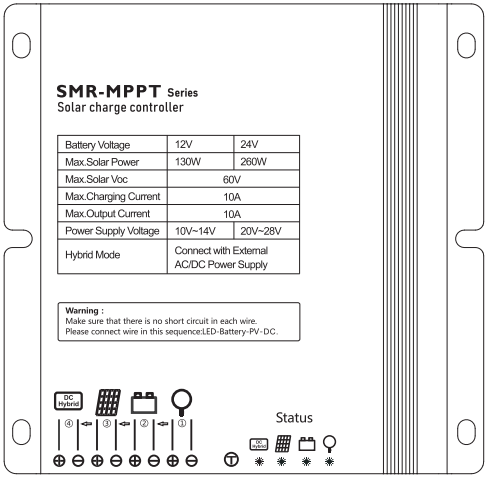
SMR-MPPT series
Solar charge controller
(RS485 communication optional)
12/24V，10A



User Manual

User Manual_SMR-MPPT series_PD
CE, RoHS, ISO9001:2015
Subject to change without notice!

Dear Clients,

Thanks for selecting the SMR-MPPT series solar controller!Please take the time to read this user manual, this will help you to take advantage of controller' s new features.This manual gives important recommendations for installing, programming, using and so on. Read this user manual in full before installing or connecting the solar controller.

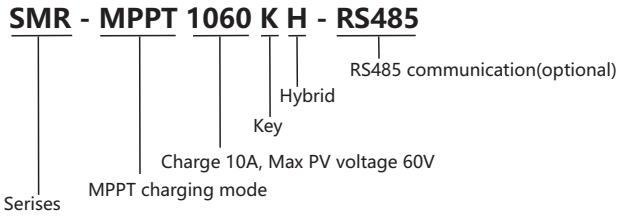
1. Product overview

SMR-MPPT series solar controller, designed for the use of solar energy systems intelligent programming MPPT controller.The charging efficiency is about 20% higher than the traditional PWM controller, which can drop the cost of the whole system.

1.1 Product features

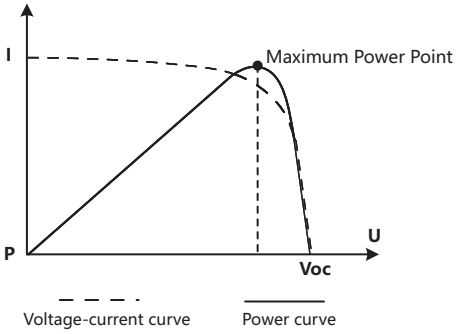
- Innovative Maximum Power Point Tracking(MPPT) technology, tracking efficiency >99.9%.
- High charge conversion efficiency up to 97.2% .
- Monitoring of the running status and parameters.
- Dual automatic limit function for rated charging current and charging power.
- Clear and easy to understand charging and discharging, fault indication.
- Suitable for Gel, Liquid, AGM and Lithium battery.
- External temperature sensor with automatic temperature compensation.
- Automatic over-temperature power reduction function .
- Four stage charging: MPPT, boost, equalization, float.
- When BMS power off because of LVD, it can activate the system automatically.
- The battery and mains power (DC) complement each other, and the load power supply priority can be set. The controller automatically switches between the two according to the setting to ensure the normal operation of the load.
- 0℃ Charging Protection(Lithium).
- Based RS-485 standard Modbus protocol.
- Equipped with buttons and digital tubes for quick setting of controller parameters.
- The communication interface provides external power supply.
- Waterproof IP67, Strong and durable aluminum case.
- Perfect EMC & thermal design.
- Full automatic electronic protect function

1.2 Product naming rules



2. Instructions

2.1 MPPT charging introduction



MPPT, the full name of "maximum power point tracking", is an advanced charging method. The MPPT controller can detect the power generation of the solar panel in real time and track the maximum voltage current value (VI), so that the system can charge the battery at the highest efficiency. Compared with the traditional PWM controller, the MPPT controller can play the maximum power of the panel, so it can provide a larger charging current, generally speaking, MPPT can improve the energy utilization rate of 15% to 20% than the PWM controller.

2.2 MPPT-Four Chargeing Stage

Battery type: AGM/GEL/LIQ.

As shown in Figure 2-2, the lead-acid battery is charged in the following stages: MPPT charge, constant voltage charge (Equalization charge/Boost charge/Float charge).

The constant voltage charging stage is divided into three stages: Equalization charge, Boost charge and Float charge:

- **MPPT Charge**
  When the battery voltage does not reach the target constant voltage value, the controller will carry out MPPT charging. When the battery voltage reaches the constant voltage value, the MPPT charging will automatically exit and enter the constant voltage charging (Equalization charge/Boost charge/Float charge).
- **Boost Charge**
  When the battery has recharged to the Boost voltage setpoint, the controller will charge at a constant voltage, and the charging current will gradually decrease over time. This process will be maintained for 120 minutes before switching to a floating charge.
- **Equalization Charge**
  Certain types of batteries benefit from periodic equalizing charge, which can stir the electrolyte, balance battery voltage and complete chemical reaction. Equalizing charge increases the battery voltage, higher than the standard complement voltage, which gasifies the battery electrolyte.

※ If the controller detects that the battery voltage is too low, it will automatically start balanced charging, which takes 120 minutes, and then switch to float charging.
※ Balanced charging and strong charging are not repeated during a single full charge process to avoid excessive gas release or battery overheating.

WARNING: Risk of explosion!
Equalizing flooded battery can produce explosive gases, so well ventilation of battery box is necessary.

- **Float Charge**
  After the Boost voltage stage, the controller will reduce the battery voltage to Float voltage setpoint. When the battery is fully recharged, there will be no more chemical reactions and all the charge current transmits into heat and gas at this time. Then the controller reduces the voltage to the floating stage, charging with a smaller voltage and current. It will reduce the temperature of battery and prevent the gassing, also charging the battery slightly at the same time. The purpose of Float stage is to offset the power consumption caused by self consumption and small loads in the whole system, while maintaining full battery storage capacity.
  In Float stage, loads can continue to draw power from the battery. In the event that the system load(s) exceed the solar charge current, the controller will no longer be able to maintain the battery at the Float setpoint. Should the battery voltage remains below the boost reconnect charging voltage, the controller will exit Float stage and return to Bulk charging.

2.3 Lithium battery charging mode

Battery types are available in four and eight series lithium iron phosphate.

As shown in Figure 2-3, the lithium battery charging stage includes: MPPT charging/constant voltage charging.

- **MPPT charging stage:** When the battery voltage has not reached the overcharge protection voltage, the controller will charge MPPT. When the battery voltage reaches the overcharge protection voltage, the MPPT charging will automatically exit and enter the constant voltage charging.
- **Constant voltage charging stage:** the lithium battery is in the constant voltage charging stage, when the battery voltage reaches the overcharge protection voltage, the controller will carry out constant voltage charging, and the charging current will gradually decline over time, this process will remain for 60 minutes, and then stop charging, and re-enter the next charging cycle when the battery voltage reaches the overcharge recovery voltage.

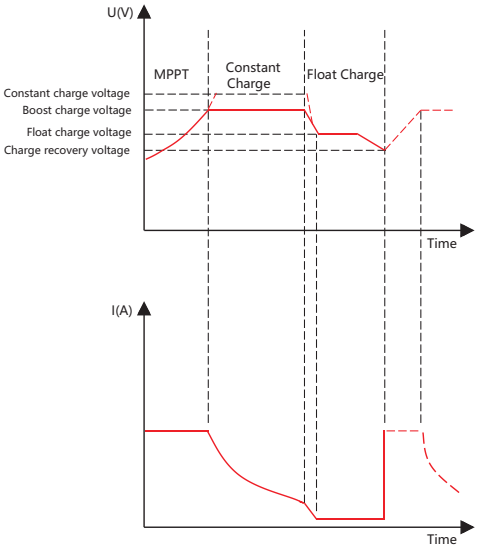


Figure 2-2 Lead-acid battery charging curve

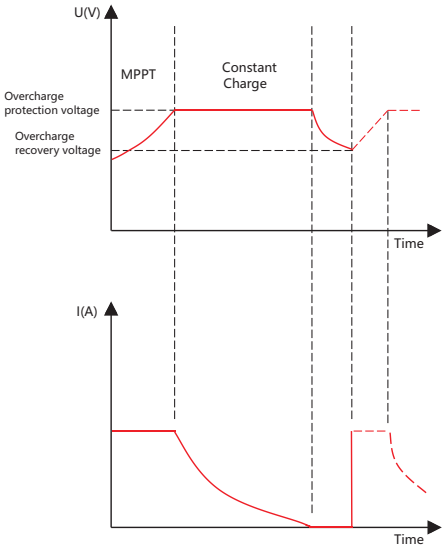


Figure 2-3 Lithium battery charging curve

3. Safty Instruction and Waiver of Liability

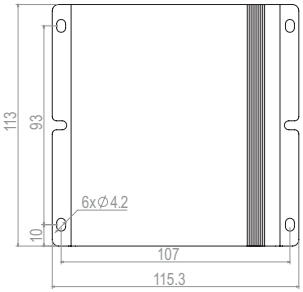
3.1 Safety

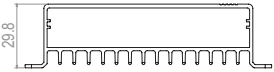
①The solar charge controller may only be used in PV systems in accordance with this user manual and the specs of other module manufacturers. No energy source other than solar gen. may be connected to the solar charge controller.
②Batteries store a large amount of energy, never short circuit a bat. under all circumstances. We strongly recommend connecting a fuse directly to the battery to protect any short circuit at the bat. wiring.
③Batteries can produce flammable gases. Avoid making sparks, fire or any naked flame. Make sure that the bat. room is ventilated.
④Avoid touching or short circuiting wires or terminals. Be aware that the voltages on special terminals or wires can be as much as twice the battery voltage. Use isolated tools, stand on dry ground, and keep your hands dry.
⑤Keep children away from batteries and the charge controller.

3.2 Liability Exclusion

The manufacturer shall not be liable for damages, especially on the battery, caused by use other than as intended or as mentioned in this manual or if the recommendations of the battery manufacturer are neglected. The manufacturer shall not be liable if there has been service or repair carried out by any unauthorized person, unusual use, wrong installation, or bad system design.

4. Dimensions (Unit: mm)



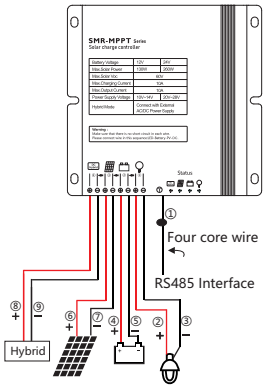


SMR-MPPT1060KH

5. Installation

5.1 Electrical connection diagram

The following diagrams provide an overview of the connections and the proper order.



RS485(optional)

Female connector

Num	Wire	RS485
1	Black	GND
2	Blue	RS485-A
3	Green	RS485-B
4	Brown	B+

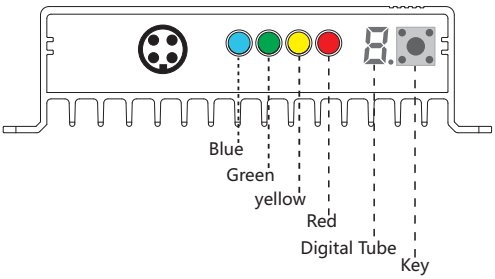
1.The connectors with electricity are prohibited to connect together!
2.GND is not connected to B-.

5.2 Wiring steps

①First connect the RS485 well(If there is no RS485 interface, proceed to the second step directly);
②As the chart, Connect the load first with corresponding red(positive) and black (negative) cables, then seal them with tape.
③Connect the battery with corresponding positive and negative cables, load will be on.
④Connect panel with the corresponding red(positive) and black(negative) cables, the controller begins charging.
⑤Finally, connect the external mains power (DC) to the DC terminal of the controller.
⑥Confirm the LED display status, please refer to the "**10.2 Faults and Alarms**" to identify the reason.

- Make sure the wire length between battery and controller is as short as possible.
- Recommended Wire size: 2.5mm²

6. LED indications



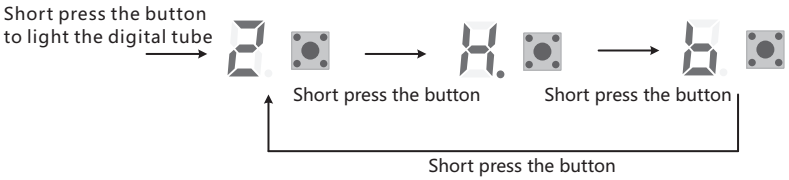
6.1 Controller LED light status indication

LED	Status	Function
Green LED	On	Solar panel is correctly connected, but not charged
	Fast flash(0.1s on/0.1s off)	MPPT charging
	Flash(0.5s on/0.5s off)	Boost or Equalization charging(GEL,Liquid,AGM)
	Slow flash(0.5s on/2s off)	Float Charging
Yellow LED	On	Battery is normal
	Slow flash(0.5 on/2s off)	Battery voltage is low
	Fast flash(0.1 on/0.1s off)	Low voltage protection
	Off	Over voltage protection
Red LED	Off	Work normal
	On	The load has been turned off
	Flash(0.2s on/0.5s off)	Over temperature protection
	Fast flash(0.1s on/0.1s off)	Short circuit or Over current protection
Blue LED	On	In the work of municipal
	Off	The mains power connection is abnormal
	Slow flash	The mains power connection is normal

*If the controller is in multiple protection states at the same time, the priority order of displaying fault information is: short circuit protection -->overcurrent protection -->low voltage protection -->overvoltage protection -->over temperature protection.

6.2 Digital tube status indication and key operation

This product is equipped with buttons and nixie tube, you can quickly set the premade battery parameters and discharge control logic of the controller, short press the button to light the nixie tube,short press again to switch the display value, the nixie tube content will be displayed in sequence between the battery type code, load working mode and power supply priority three parameters:



When the digital tube is lit up, long press the button to change the controller parameters. At this time, the digital tube flashes quickly, and the corresponding indicator light for the setting item stays on. Short press the button again to change the setting value. Long press to save, and the LED lights will flash three times together. The specific example is as follows:

Status	Display	Notes
○ ○ ● ○ The yellow light is always on		The constant yellow light indicates the battery type setting. Short press the button to switch between AGM, gel, liquid, and lithium iron phosphate batteries. Please refer to Appendix 6.2.1 for specific parameters.
○ ○ ○ ● The Red light is always on		The red light is always on, which is set for the load working mode. Short press it can switch between 24-hour, D2D modes. Please refer to Appendix 6.2.2 for specific parameters.
● ○ ○ ○ The Blue light is always on		The blue light is constantly on, indicating the priority setting for power supply. It shows A as mains power priority and b as battery priority. Specific parameters can be found in “7. Switching of mains power”.

Appendix 6.2.1

Display	Battery type	Battery parameters
	AGM	Low voltage protection/restoration: 11.2V/12.2V
	GEL	Low voltage protection/restoration: 11.2V/12.2V
	Liquid	Low voltage protection/restoration: 11.2V/12.2V
	LiFePO4	Overcharge protection/recovery: 14.4V/14.0V, low voltage protection/recovery: 11.0V/12.0V
	LiFePO4	Overcharge protection/recovery: 28.8V/28.0V, low voltage protection/recovery: 22.0V/24.0V

***When the digital display shows  , it represents that the current battery parameters are custom parameters. Please use RS485 to read the settings.**

Appendix 6.2.2

The load working mode can be set as follows:

Display	Load working mode
	Load 24H normally open
	D2D (dusk to early morning mode, night load on)

7. Switching of mains power

This product has the function of complementary mains power supply, which can switch between battery power supply and mains power (DC) supply according to the set requirements. The mains power switching function can be set as battery priority and mains power priority. When the battery and mains power supply are recognized normally (see the attached table for the recognition range), the controller will work according to the set power supply priority

Priority of mains power (digital display A):

1.When the controller is set to prioritize mains power and the mains power is recognized normally (the battery is correctly connected and the battery voltage is normal), the controller will supply power to the load through mains power (DC). At this time, the blue LED light is constantly on, indicating that the controller is discharging at the mains power (DC) end;

2.If the mains power (DC) drops or exceeds the recognition range, it will switch to the battery to supply power to the load. At this time, the blue LED will turn off, indicating that the mains power (DC) has not been correctly connected. After the mains power (DC) is recognized normally, it will switch to the mains power (DC) for discharge.

Battery priority (digital display b):

1.When the controller is set to battery priority and the battery is recognized normally (the mains power is correctly connected and the mains voltage is normal), the controller will supply power to the load through the battery. At this time, the blue LED will flash slowly, indicating that the mains power (DC) is connected normally, but the controller has not been discharged by the mains power (DC);

2.If the battery voltage is lower than the low voltage protection+0.2V, it will switch to the mains power (DC) supply until the battery voltage is higher than the low voltage recovery voltage and the controller is in a charging state, then the controller will switch back to discharging the battery.

※When the voltage systems connected to the battery end and the mains end are inconsistent (i.e. 12V system on one end and 24V system on the other end), the controller will make a judgment based on the battery end voltage system.If the mains and battery voltage systems are inconsistent, the controller will stop discharging. If only connected to the mains, the controller will work normally directly.

※ The mains power does not charge the battery at any time, only the solar panels charge the battery.

※ Battery voltage recognition range:

Battery type	Voltage range	System
AGM、GEL、Liquid	10.0V < Battery voltage < 15.0V	12V
	20.0V < Battery voltage < 30.0V	24V
	else	Not recognized
Li	Set overcharge protection value for remote control < 17.0V	12V
	Set overcharge protection value for remote control > 17.0V	24V

※Identification range of mains (DC) voltage:

Mains (DC) voltage	System
10.0V~14.0V	12V
20.0V~28.0V	24V
0V~10.0V，14.0V~20.0V，28.0V~∞	Not recognized

8. Factory default Settings

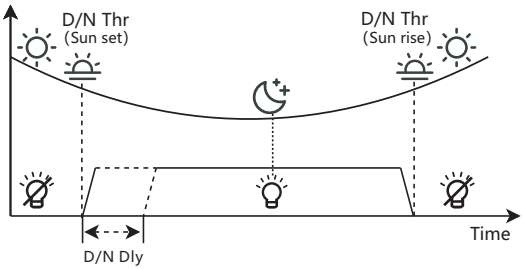
The default parameters of the controller are as follows:

Num	Name	Setting data
1	Battery	GEL
2	LVD	11.2V
3	LVR	12.0V
4	Equal	14.8V
5	Boost	14.5V
6	Float	13.7V
7	0℃ Chg	Yes
8	Work mode	24H(Normally open mode)
9	D/N Thr	5.0V
10	D/N Dly	0min
11	Power supply priority	b(Battery priority)

9. Operation mode

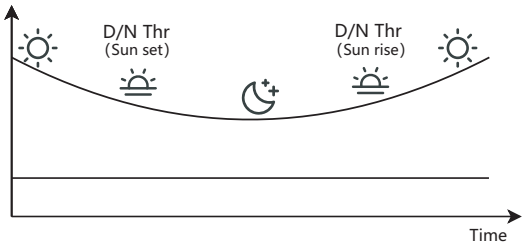
MPPT-DC series controller with advanced load control function. The modes of lighting can be based on customer needs.

9.1 Dusk to Dawn(D2D)



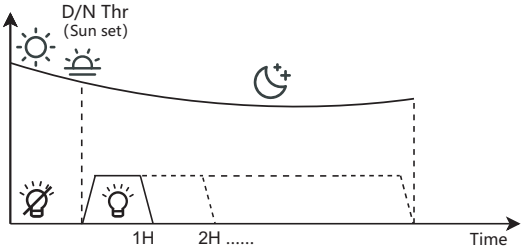
When the solar voltage is lower than the light control point voltage, the load opens until the light control point closes in the early morning of the next day.

9.2 Normally open mode(24H)



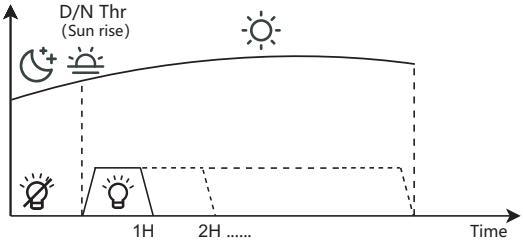
When the load of the controller is set to normally open mode and not in a protected state, the load will be turned on for 24 hours.

9.3 Night mode(Only set through RS485)



When the solar voltage is lower than the light control point voltage, the load is turned on for several hours (see "6. Status and Parameters" for parameter settings).

9.4 Daytime mode(Only set through RS485)



When the controller enters the charging state, the load is turned on for several hours (see "6. Status and Parameters" for parameter settings).

10. LVD, LVR, Threshold, Dimming

10.1 Low Voltage Disconnect(LVD)

①GEL,Liquid,AGM:

Low voltage disconnect setting range: 10.8~11.8V/21.6~23.6V

②Li:

Low voltage disconnect setting range: 9.0~30.0V

10.2 Low Voltage Reconnect(LVR)

①GEL,Liquid,AGM**:**

Low voltage reconnect setting range:11.4~12.8V/22.8~25.6V

②Li:

Low voltage reconnect setting range: 9.6~31.0V

※ LVR should be higher than LVD at least 0.6/ 0.2V.

10.3 Day/Night Threshold and Day/Night Delay

The controller recognizes day and night based on the solar array open circuit voltage. This day/night threshold can be modified according to local light conditions and the solar array used.

Day/Night threshold setting range: 3.0~20.0V.

In the evening, when the solar array open circuit voltage reaches the setting day/night threshold, you can adjust the day/night delay time to make the load turn on a little later.

Day/Night delay time setting range: 0~30min.

※ 1.The load turn-off requirement of the light control point voltage is 1V higher than the set value, that is, when the solar panel voltage is 4.0~21.0V in the morning, the load will be turned off.

2.The controller has an automatic day/night threshold adjustment function. If the lowest voltage of solar array is higher than the setting day/night threshold, the load has no output in first night, 24 hours later the controller can automatically adjust the day/night threshold to meet the requirements of lighting at night.

11. Faults & Alarms

Fault	Status	Reason	Remedy
Load are not powered	low voltage protection	Battery capacity is low	Load will be reconnected when battery is recharged
	Overcurrent,short protection circuit	Loads are over current or short circuit	Switch off all loads, remove short circuit,load will be reconnected after 1 minute automatically
	Over temperature protection	Controller temperature is too high	Load reconnects after temperature reduces
High battery voltage	Over voltage protection	High battery voltage>(CVT+0.2V)	Check if other sources overcharge the battery.If not,controller is damaged
		Battery wires or damaged battery fuse battery has high resistance	Check battery wires,fuse and battery.
Unable to recognize the system voltage	The red, yellow, and green lights flash at the same time	The battery voltage is out of the normal range during startup	Charge or discharge the battery to keep the battery voltage within the normal operating range
	The yellow and blue lights flash at the same time	The system voltage identified by the battery end and the mains end is inconsistent	The battery terminal and the mains terminal use the same level of voltage, such as 12V (or 24V)
Battery is empty after a short time	Low voltage protection	Battery has low capacity	Change battery
Battery can' t be charged	The green light stays on	PV panel fault or reverse connection	Check panels and connection wires

12. Technical Data

	Item		SMR-MPPT1060KH	SMR-MPPT1060KH-RS485
Battery Parameters	Max Charging Current		10A	
	System Voltage		12V/24V automatical recognization	
	Battery Type		Lithium, Liquid, Gel, AGM （Programmable, default: Gel)	
	Liquid, Gel and AGM	MPPT Charging Voltage	<14.5/29.0V@25℃	
		Boost Voltage	14.0~14.8V/28.0~29.6V(Default: 14.5/29.0V@25℃, Programmable)	
		Equalization Voltage	14.0~15.0V/28.0~30.0V(Default: 14.8/29.6V@25℃, Liquid/AGM, Programmable)	
		Float Voltage	13.0~14.5V/26.0~29.0V(Default: 13.7/27.4V@25℃, Programmable)	
		Low Volt. Disconnect	10.8~11.8V/21.6~23.6V(Default: 11.2/22.4V, Programmable)	
		Reconnect Voltage	11.4~12.8V/22.8~25.6V(Default: 12.2/24.4V, Programmable)	
		Overcharge Protect	15.5/31.0V	
		Temp. Compensation	-4.17mV/K per cell (Boost, Equalization), -3.33mV/K per cell (Float)	
	Lithium	Charging Volt. target	10.0~32.0V(Lithium, Programmable ）	
		Charging Volt. recovery	9.2~31.8V(Lithium, Programmable ）	
		Low voltage disconnect	9.0~30.0V(Lithium, Programmable)	
		Low voltage reconnect	9.6~31.0V(Lithium, Programmable ）	
		0℃ Charging protection	Yes, No, Slow(Lithium, default: Yes)	
	Max volt on Bat. Terminal		35V	
Panel Parameters	Max input power		130W/260W	
	Max volt on PV terminal		60V *1	
	Dusk/Dawn detect volt.		3.0~20.0V(Programmable)	
	Day/Night delay time		0~30min （Programmable)	
	MPPT tracking range		（Battery Voltage +1.0V）~Voc*0.9 *2	
	Max tracking efficiency		>99.9%	
Mains	Mains mode		External DC power supply	
	Power supply voltage		10V~14V(12V system); 20V~28V(24V system)	
Load	Output Current		10A	
System Parameters	Communication mode		/	RS485
	Power supply priority		A Mains priority, b battery priority (default b, programmable)	
	Max charge conversion		97.2%	
	Self consumption		12~24mA	
	Dimensions		113*115.3*29.8mm	
	Net weight		516g	
	Ambient temperature		-35~+60℃	
	Ambient humidity		0~100%RH	
	Protection degree		IP67	

*1.This value represents the maximum voltage of the solar panel at the minimum operating ambient temperature.
*2.Voc means the open circuit voltage of the solar panel.
*3.Around oblique line value separately on behalf of 12V and 24V system's value.

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