User Manual of MPPT Solar Charge Controller

System voltage: 12V/ 24V/ 36V/ 48V/ 96V

⚠ **Important safety instructions (for the convenience of future use, please keep this handbook. Please read all the instructions and notes in the manual carefully before you install it).**

This manual contains all the safety, installation and operation instructions of the series solar charge controller (hereinafter referred to as "controller"):

➢ Please install it in the room to avoid the exposure of the components and prevent the water from entering the controller.

➢ Install the controller in well ventilated places, the controller's case temperature may become very hot during operation.

➢ It is recommended that safety or circuit breakers be connected to the input, load and battery terminals to prevent the danger of electric shock in use.

➢ After installation, check all connections are firm, to avoid the false connection caused by heat accumulation and dangerous.

➢ If the display is not displayed for the first time, please cut off the fuse or circuit breaker immediately and check whether the line is connected correctly.

➢ If the system needs to connect the inverter, please connect the inverter directly to the battery, and do not connect with the load end of the controller.

➢ When the controller is in the normal charge state, do not disconnect the battery connection, otherwise the DC load may be damaged.

Catalogue

1. MPPT Controller General Information

1.1 Overview

Thank you for choosing the MPPT solar charging controller!

The series has high conversion efficiency, efficient MPPT algorithm, neat internal structure and beautiful appearance design. With the continuous optimization of the products, the series has its unique advantages:

◆ The various sampling data show on the screen, convenient user access.

◆ The wide input voltage range of PV, suitable for a variety of commonly used specifications of solar panels.

◆ The professional adaptation of high voltage battery system, providing solutions for special applications.

◆ The extension of the functions of WIFI, wireless communication and remote cloud monitoring.

◆ Expand the function of parallel machine to meet the combination application of multiple products.

◆ The machine function and development, meet the multiple product combination application.Continuous optimization design, super high cost performance.

Features:

◆ It has an efficient MPPT algorithm, MPPT efficiency ≥99.5%，and converter efficiency up to 98%

◆ Charge mode: three stages (constant current, constant voltage, floating charge), it prolongs service life of the batteries.

◆ Four types of load mode selection: ON/OFF, PV voltage control, Dual Time control, PV+Time control .

◆ Three kinds of commonly used lead-acid battery (Seal\Gel\Flooded) parameter settings can be selected by the user, and the user can also customize the parameters for other battery charging.

◆ It has a current limiting charging function. When the power of PV is too large, the controller automatically keeps the charging power, and the charging current will not exceed the rated value.

◆ High definition LCD display function to check the device running data and working status, also can support modify the controller display parameter.

◆ Support multi - machine parallel to realize system power upgrade.

◆ RS485 communication, we can offer communication protocol to convenient user's integrated management and secondary development.

◆ Support PC software monitoring and WiFi module to realize APP cloud monitoring.

◆ CE, RoHS, FCC certifications approved, we can assist clients to pass various certifications.

◆ 3 years warranty, and 3~10 years extended warranty service also can be provided.

1.2 Characteristics
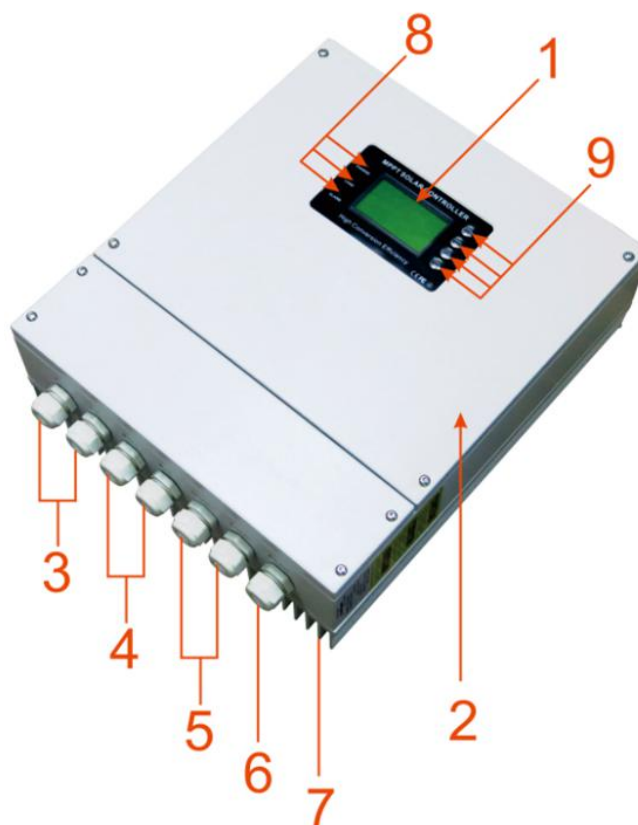
Item	Name	Item	Name
1	LCD	6	Communication interface
2	Upper cover plate	7	Heat sink
3	PV Terminals	8	Signal lamp
4	Battery Terminals	9	Button
5	Load Terminals		

1.3 Accessories Instruction
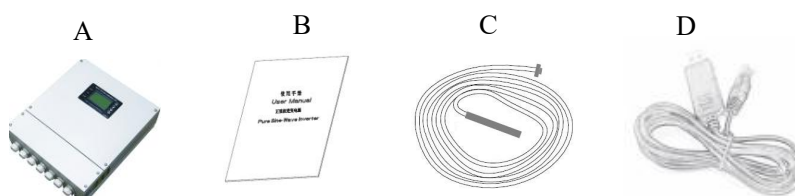
MPPT Solar Charge Controller Accessories Diagram

Remark: Extra accessories can be purchased
1.RS485 to USB cable;
2.RS485 to wifi modular

Object	Quantity	Description

A	1 unit	MPPT solar charge Controller
B	1 unit	User Manual
C	1 pcs	Temperature sensing wire
D	1 pcs	RS485 to USB cable (option)

If there is any part missing, please contact your dealer.

1.4 Maximum Power Point Tracking Technology

The MPPT controller can detect the generation voltage of the solar panel in real time and track the maximum voltage and current value (V-I), so that the system can charge the battery with the maximum power output.

Under the assumption that the conversion efficiency of the system is 100%, the following formula is established.

Input Voltage(V_{Mpp})* Input Current (I_{PV})=Battery Voltage (V_{Bat})*Charge Current (I_{Bat})

Normally, the V_{Mpp} is always higher than $V_{Bat,}$ Due to the principle of conservation of energy, the I_{Bat} is always higher than $I_{PV.}$ The greater the discrepancy between V_{Mpp} &$V_{Bat,}$ the greater the discrepancy between I_{PV}&$I_{Bat.}$ The greater the discrepancy between array and battery. This is also the simplest way to distinguish whether the real MPPT controller.

As the Figure shown below, is the maximum power point curve, the shadow is the working range of the PWM controller, it can obviously diagnose that the MPPT mode can improve the usage of the solar energy resource. According to our test, our company's MPPT controller can improve the utilization of solar array 20%~60% (The efficiency may be dirfferent due to the environment.)
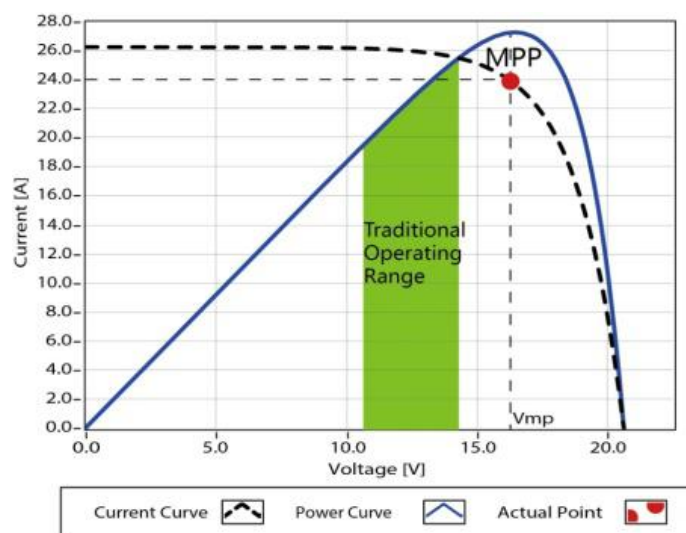
Maximum Power Point Curve

In actual application, as shading from cloud, tree and snow, the panels may have multiple MPPT points, but there is only one real Maximum Power Point. As the below Figure shows:
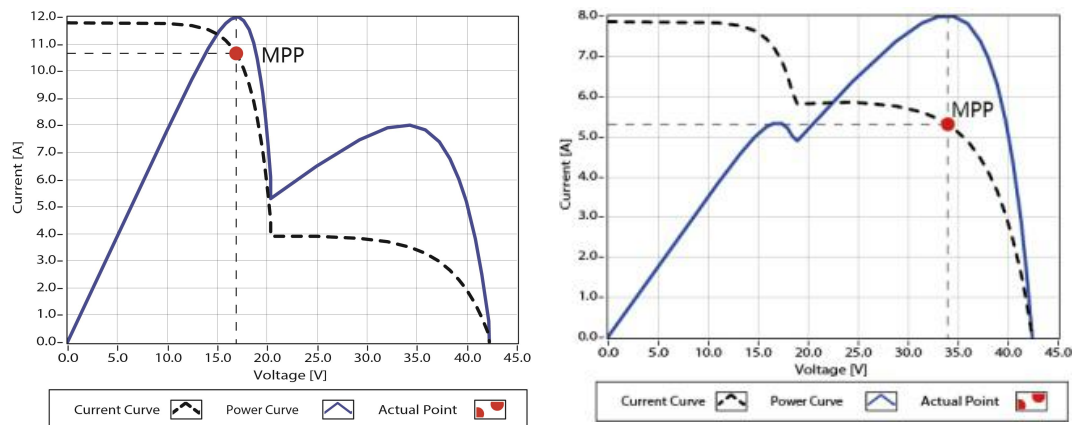
Mutil-MPP Curve

If there are multiple MPPT points, if there is no good algorithm, it will lead to work on the unreal MPPT point. Our product can track the actual MPPT point quickly and accurately, improve the utilization of array energy and avoid the waste of resources.

1.5 Battery Charging Stage

The controller have 3 stages charge mode, Constant Current Charging(Bulk Charging), Constant Voltage Charging(CV) and Floating Charging(CF) for rapid, efficient, and safe battery charging.
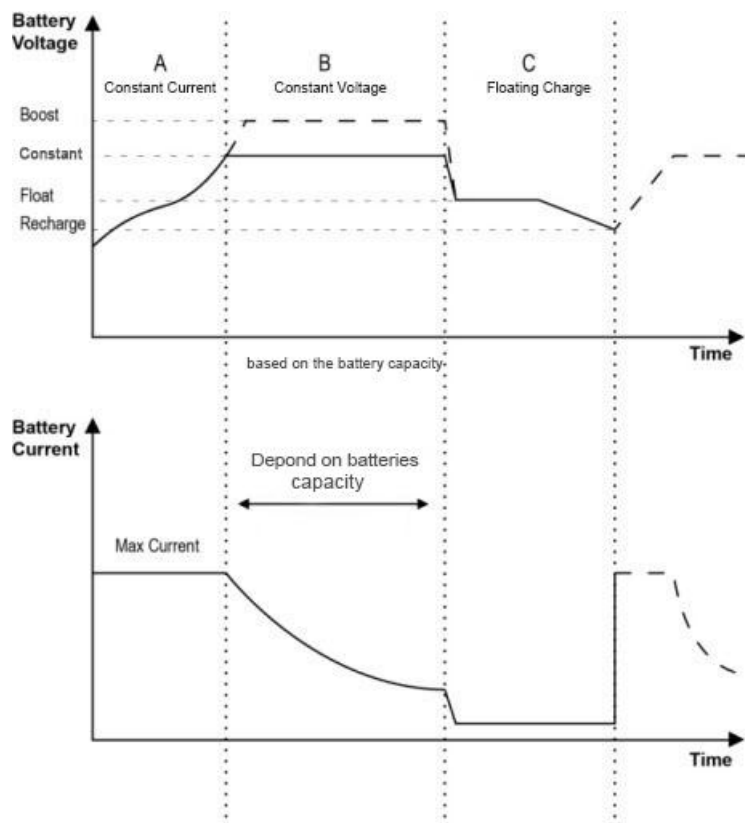
Battery Changing Stage Curve

a) Constant Current Charging_CC(Bulk Charging)

In this stage, the battery voltage has not yet reached constant voltage (Constant or Boost Voltage), the controller operates in constant current mode, delivering its maximum current to the batteries (MPPT Charging).

b) Constant Voltage Charging_CV(Constant and Boost Charging)

When the battery voltage reaches the constant voltage set point, the controller will start to operate in constant voltage charging mode, this process the charging current will drop gradually. The constant charge voltage will increase 0.2V on the basis of constant voltage at 1st of each month, charge time is 60 mins. (The data of boost charge voltage can be set via PC software and APP)

c) Floating Charging_CF

After the constant voltage stage, the controller will reduce charging current to maintaining the battery voltage on the Floating Voltage set point. Charging the battery with a smaller current and voltage on Floating Voltage stage, while maintaining full battery storage capacity.

In Floating charging stage, loads are able to obtain almost all power from solar panel.If loads exceed the power, the controller will no longer be able to maintain battery voltage in Floating charging stage. If the battery voltage remains below the Recharge Voltage, the system will leave Floating charging stage and return to Bulk charging stage.

2. Installation Instructions

2.1 Selecting the Mounting Location

✍ The position should be taken into consideration of the weight and size of the controller.

✍ The ambient temperature of the position should be within the range of -20℃ ~50℃.

✍ A good ventilation environment should be maintained in the position.

✍ Install position should avoid direct sunlight.

2.2 Safe distance

Refer to the following safety clearance to ensure that other equipment or objects are not within this range to ensure that there is sufficient space for heat dissipation.

Direction	Safety Distance
Left-Right direction	>33cm
Up-Down direction	>50cm

2.3 Dimensions

2.4 Precautions for controller installation

Please read the safety instructions of the title page carefully before installing the controller！

3. MPPT Controller Connection

3.1 Connection of the PV Power System
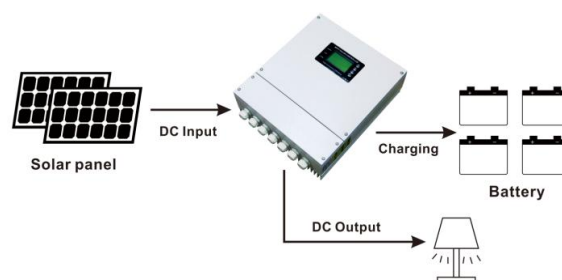
PV Power System Connection Diagram

3.2 Serial connection (string) of PV modules

As the core component of PV system, controller could be suitable for various types of PV modules and maximize converting solar energy into electrical energy. According to the open circuit voltage(V_{oc}) and the maximum power point voltage(V_{Mpp}) of the MPPT controller, the series number of different types PV modules can be calculated. The below table is for reference only.

PV$_{input}$ <DC150V Prohibit the total input voltage greater than 150V							
System Voltage	36cell Voc<23V		48cell Voc<31V		54cell Voc<34V		60cell Voc<38V
	Max.	Best	Max.	Best	Max.	Best	Max.	Best
12V	6	2~3	4	2	4	2	3	1
24V	6	3	4	2	4	2	3	2
36V	6	4	4	3	4	3	3	2~3
48V	6	5	4	4	4	4	3	3

System Voltage	72cell Voc<46V		96cell Voc<62V		Thin-Fim Module 80V<Voc<150V	
	Max.	Best	Max.	Best	Max.	Best
12V	3	1	2	1	1	1
24V	3	2	2	1	1	1
36V	3	2	2	1	1	1
48V	3	3	2	2	1	1

PV$_{input}$ <DC300V Prohibit the total input voltage greater than 300V							
System Voltage	36cell Voc<23V		48cell Voc<31V		54cell Voc<34V		60cell Voc<38V
	Max.	Best	Max.	Best	Max.	Best	Max.	Best
48V	13	5~8	9	4~6	8	4~6	7	3~5
96V	13	10~12	9	7~8	8	6~8	7	6~7

System Voltage	72cell Voc<46V		96cell Voc<62V		Thin-Fim Module 80V<Voc<150V	
	Max.	Best	Max.	Best	Max.	Best
48V	6	3~4	4	2~3	3	2
96V	6	5~6	4	4	3	3

NOTE: The above parameter values are calculated under standard test conditions (STC (Standard Test Condition): Irradiance 1000W/m^2, Module Temperature 25℃, Air Mass 1.5)

3.3 PV Array Input Total Power

This MPPT controller has a limiting function of charging current, the charging current will be limited within rated range. Therefore, the controller will charge the battery with the rated charging power even if the input power at the PV exceeds. Such as: for 96V Solar System with 60A controller, no matter the input power of the solar panel is greater than the rated number, the charging current will not be more than 60A.

The actual operation power of the PV array conforms to the conditions below

1) PV power ≤ controller rated power, the maximum power of the controller is equal to the actual power of the PV array.

2) PV power > controller rated power, the maximum charge power of the controller is equal to the rated power. If the PV array higher than rated power, the charging time at rated power to battery will be longer, more energy to battery yields. Meanwhile, it will waste the power under the fierce sunshine due to the limitation of current.

Note: for the rated power of different types of products, please refer to the technical parameters form.

3.4 System Voltage and Battery Type

1) The controller recognised the system according to the voltage of the first connected battery and reidentified after the power failure was restarted. Therefore, please confirm whether the LCD display system is consistent with the actual system when starting, otherwise, it is necessary to recheck the battery voltage.

Note:battery group detailed system identification voltage please refer to the technical parameters table!

2）The controller has been set up to charge 3 kinds of conventional battery parameters for the following forms. If you need to charge for other special batteries, please choose "User" type, then set up by PC software or APP. (parameters is in 12V system at 25℃, please use double value in 24V, use three times value in 36V and use four times value in 48V.)

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

3.5 DC Load Output Voltage and Max. Discharge Current

The controller has DC LOAD output function, and its output voltage range is the same as the battery group. If the battery's voltage is 100.8V, then DC can output a voltage of 100.8V at this moment.

3.6 Specifications for Cables and Breakers

The wiring and installation methods must conform to all national and local electrical code requirements.

PV array specification of Wiring

Since PV array output can vary due to the PV module size, connection method or sunlight angle, the minimum wire can be calculated by the Isc of PV array. Please refer to the value of Isc in PV module specification. (When the PV modules connect in series, the Isc is equal to the PV module's Isc. When the PV modules connect in parallels, the Isc is equal to the sum of PV module's Isc.)

And in order to facilitate the opening and closing of the machine and safety, it is recommended to install the circuit breaker. Please refer to the specification selection of the next table wire and circuit breaker.

Model	Rated charge current	Rated discharge current	Battery wire (mm2/AWG)	Load wire (mm2/AWG)	Breaker
50A	50A	50A	10/7	10/7	>100A
60A	60A	60A	16/6	16/6	>100A
70A	70A	70A	20/5	20/5	>125A

| 80A | 80A | 80A | 26/3 | 26/3 | >125A |
| 100A | 100A | 100A | 34/2 | 34/2 | >150A |

3.7 Steps of Switch on and off

Make sure that the controller is installed and connected as above

Opening process: Step 1: open the circuit breaker on the battery side(breaker①), make sure that the controller is connected with the battery (the LCD of the controller will display the content), and set the battery type.

Step 2: if you need to use the DC load output, then set the output control mode first, and then open the DC output circuit breaker(breaker②).

Step 3: open the circuit breaker on the input side of the solar panel PV(breaker③), if the PV input voltage is in the charge range of the controller, then the controller will enter the charging state.

Closing process: turn off the circuit breaker in turn：③②①

> **Warning：**
> ➢ If the system needs to connect the inverter, please connect the inverter directly to the battery, and do not connect with the load end of the controller.
> ➢ When the controller is in the normal charge state, do not disconnect the battery connection, otherwise the DC load may be damaged.Therefore, the damage to the controller will not be within the warranty.

## 3.8 Communication port description

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

Note: a communication port will be occupied when the user uses parallel machine functions. In this

time, PC monitoring and WIFI APP remote monitoring can not be performed (such as the use of PC monitoring software and APP to obtain messy data).

The communication port is the standard 8 line RJ45 interface, and the pin is defined as follows:

PIN	Function
1	RS485-A
2	RS485-B
3	Empty
4	Empty
5	GND
6	GND
7	+5V
8	+5V
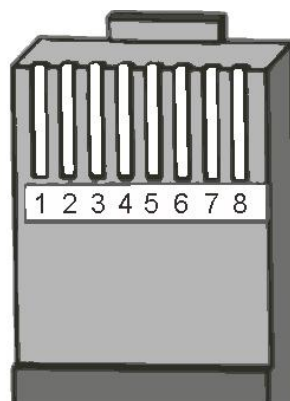
(**Note:** the definition of the foot is only applicable to the related products of our company!)

4. Operation

4.1 Meaning of LED and function key

LEDs and Buttons	Instruction
ALARM (Red)	Controller in fault state
CHANGE(Blue)	Controller start to charge power
LOAD(Green)	DC load turn on
UP	Page up and numerical increase
DOWN	Page down and numerical reduction
ENTER	Enter in
ESC	Exit and save data

Charge indicator light instruction

This controller have 3 mode :

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

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

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

In CF Mode ,the light will keep on .

4.2 Menu introduction

Main menu	Display contents		introduction
Work Status	Fault		Normal work will display No Fault.
			Off normal work will display related Fault：
			BatOVP：battery overcharge protection
			PVOVP：PV input over voltage protection
			ChgOCP：over Charge current protection
			LoadOCP：load output over current protection
			BatOTP：battery over temperature protection
			CHGOTP：MPPT internal over temperature protection
			PVUVP mean：PV input low voltage protection
	Charging mode:		CC or CV or CF
	PV Volt		PV input voltage
	Bat Temp		After accessing the battery temperature line, the real-time temperature of the battery pack will be displayed.
	HS Temp		Temperature of heat sink
	Load Current		DC load output current
	Charge Current		Charging current
	Charge Power		Charging power
	Charge Volt		Charging voltage
Setting	Load Set	Load：	DC Load control mode：
			1.**ON/OFF** mode
			2.**Light Ctrl** mode
			3.**FT1-LigCtr-X** :Fix-time control mode:
			Load:FT1-LigCtr-X Shut down after X hours in the dark
			Ctr2:FT2-LigCt-X Turn on X hours before daylight
			4.**D-Time Ctrl** Dual period control mode
	Time&Date Set	Time	Time Set
		Date	Date Set
	Bat Type Setting	Type：	Selection of battery type（GEL,SEL,FLD,USER）
		Num:	Machine category selection (0 represents common, 1 represents host).
		Bulk Volt:	Bulk Volt Set
		Float Volt:	Float Volt Set
		MaxChgCurr:	Set the Max. charge current
Information	96V 60A		Controller model
	96V BAT CHG SYS		System voltage
	Load：		DC output control mode after user set
	TOTAL：		Total energy from this machine
	Firmware ：		Firmware Ver.
	Bat ：		Battery Type display

5. Parameters

		48BL-80A	48BL-100A	48BH-80A	96BH-50A
Product category	Controller Properties	MPPT (maximum power point tracking)			
	MPPT efficiency	≥99.5%			
	Standby power	<3‰Rated power			
	System voltage	Automatic recognition		48V	96V
	Heat-dissipating method	Air cooling			
	Range of system voltage identification	9V~15V (12V sys) \18V~30V(24V sys)\ 32V~40V(36V sys)\42V~60V(48V sys)		36V~60V	72V~120V
Input Characteristics	Max.PV input voltage(VOC)	DC150V		DC300V	
	Start the charge voltage point	Battery voltage + 3V		Battery voltage + 10V	
	Low input voltage protection point	Battery voltage + 2V		Battery voltage + 5V	
	Over voltage protection point	DC150V		DC300V	
	Over voltage recovery point	DC145V		DC290V	
	Rated PV power — 12V system	1040W	1300W	—	—
	24V system	2080W	2600W	—	—
	36V system	3120W	3900W	—	—
	48V system	4160W	5200W	4160W	—
	96V system	—	—	—	5200W
Charge Characteristics	Selectable Battery Types (Default Gel battery)	Sealed lead acid, Gel battery, Flooded(Other types of the batteries also can be defined)			
	Charge rated current	80A	100A	80A	50A
	Output Voltage Stability Precision	≤±1.5%			
	Charge Method	3-Stage: constant current(fast charging)-constant voltage-floating charge			
LOAD Characteristics	Load voltage	The same as the battery voltage			
	Load rated current	80A	100A	80A	50A
	Load control mode	On\Off mode, PV voltage control mode,Dual-time control mode, PV + Time control mode			
	Low voltage protection	The default protection point is 10.5V, and it is restored to 11V (can be set)			
	Setup mode	PC software /APP/ controller display			
Display & Communication	Display mode	LCD (128*64 dots) &backlight			
	Communication mode	8-pin RJ45 port/RS485/support PC software monitoring/ support WiFi module to realize APP cloud monitoring			
Other Parameters	Protect function	Input-output over \ under voltage protection,Prevention of connection reverse protection etc.			
	Operation Temperature	-20℃~+50℃			
	Storage Temperature	-40℃~+75℃			
	IP(Ingress protection)	IP67			
	Max. connection size	50mm^2			
	Net Weight (kg)	7.1			
	Gross Weight (kg)	8.8			
	Product Size (mm)	420*280*95			
	Packing Size(mm)	510*368*210			

6. maintenance and cleaning

6.1 replacement fuse

If the insurance is caused by high temperature or other faults, the fuse needs to be replaced correctly. Remove the broken fuse from the interface, install the new fuse, check whether the connection is correct, and install the equipment.

6.2 clean air vent radiator

Clean the fan vent and internal heat sink regularly and wipe with dry or wet cloth.

Note: no washing liquid or corrosive solvent can be used, and liquid is not allowed to flow into the machine to ensure that the ventilation holes of the equipment are not blocked.

7. warranty

Within the warranty period, the controller can be repaired free of charge if it is not caused by improper operation, otherwise the cost of repair will be charged.

In the delivery of the agent, please properly package the equipment to avoid damage to the equipment in the transportation.

8. Warranty card

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MPPT controller warranty card			
Name		**Country**	
Addr		**mail**	
Tele-Number		**Zip code**	
Date of purchase		**Supplier**	
Install date		**installation personnel**	
Contact information			
Controller model			
Solar controller sequence number			
Battery pack parameters			
Parameters and configuration mode of solar energy components			
Remarks			