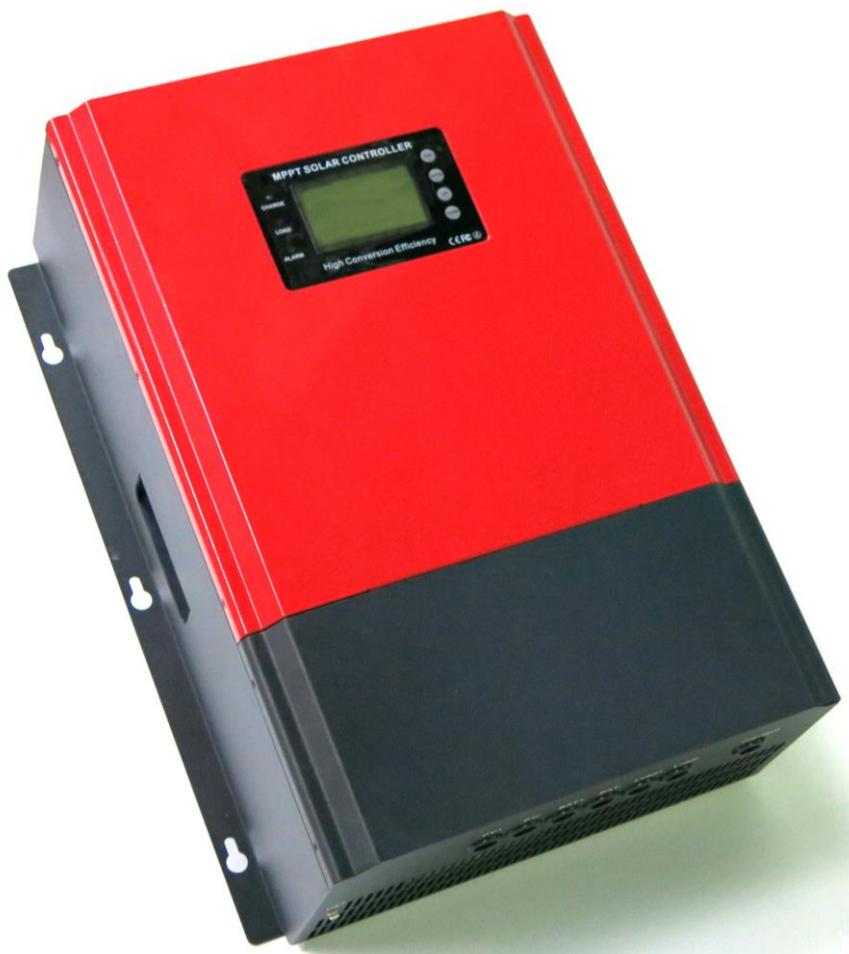


# User Manual of MPPT Solar Charge Controller



Model #	Battery system	Max. PV input voltage	Rated current
SMG-B96-80A	96V	430V	80A
SMG-B96-100A	96V	430V	100A
SMG-B120-50A	120V	430V	50A
SMG-B192-60A	192V	430V	60A
SMG-B192-100A	192V	430V	100A
SMG-B216-60A	216V	430V	60A
SMG-B240-60A	240V	430V	60A
SMG-B240-80A	240V	660V	80A
SMG-B384-80A	384V	850V	80A



**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.

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### 1. MPPT Controller General Information

## 1.1 Overview

Thank you for choosing the MPPT solar charging controller!

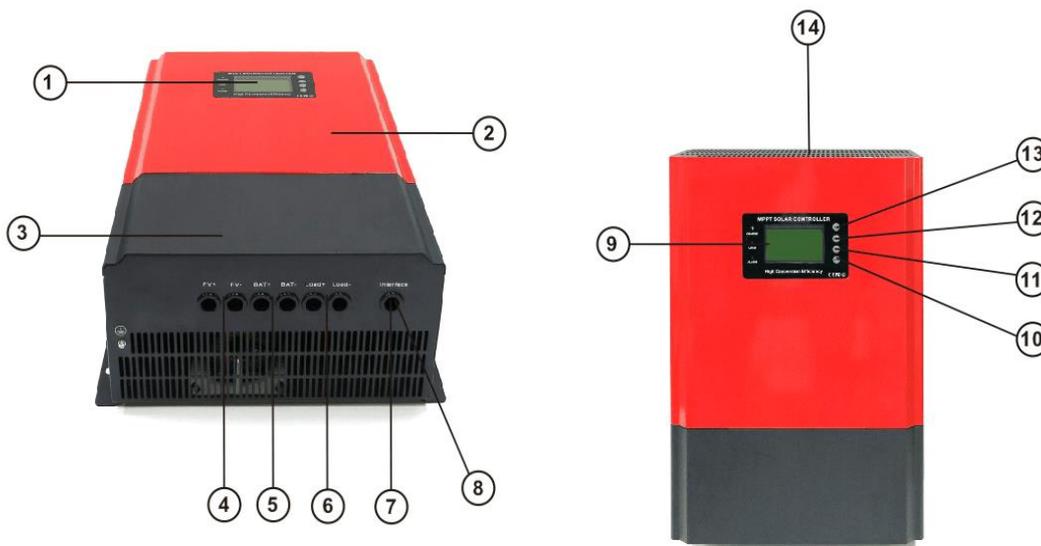
The series has high conversion efficiency, efficient MPPT algorithm, neat internal structure and beautiful appearance design. With the continuous optimization of the products, the series has its unique advantages:

- ◆ 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:

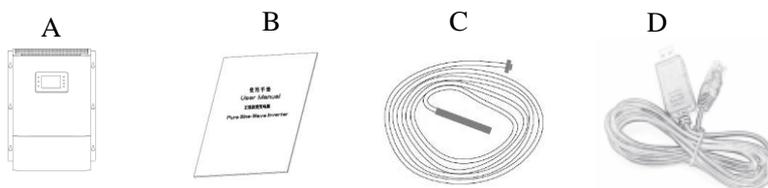
- ◆ It has an efficient MPPT algorithm, MPPT efficiency  $\geq 99.5\%$ , and converter efficiency up to 98%
- ◆ Charge mode: three stages (constant current, constant voltage, floating charge), it prolongs service life of the batteries.
- ◆ Four types of load mode selection: ON/OFF, PV voltage control, Dual Time control, PV+Time control .
- ◆ Three kinds of commonly used lead-acid battery (Seal\Gel\Flooded) parameter settings fcan 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	7	Communication interface
2	Upper cover plate	8	Bat. Temp interface
3	Connection cover plate	9	Signal lamp
4	PV Terminals	10~13	Button
5	Battery Terminals	14	Fan channel
6	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

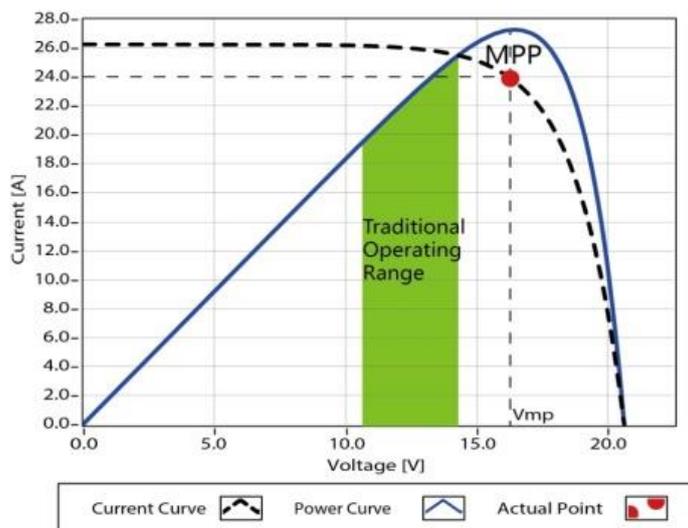
The MPPT controller can detect the generation voltage of the solar panel in real time and track the maximum voltage and current value (V-I), so that the system can charge the battery with the maximum power output.

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

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

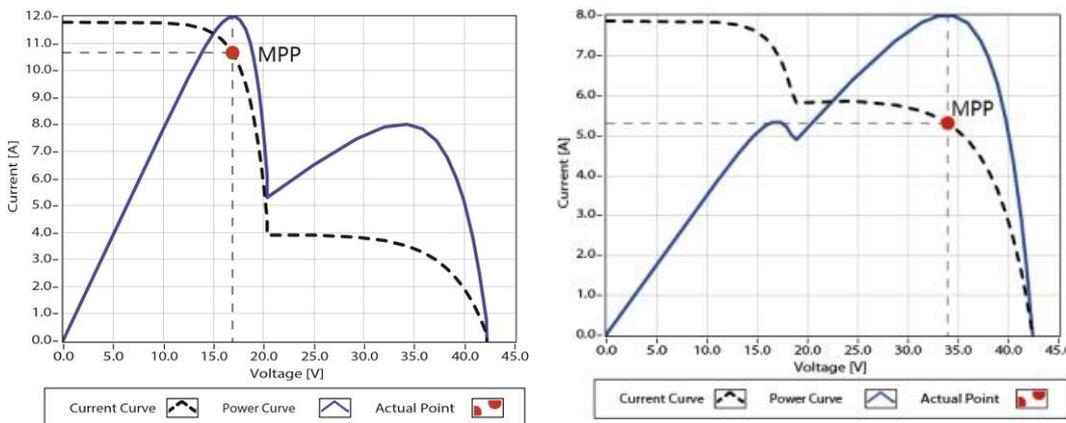
Normally, the  $V_{Mpp}$  is always higher than  $V_{Bat}$ . Due to the principle of conservation of energy, the  $I_{Bat}$  is always higher than  $I_{PV}$ . The greater the discrepancy between  $V_{Mpp}$  &  $V_{Bat}$ , the greater the discrepancy between  $I_{PV}$  &  $I_{Bat}$ . The greater the discrepancy 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 different 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:

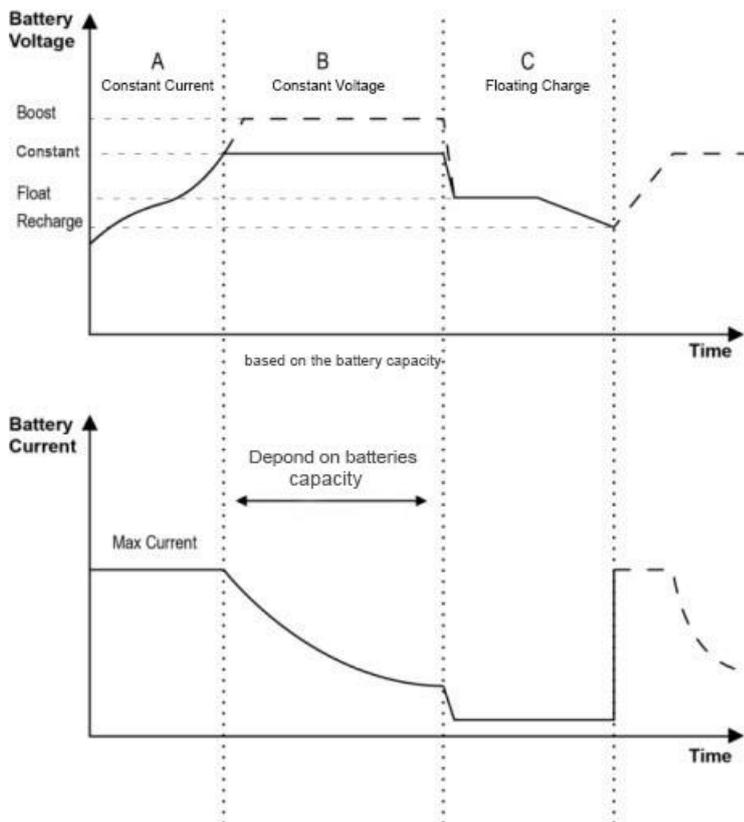


Mutil-MPP Curve

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**

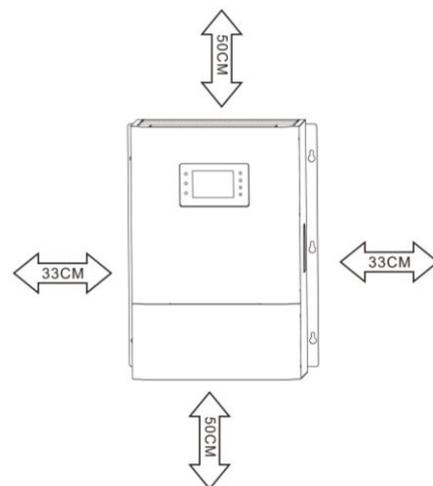
**2.1 Selecting the Mounting Location**

- ☞ 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°C ~50°C.
- ☞ A good ventilation environment should be maintained in the position.
- ☞ Install position should avoid direct sunlight.

**2.2 Safe distance**

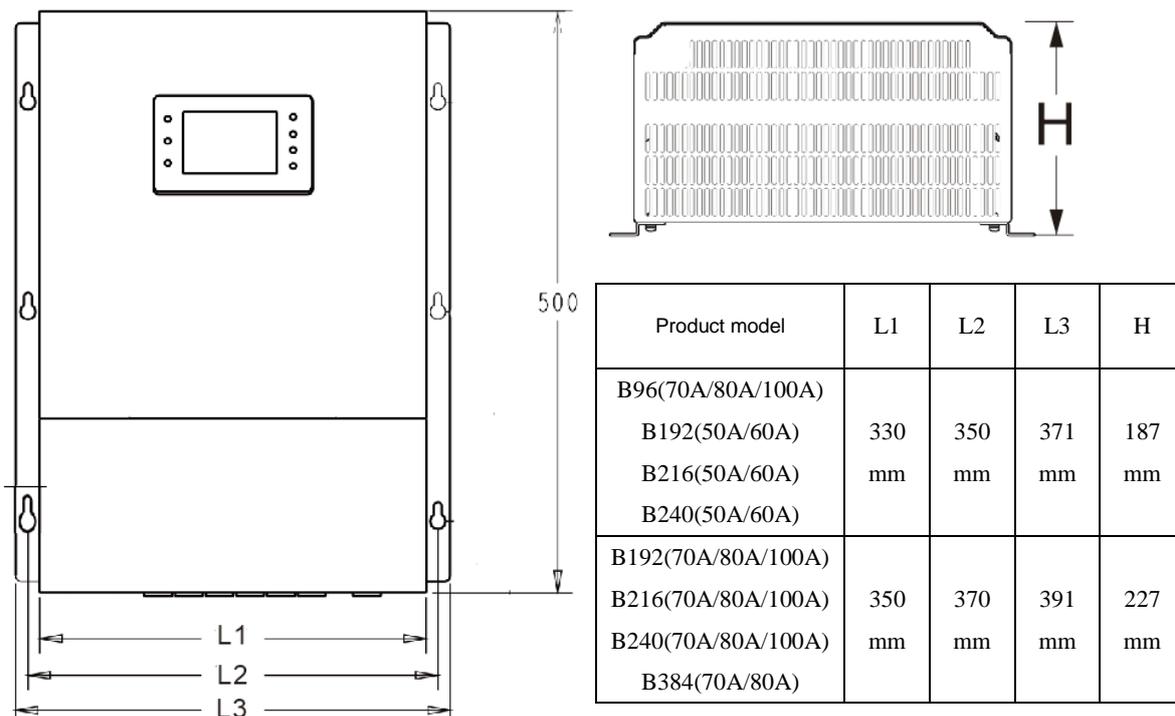
Refer to the following safety clearance to ensure that other equipment or objects are not within this range to ensure that there is sufficient space for heat dissipation.

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



Controller Safety Distance

**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 <sub>input</sub> <DC430V Prohibit the total input voltage greater than 430V								
System Voltage	36cell Voc<23V		48cell Voc<31V		54cell Voc<34V		60cell Voc<38V	
	Max.	Best	Max.	Best	Max.	Best	Max.	Best
96V	18	10~15	13	8~11	12	7~10	11	6~9
192V	18	15~18	13	11~13	12	11~12	11	10~11
216V	18	16~18	13	12~13	12	11~12	11	10~11
240V	18	17~18	13	13	12	12	11	11
System Voltage	72cell Voc<46V		96cell Voc<62V		Thin-Fim Module 80V<Voc<150V			
	Max.	Best	Max.	Best	Max.		Best	
96V	9	5~7	7	4~6	4		2~3	
192V	9	7~9	7	5~6	4		3	
216V	9	8~9	7	6	4		3	
240V	9	9	7	6	4		3~4	

PV <sub>input</sub> <DC660V Prohibit the total input voltage greater than 660V								
System Voltage	36cell Voc<23V		48cell Voc<31V		54cell Voc<34V		60cell Voc<38V	
	Max.	Best	Max.	Best	Max.	Best	Max.	Best
192V	28	17~23	21	12~17	19	11~15	17	10~13
216V	28	18~24	21	13~18	19	12~16	17	11~14
240V	28	19~25	21	14~19	19	13~17	17	12~15
System Voltage	72cell Voc<46V		96cell Voc<62V		Thin-Fim Module 80V<Voc<150V			
	Max.	Best	Max.	Best	Max.		Best	
192V	14	8~11	10	6~8	6		4	
216V	14	9~12	10	7~8	6		4~5	
240V	14	10~12	10	8	6		5	

PV <sub>input</sub> <DC850V Prohibit the total input voltage greater than 850V								
System Voltage	36cell Voc<23V		48cell Voc<31V		54cell Voc<34V		60cell Voc<38V	
	Max.	Best	Max.	Best	Max.	Best	Max.	Best
384V	36	32~36	27	24~27	25	22~25	22	19~22
System Voltage	72cell Voc<46V		96cell Voc<62V		Thin-Fim Module 80V<Voc<150V			
	Max.	Best	Max.	Best	Max.		Best	
384V	18	16~18	13	12~13	8		7~8	

**NOTE:** The above parameter values are calculated under standard test conditions (STC (Standard Test Condition): Irradiance 1000W/m<sup>2</sup>, Module Temperature 25°C, 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 can charge the DC12V, DC24V, DC36V and DC48V batteries. 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°C, please use 8 times value in 96V, use 16 times value in 192V and use 32 times value in 384V etc.)

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 I<sub>sc</sub> of PV array. Please refer to the value of I<sub>sc</sub> in PV module

specification. (When the PV modules connect in series, the I<sub>sc</sub> is equal to the PV module's I<sub>sc</sub>. When the PV modules connect in parallels, the I<sub>sc</sub> is equal to the sum of PV module's I<sub>sc</sub>.)

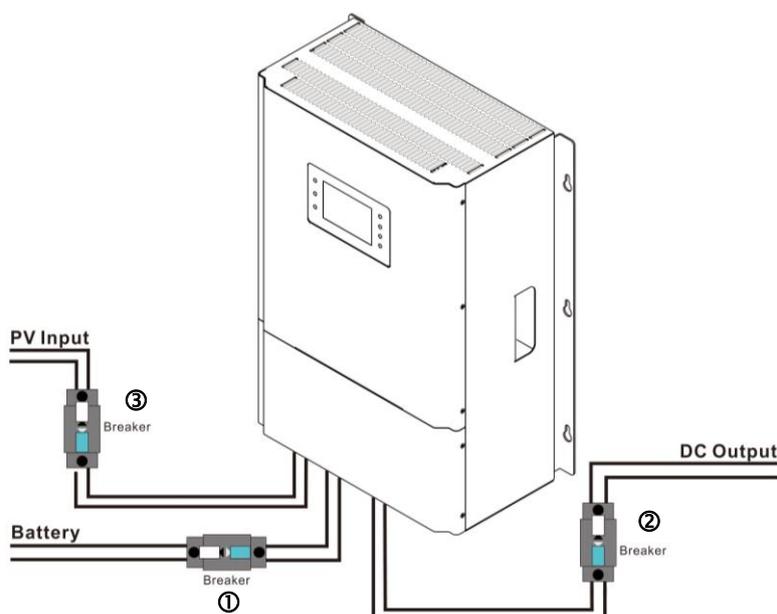
And in order to facilitate the opening and closing of the machine and safety, it is recommended to install the circuit breaker. Please refer to the specification selection of the next table wire and circuit breaker.

Model	Rated charge current	Rated discharge current	Battery wire (mm <sup>2</sup> /AWG)	Load wire (mm <sup>2</sup> /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

Before you connect the wire, please open the product case. After done it, please close and locked them, it is helpful to protect the connection port.



### 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**

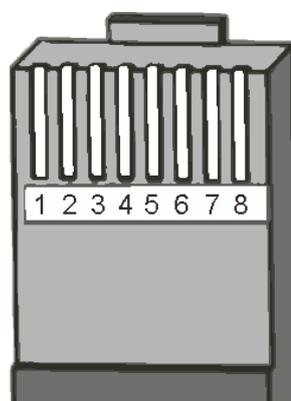
The communication port of the controller can match our RS485-USB communication line to achieve PC terminal monitoring software communication. It can also match our WIFI module products to achieve remote APP cloud monitoring.

**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:

(Note: the definition of the foot is only applicable to the related products of our company!)

PIN	Function
1	RS485-A
2	RS485-B
3	Empty
4	Empty
5	GND
6	GND
7	+5V
8	+5V



**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 Mode

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

#### 4.2.1 Menu content description

Main menu	Display contents	introduction
<b>Work Status</b>	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	
<b>Setting</b>	Load Set	Load:	DC Load control mode: 1. <b>ON/OFF</b> mode 2. <b>Light Ctrl</b> mode 3. <b>FT1-LigCtr-X</b> :Fix-time control mode: <b>Load:FT1-LigCtr-X</b> Shut down after X hours in the dark <b>Ctr2:FT2-LigCt-X</b> Turn on X hours before daylight 4. <b>D-Time Ctrl</b> 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		
<b>Information</b>	192V 60A		Controller model	
	192V 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

	Series	SMG-B96			SMG-B192\SMG-B216 (220) \SMG-B240					SMG-B384	
	Power model	70A	80A	100A	50A	60A	70A	80A	100A	70A	80A
<b>Product category</b>	Controller Properties	MPPT (maximum power point tracking)									
	MPPT efficiency	≥98%	≥98%	≥98%	≥98%	≥98%	≥98%	≥98%	≥98%	≥98%	≥98%
	System voltage	DC96V			DC192V\DC216V(DC220V)\DC240V					DC384V	
	Range of V <sub>identification</sub>	DC72V~DC128V			DC144V~DC256V\DC162V~DC288V\DC180V~DC320V					DC288V~DC512V	
	Heat-dissipating method	Intelligent fan cooling									
<b>Input Characteristics</b>	Open circuit V <sub>max-pv</sub>	DC430V			DC430V	DC430V	DC660V	DC660V	DC660V	DC850V	
	Start charge V <sub>start-pv</sub>	V <sub>bat</sub> +20V	V <sub>bat</sub> +20V	V <sub>bat</sub> +20V	V <sub>bat</sub> +20V	V <sub>bat</sub> +20V	V <sub>bat</sub> +20V	V <sub>bat</sub> +20V	V <sub>bat</sub> +20V	V <sub>bat</sub> +20V	V <sub>bat</sub> +20V
	Low protection V <sub>low-pv</sub>	V <sub>bat</sub> +10V	V <sub>bat</sub> +10V	V <sub>bat</sub> +10V	V <sub>bat</sub> +10V	V <sub>bat</sub> +10V	V <sub>bat</sub> +10V	V <sub>bat</sub> +10V	V <sub>bat</sub> +10V	V <sub>bat</sub> +10V	V <sub>bat</sub> +10V
	Over protection V <sub>over-pv</sub>	DC430V	DC430V	DC430V	DC430V	DC430V	DC660V	DC660V	DC660V	DC850V	DC850V
	Rated PV power	7280W	8320W	10400	10400W\13000W	12480W\15600W	14560W\18200W	16640W\20800W	20800W\26000W	29120W	33280W
<b>Charge Characteristics</b>	Selectable Battery Types	Sealed lead acid, Gel battery, Flooded (Other types of the batteries also can be defined)-- Default Gel battery									
	Charge rated current	70A	80A	100A	50A	60A	70A	80A	100A	70A	80A
	Charge Method	3-Stage: constant current(fast charging)-constant voltage-floating charge									
<b>LOAD Characteristics</b>	Load voltage	The same as the battery voltage			The same as the battery voltage		N/A	N/A	N/A	N/A	N/A
	Load rated current	70A	80A	100A	50A	60A	N/A	N/A	N/A	N/A	N/A
	Load control mode	On\Off mode, PV voltage control mode, Dual-time control mode, PV + Time control mode					N/A	N/A	N/A	N/A	N/A
<b>Display &amp; Communication</b>	Display mode	LCD128*64 dots/ backlight display									
	Communication mode	8-pin RJ45 port/RS485/support PC software monitoring/support WiFi module to realize APP cloud monitoring									
<b>Other</b>	Protect function	Input-output over \ under voltage protection, Prevention of connection reverse protection etc.									

Parameters	Operation Temperature	-20°C~ +50°C			
	Storage Temperature	-40°C~ +75°C			
	IP(Ingress protection)	IP21			
	Net Weight (kg)	14.7kg	14.7kg	18.8kg	18.8kg
	Gross Weight (kg)	16.6kg	16.6kg	20.6kg	20.6kg
	Product Size (mm)	371*500*187	371*500*187	391*500*227	391*500*227
	Packing Size(mm)	590*420*270	590*420*270	590*440*320	590*440*320

## 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

<b>MPPT controller warranty card</b>			
<b>Name</b>		<b>Country</b>	
<b>Addr</b>		<b>mail</b>	
<b>Tele-Number</b>		<b>Zip code</b>	
<b>Date of purchase</b>		<b>Supplier</b>	
<b>Install date</b>		<b>installation personnel</b>	

<b>Contact information</b>	
<b>Controller model</b>	
<b>Solar controller sequence number</b>	
<b>Battery pack parameters</b>	
<b>Parameters and configuration mode of solar energy components</b>	
<b>Remarks</b>	

