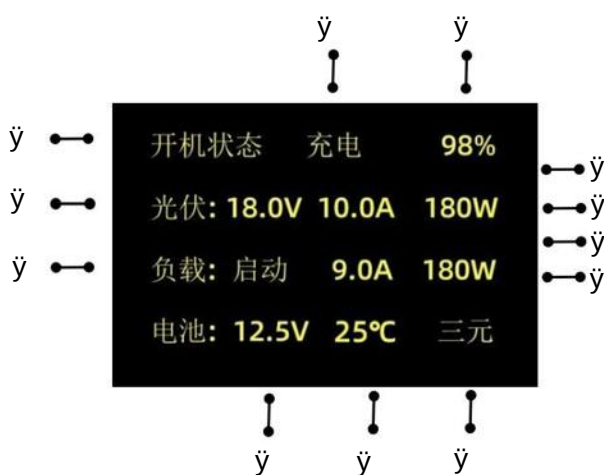
Serial number	Fan start-up logic diagram
PV charging	Fan voltage  0 40y 45y 60y
When PV is not charging, Discharge load current start move	Fan voltage  0 8A 10A

6、常见问题和解决方法

Phenomenon	Treatment method
The indicator light and LCD screen are off	Check if the battery and solar panel are connected correctly. Disconnect
Solar energy has voltage, but the battery has no voltage output	the battery and check if it has voltage. If no voltage, start battery activation in the system settings. (The battery is in the activated state and the system does not support reverse battery protection.)
The battery type and number of strings cannot be modified during MPPT operation. Changing the battery type will change the overvoltage and undervoltage protection points! The system	
Charging power does not reach the rated value	uses current limiting and constant temperature control; Check whether the system has reset the charging power; Is there a significant voltage difference between the PV model and the battery model? You can
Load cannot start some loads	configure the short-circuit load time on the host computer to adapt to different external loads. Initiate a factory reset on
Other problems or exceptions that are difficult to resolve	the setup interface. After resetting the factory settings, reconfigure the relevant parameters according to the system configuration. Be cautious! 1. Did the previous reverse
No response when battery is connected	connection cause the fuse to fail? Replace the fuse or contact the manufacturer for repair. 1. Check the fan for foreign objects and regularly clear the air
The fan does not rotate	duct. 2. If the fan still does not rotate after clearing the foreign object, contact after-sales service for a replacement. 3. Is silent mode enabled?

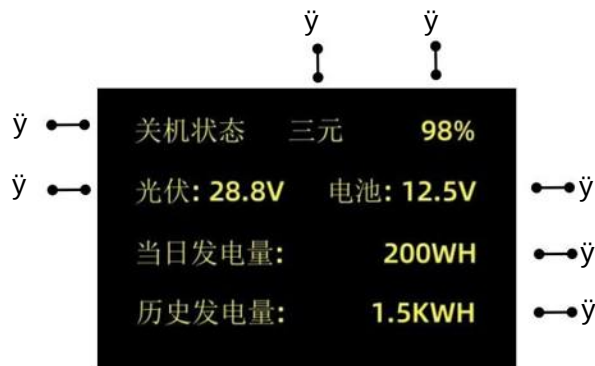
7、显示界面介绍

7.1 Start the system display interface



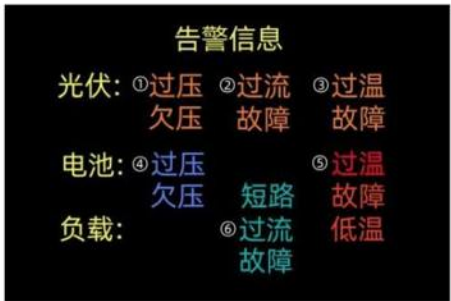
- Power-on status display
- System charging status (charging, discharging, protection)
- SOC display
- PV voltage display
- PV charging current display
- PV charging power display
- Load startup status display
- Load output current display
- Load output power display
- Battery voltage display
- Battery temperature display (not displayed if NTC is not connected)
- Battery type display (ternary, iron-lithium, lead-acid, other)

7.2 Close the system display interface



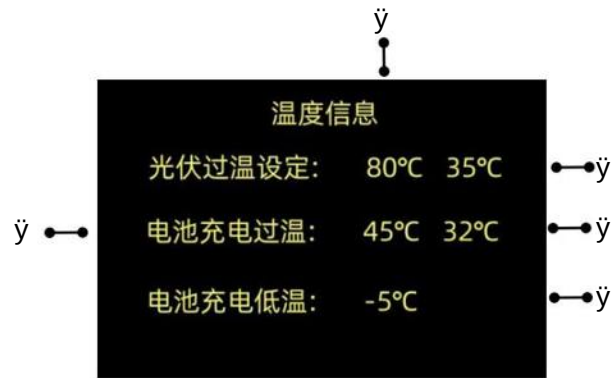
- ☐ Indicates that the device is currently powered off.
- ☐ Indicates that the current battery is a ternary type
- ☐ Display battery charge SOC
- ☐ Display the photovoltaic voltage value
- ☐ Display battery voltage value
- ☐ Display the power generation of the day
- ☐ Display historical power generation

7.3 System alarm interface "Fault": sensor failure (users can take corresponding measures based on the alarm information)



- ☐ Photovoltaic "overvoltage" and "undervoltage" prompts
- ☐ Photovoltaic "overcurrent" and "fault" prompts
- ☐ Photovoltaic "overtemperature" and "fault" prompts
- ☐ Battery "overvoltage" and "undervoltage" prompts
- ☐ Battery "overtemperature", "low temperature", "fault" prompts
- ☐ Load "short circuit", "overcurrent", "fault" prompts

7.4 System Temperature Interface



- ☐ Current photovoltaic over-temperature protection point (can be modified through the host computer)
- ☐ Current photovoltaic working real-time temperature
- ☐ Current battery charging over-temperature value (can be modified through the host computer)
- ☐ Current battery real-time temperature
- ☐ Current battery setting charging low temperature value (can be modified through the host computer)

8、产品安装

8.1 Installation Notes

- ⚠ Be very careful when installing the battery. Wear protective glasses when installing open lead-acid batteries. Once in contact with battery acid, please rinse with clean water in time.
- ⚠ Avoid placing metal objects near the battery to prevent the battery from short circuiting.
- ⚠ Acidic gas may be generated when the battery is charging. Ensure that the surrounding environment is well ventilated.
- ⚠ The battery may produce flammable gas, please keep away from sparks.
- ⚠ When installing outdoors, avoid direct sunlight and rain infiltration.
- ⚠ Loose connection points and corroded wires may cause great heat to melt the wire insulation, burn surrounding materials, and even cause fire, so make sure the connectors are tightened and the wires are
 - It is best to secure them with cable ties to prevent the wires from shaking and causing the connectors to become loose when moving.
- ⚠ When connecting the system, the voltage at the component output terminal may exceed the safety voltage for human body. When operating, be sure to use insulating tools and keep your hands dry.
- ⚠ The battery terminals on the controller can be connected to a single battery or a group of batteries. The subsequent instructions in the manual are for single battery use, but
 - The same applies to a system with a battery.
- ⚠ Please follow the safety recommendations of the battery manufacturer.
- ⚠ Ground the controller ground terminal
- ⚠ During installation, do not connect the battery in reverse, as this will cause irreversible damage.

8.2 Installation Steps

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

Step 1: Choose an installation location

Avoid installing the controller in places exposed to direct sunlight, high temperatures, or where water can easily enter, and ensure that there is good ventilation around the controller.

Step 2: Fasten the suspension screws

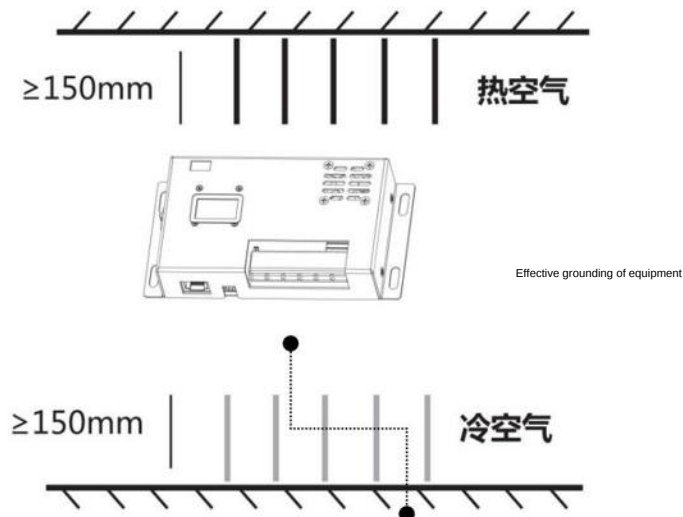
Mark the installation location according to the installation size of the controller, drill two installation holes of appropriate sizes at the two marks, and fix the screws on the two installation holes.

Step 3: Secure the controller

Align the controller's fixing holes with the two pre-fixed screws and hang it up, then tighten the two screws below.

Step 4: Secure the ground wire

Lock a wire with the screw on the side of the controller, and effectively connect the other end of the wire to the ground (you can tie it with a metal block and bury it) to prevent leakage, static electricity, and lightning current from being conducted to the ground.



9、保护功能

☐ Equipment over-temperature protection

When the internal temperature of the controller exceeds the set value, the charging power will be automatically reduced or even shut down during charging, thereby further slowing down the temperature rise inside the controller.

☐ Battery over-temperature protection

Battery over-temperature protection requires an external battery temperature sampling sensor. When the battery temperature is detected to be too high, charging will be stopped. When the battery temperature drops to

When the temperature is 5 degrees lower than the set value, it will last for 2 seconds and then automatically resume charging.

☐ Input overpower protection

When the battery panel power is greater than the rated power, the controller will limit the charging power within the rated power range to prevent excessive current from damaging the controller.

The device enters current limiting charging.

☐ The PV input voltage is too high

If the voltage at the PV array input is too high, the controller will automatically cut off the PV input.

☐ Photovoltaic input reverse polarity protection

If the polarity of the PV array is reversed, the controller will not be damaged and will continue to operate normally after the wiring error is corrected.

☐ Nighttime anti-reverse charging protection

Prevent the battery from discharging through the solar cell at night. Special note: There is no battery reverse polarity protection function

10、系统维护

In order to keep the controller at its best performance for a long time, it is recommended to check the following items regularly.

☐ When abnormal faults or error prompts are found, corrective measures should be taken promptly.

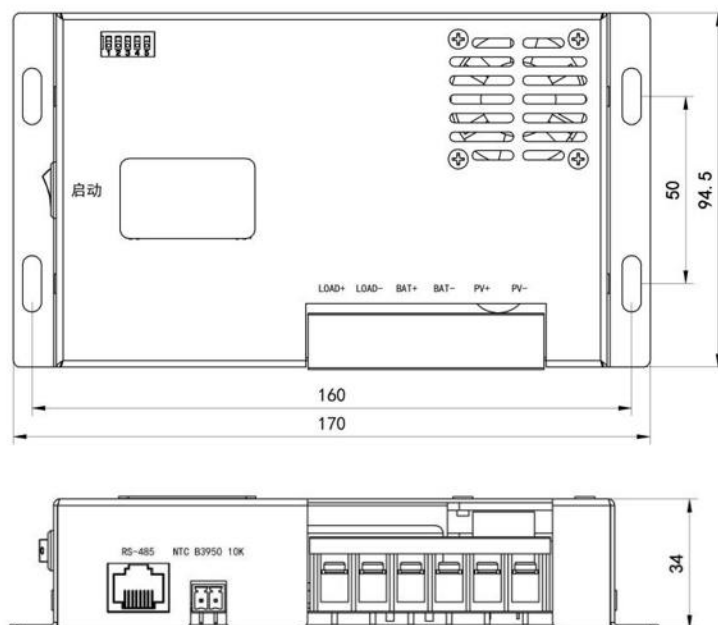
☐ Check the terminal blocks for corrosion, insulation damage, signs of high temperature, burning/discoloration, or casing deformation, and repair or replace them promptly.

☐ If any exposed, damaged, or insulation-deteriorated wires are found during inspection, they should be repaired or replaced promptly.

☐ Check for dirt, nesting insects, and corrosion and clean them immediately.

Warning: Risk of electric shock! When performing the above operations, make sure that all power to the controller is disconnected before performing the corresponding inspection or operation! Non-professionals are not allowed to operate without authorization.

11、产品尺寸示意图



12、通讯协议

12.1 Basic communication configuration

Transmission Mode	RTU	Protocol standard/function code	0x02 Read one or more input states bit by bit	
Baud rate	The default is 9600bps	This communication protocol is based on the standard MODBUS protocol>, master cycle Request data from the slave, the slave receives the request Request instructions and respond with response data.	0x03 Read holding register	Read as 16-bit words
Check digit	No verification		0x04 Read a register	Read as 16-bit words
Data bits	8bit		0x05 Write a coil status	Bitwise Write
Stop bits	1 bit		0x06 Write a holding register	Write as 16-bit words
Frame Interval	Not less than 3.5 bytes		0x10 Write multiple holding registers	Write as 16-bit words
Frame length	200 bytes		When the communication module detects an error other than a CRC error, it must send a signal back to the host. Information, the highest position of the function code is 1; 01 is an illegal function code, 02 is an illegal data address 03 Illegal data value 04 Service failure	
The maximum response time of the slave is 350 bytes.				
Host polling interval minimum 400 bytes time				

12.2 Information Address

Register address table, read corresponding function code 0x03, set corresponding function code 0x06. The address in the table below is the same as the address in the actual information frame, no need to offset or do other conversion

address (decimal)	significance	Byte read/write		example	explain
40,000	Device Model	2	R	15	20A Series
40001	Software Version	2	R	02	V02
40002	Hardware Version	2	R	01	V01
40003	Maximum Power Support	2	R	500	320W (based on PV and battery)
40004	Reserved	2	R	Not used	Reserve
40005	Photovoltaic step-down radiator temperature	2	R	25	The current system temperature is 25 degrees Celsius
40006	PV NTC status	2	R	0	0~7
40007	BAT NTC status Reserved	2	R	0	0~7
40008	Reserved	2	R	Not used	Reserve
40009	Charging	2	R	Not used	Reserve
40010	stage Charging	2	R	3	1: Activation, 2: Trickle, 3: Constant current, 4: Constant pressure
40011	status Fully	2	R	1	0: Not charging, 1: Charging
40012	charged status	2	R	1	0: Not fully charged, 1: Fully charged
40013	Current load status	2	R	1	1 is starting, 0 is shutting down
40014	Buck heat sink temperature	2	R	50	50y
40015	Reserved	2	R	Not used	Reserve
40016	Reserved	2	R	Not used	Reserve
40017	Reserved	2	R	Not used	Reserve
40018	Reserved	2	R	Not used	Reserve
40019	Reserved	2	R	Not used	Reserve
40020	PV input voltage PV input	2	R	455	45.5V
40021	current PV input power	2	R	11	1.1A
40022	PV heat sink temperature	2	R	100	100W
40023	PV fault code Battery output	2	R	20	20y
40024	voltage	2	R	0	See fault table 1
40025		2	R	252	25.2V

40026	Battery output current,	2	R	12	1.2A
40027	Battery output power,	2	R	100	100W
40028	Battery radiator temperature,	2	R	25	25℃
40029	Battery fault code,	2	R	See fault table 2	See fault table 2
40030	Load output current, Load	2	R	18	1.8A
40031	output power, Fan start	2	R	125	125W
40032	status, 40033 Historical	2	R	0	0: Disable 1: Enable
system charging WH number high 2, 40034 Historical system charging WH number			R	H+L (unit WH)	Historical total power generation WH
low 2			R		
40035	The current SOC value	2	R	982	98.2%
40036	reserves	2	R	Not used	Reserve
40037	today's power generation	2	R	855	855WH
40038	MPPT working mode	2	R	0	See function table 2
40039	Remote load switch	2 R/W		0	1: Load on; 0: Load off
40040 PV access maximum voltage setting 2 R/W				588	58.8V
40041 PV access minimum voltage setting 2 R/W				200	20.0V
40042 User-set maximum charging power 2 R/W				500	500W
40043	Reserve	2 R/W		Not used	Reserve
40044 PV stop working temperature setting 2 R/W				70	70℃
40045 Current PV start fan temperature 2 R/W				40	40℃ fan starts
40046	Device Address	2 R/W		01	Communication address: 01H
40047 Battery charging maximum voltage setting 2 R/W 40048 Battery discharging minimum voltage				588	58.8V
setting 2 R/W Reserved				240	24.0V
40049		2 R/W		Not used	Reserve
40050 Current battery discharge high temperature setting 2 R/				60	>60℃ stop load output
W 40051 Current battery discharge low temperature setting 2				-10	Stop load output when the temperature drops below -10℃
R/W 40052 Current battery charge high temperature setting 2 R/W				45	Stop charging the battery when the temperature is >45℃
40053 Current battery charging low temperature setting 2 R/W				0	<0℃ Stop charging the battery
40054	Reserved	2 R/W		Not used	Reserve
40055	setting of battery type and	2 R/W		0	0: Ternary lithium see function table 1
40056	battery string number for	2 R/W		5	5 strings of ternary lithium
40057	startup	2 R/W		1	0: Disable power generation, 1: Start power generation (default)
40058	Battery activation Set	2 R/W		0	0: Disable activation (default), 1: Activate
40059	baud rate	2 R/W		0	1:9600 (default) 0-8
40060	Backlight time	2 R/W		60	60S (default) (some models)
40061	Lock screen	2 R/W		0	0: unlock, 1: lock (some models)
40062	Reserve	2 R/W		Not used	Reserve
40063 User-set battery overvoltage value 2 R/W 40064				1600	16.0V
User-set battery undervoltage value 2 R/W 40065 User-				1000	10.0V
set load short-circuit time 2 R/W				500	500*20(us)
40066	Reserved	2 R/W		Not used	Reserve
40067		2 R/W		Not used	Reserve
40068	Reserve	2 R/W		Not used	Reserve
40069	Reserve	2 R/W		Not used	Reserve
40070	Reserve	2 R/W		Not used	Reserve

13、附件详细表

13.1 Function Table

Function table 1 (decimal)		
NMC Battery Ternary Lithium Battery		0
LFP Battery Lithium Iron Phosphate Battery		1
PAB Battery	lead-acid batteries	2
Gel Battery	Gel battery	3
SIB Battery Sodium Ion Battery		4
OTH Battery Other batteries		5
ERR	Misconfiguration	8

Function table 2 (decimal)		
MPPT->BAT	Solar panel to battery charging	0

13.2 Fault Table

Fault Table 1 (Decimal)					
OV	Solar panel overvoltage	1	SC	Solar panel short circuit	128
UV	Solar panel undervoltage	2			
OT	System overheating	4			
TF	Temperature sensor failure	8			
OC	Solar panel overcurrent	16			
OP	Solar panel power overload	32			
SF	Current sensor fault	64			

Fault Table 2 (Decimal)					
OV	Battery overvoltage	1	SF	Battery current sensor fault	128
UV	Battery undervoltage	2	SC	Battery short circuit	256
OT	Battery overheating	4	LOC1	Load level one overcurrent	512
UT	Low battery temperature	8	LOC2	Load secondary overcurrent	1024
TF	Temperature sensor failure	16	LSC	Load short circuit	2048
OC	Battery overcurrent	32	LSF	Load current sensor fault	5096
OP	Battery overload	64	PF	Abnormal battery configuration	10192

14、应用接线图

