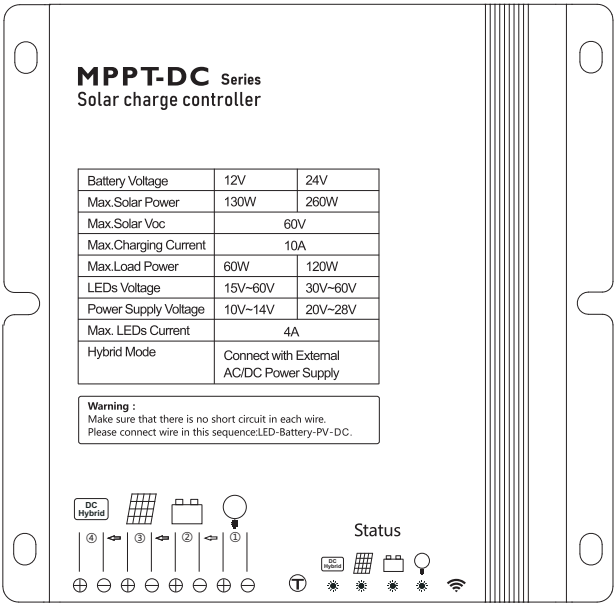
MPPT-DC Series
Solar charge controller
12/24V, 10A



User Manual

User Manual_MPPT-DC series_PE
CE, RoHS, ISO9001:2015
Subject to change without notice!

Dear Clients,

Thanks for selecting the MPPT-DC 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.

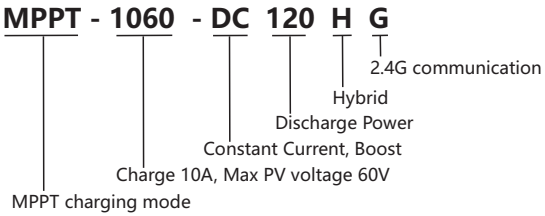
1. Product overview

MPPT-DC 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

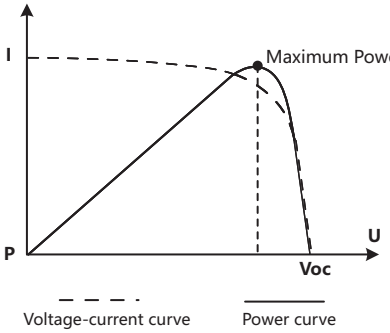
- Innovative Maximum Power Point Tracking(MPPT) technology, tracking efficiency >99.9%.
- High charge conversion efficiency up to 97.5% .
- Constant current output, adjustable output current, resolution of 0.05A.
- Five stage time and power adjustment, power adjustable from 0 to 100%.
- When the battery level is low, automatic power reduction operation can be set.
- 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).
- 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.

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.

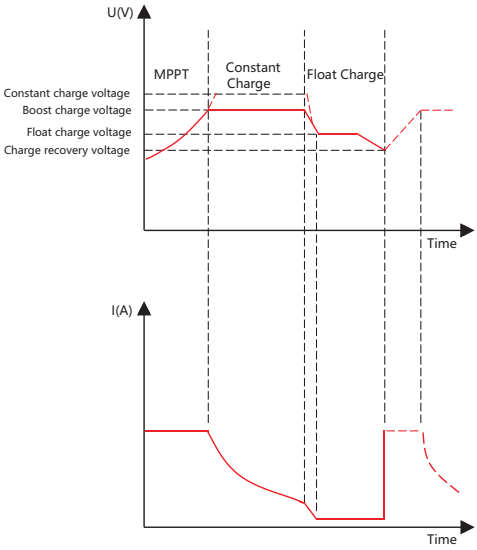


Figure 2-2 Lead-acid battery charging curve

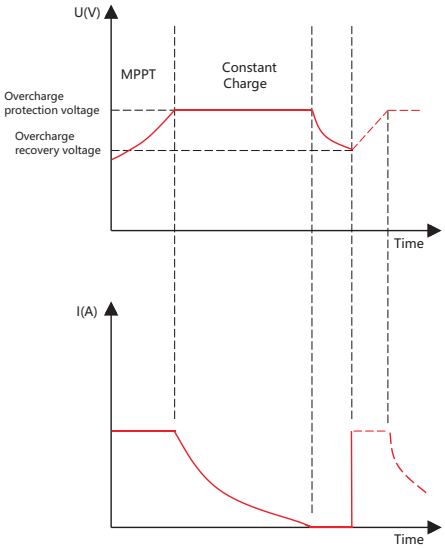


Figure 2-3 Lithium battery charging curve

3. Safty Instruction and Waiver of Liability

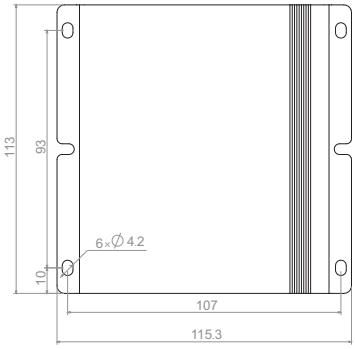
3.1 Safety

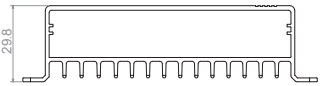
①The solar charge controller may only be used in PV systems in accordance with this user manual and the specs of other module manufacturers. No energy source other than solar gen. may be connected to the solar charge controller.
②Batteries store a large amount of energy, never short circuit a bat. under 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)





MPPT1060-DC120HG

5. Installation

5.1 Electrical connection diagram

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

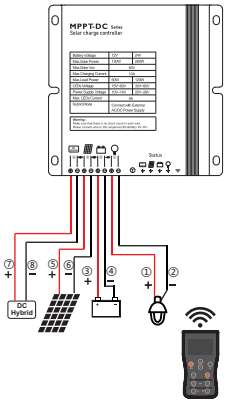


Figure 1. 2.4G remote control communication

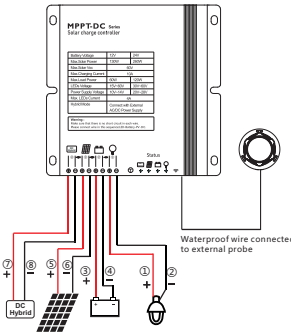


Figure 2. Infrared/microwave induction

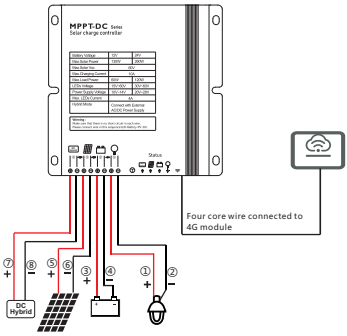
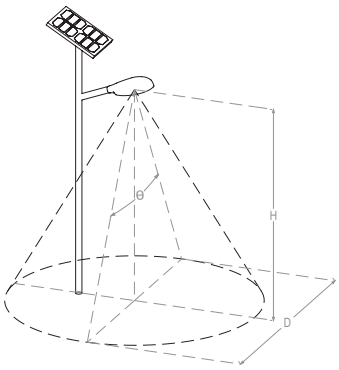


Figure 3. 4G iot module communication

5.2 Sensor



Type	Angle(θ)	High(H)	Width(D)
Infrared sensor(IR)	120°	6~8m	6~8m
Microwave sensor(WB)	120°	6~8m	7~12m

Induction Introduction :
Human body infrared sensing sensor: A human body sensing sensor made using the pyroelectric effect. The infrared sensing range varies with temperature and lighting conditions. Microwave Radar Sensing Sensor: A moving object detector made using the Doppler effect principle, with high radar sensing sensitivity and is not susceptible to environmental, temperature, dust, and other impacts.

Induction Notes :
1)The microwave induction controller can only be equipped with a microwave induction probe and cannot use red External sensing probe, otherwise the infrared sensing probe may be damaged!!!
2)The sensor which installed in the plastic and glass lampshade will reduce the sensitivity.
3) Sensor range will change with temperature, light conditions and so on, subject to the actual measurement.
4)The distance between any inductive sensors should be greater than 3m.

5.3 Wiring steps

①If an external module is available, please connect it first.
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 "**11. Faults and Alarms**" to identify the reason.

- Make sure the wire length between battery and controller is as short as possible.
- Recommended Wire size: 10A:2.5mm²

5.4 Transportation mode

The controller is generally integrated with the lithium battery in the lithium battery pack for transport, if the controller works normal during transport, it will waste of energy and increase the transport risk. If the controller is set to transport mode, the load has no output, then the power consumption is reduced by about 60%, to avoid lithium battery voltage too low.

5.4.1 Open circuit protection

If the controller is only connected with the battery, but not connected with solar and load, the controller will enter transportation mode after 5 minutes.

5.4.2 Press the "Test" key in transport mode

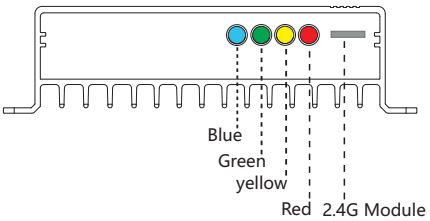
Press the "Back" and "Backlight" key at the same time , the remote controller will enter into transport mode.
Press the "Test" key in the transport mode, the remote controller displays "Transport OK" and will beep a long sound, the controller enters into transport mode.
——For detailed Settings, please refer to the SU12G intelligent remote control instruction manual.

※ After the controller enters transport mode, the red LED will super slow flash(0.2s on/5s off) ,the remote control displays "Open CP".

5.4.3 Exit the transportation mode

When the load is properly connected, press the test key or connect the solar more than 1 second during daytime , the transport mode will terminate and the controller will work normally.

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(0.5s on/2s off)	Battery voltage is low
	Fast flash(0.1s on/0.1s off)	Low voltage protection
	Off	Over voltage protection
Red LED	Off	Work normal(Standard version)
	On	Output power is 0
	Slow flash(2.5s on/2.5s off)	Work normal(Inductive version)
	Super slow flash(0.2s on/0.2s off)	Open circuit, hardware protection,transportation mode
	Flash(0.5s on/0.5s off)	Over temperature protection
	Fast flash(0.1s on/0.1s off)	Short circuit and overcurrent protection*
Blue LED	On	In the work of municipal
	Slow flash	The mains power connection is normal
	Off	The mains power connection is abnormal

*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 -->open circuit protection-->mains abnormal.

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 :

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:

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

8.1 Factory default settings

Num	Name	Setting data	Setting range
1	Time1	4.0H	0~6.5H+D2D
2	Dim1	100%	0~100%
3	Dim NP	0%	0~100%
4	Time2	0H	0~7.5H
5	Dim2	100%	0~100%
6	Dim NP	0%	0~100%
7	Time3	0H	0~7.5H
8	Dim3	100%	0~100%
9	Dim NP	0%	0~100%
10	Time4	0H	0~7.0H+T0T
11	Dim4	0%	0~100%
12	Dim NP	0%	0~100%
13	Time5	0H	0~7.5H
14	Dim5	100%	0~100%
15	Dim NP	0%	0~100%

Num	Name	Setting data	Setting range
16	D/N Thr	5.0V	3.0~20.0V
17	D/N Dly	0m	0~30min
18	Load I	0.3A	0.1~4.0A
19	Dim Auto	Yes	Yes/No
20	Dim V	12.5V	10.0~32.0V
21	Dim %	8%	1~40%
22	Battery	LI	LI/GEL/LIQ/AGM
23	CVT	14.4V	10.0~32.0V
24	CVR	14.0V	9.2~31.8V
25	LVD	10.8V	9.0~30.0V
26	LVR	11.8V	9.6~31.0V
27	0℃ Chg	Yes	Yes/Slow/No
28	Delayoff	10s	10s~150s
29	Priority Type	Hybrid	Hybrid/Battery

8.2 Read the running status

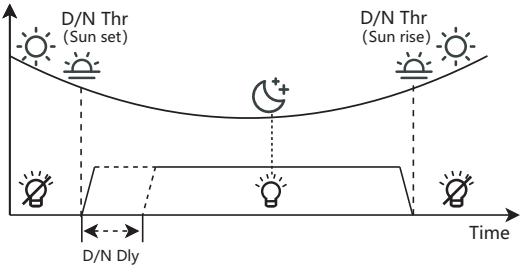
Pressing the "Status" key of the SU12G to read the running status of the controller.

Num	Name	Name describe	Unit	Example
	Status :	Charge		
1	Batt Vl	Battery voltage	V	12.5V
2	Load I	Load current	A	0.00A
3	Load V	Load voltage	V	15.0V
4	PV V	PV voltage	V	50.0V
5	PV I	PV current	A	3.0A
6	Energy	Total generating capacity	AH	15AH
7	OD Times	Over discharge times	Times	0
8	FC Times	Fully charge times	Times	0
9	Day1-HV	A day ago highest voltage	V	14.5V
10	Day1-LV	A day ago lowest voltage	V	12.8V
11	Day2-HV	Two days ago highest voltage	V	14.6V
12	Day2-LV	Two days ago lowest voltage	V	12.2V
13	Day3-HV	Three days ago highest voltage	V	14.3V
14	Day3-LV	Three days ago lowest voltage	V	11.9V

9. Operation mode

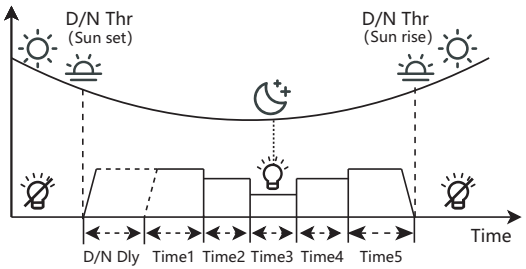
MPPT-DC series controller with advanced street light control function. The modes of lighting can be based on customer needs.

9.1 Dusk to Dawn(D2D)



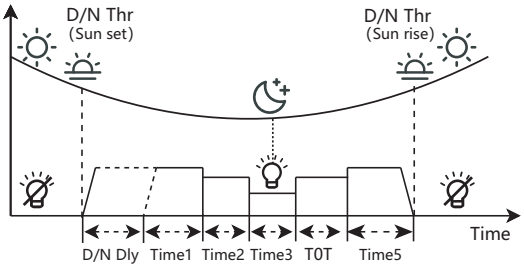
The MPPT-DC series controller is set to D2D mode, and the manned power and unmanned power values set at the first time are valid for all time periods.

9.2 Five-stage Night Mode



By SU12G remote control for time 1~5 and its human power, unmanned power Settings, can achieve a variety of time and power combination mode.

9.3 T0T mode (can set the load on time before morning coming)



On the SU12G smart remote control, time 4 can be set to T0T mode. If the load is required to be turned off during the T0T period, the time 4 power is set to 0%.

※ If Time4 is set to "T0T", Time1 can not set to "D2D".

10. LVD, LVR, Threshold, Dimming

10.1 Low Voltage Disconnect(LVD)

1. Liquid, Gel and AGM

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

2. Lithium

Low voltage disconnect setting range: 9.0~30.0V

10.2 Low Voltage Reconnect(LVR)

1. Liquid, Gel and AGM

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

2. Lithium

Low voltage disconnect setting range: 9.6V~31.0V

※ 1.If the controller goes into low voltage disconnect, it will restore only when the battery being recharged to the recovery voltage.

2.LVR should be higher than LVD at least 0.6/1.2V.

10.3 Day/Night Threshold, Day/Night Delay

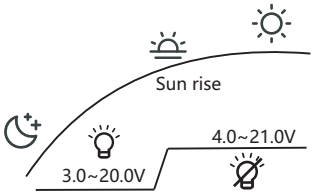
The controller recognizes day and night based on the solar array open circuit voltage. This day/night threshold can be modified according to local light conditions and the solar array used.

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.

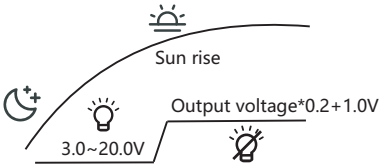
Day/Night threshold setting range: 3.0~20.0V.

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

When setting light control point > (output voltage *0.2), Day/Night threshold voltage of load disconnect is 1.0V higher than the setting data, means the load will disconnect when the solar voltage at 4.0~21.0V.



When setting light control point > (output voltage *0.2), Day/Night threshold voltage of load disconnect is (output voltage*0.2+1.0V)



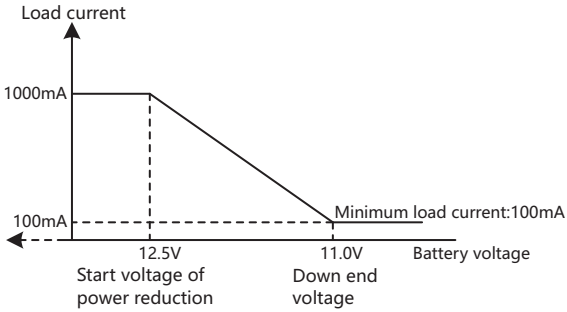
※ 1.Day/Night threshold voltage should be set around 0.22 times of open circuit voltage.

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.

10.4 Auto Dimming

The "Dim Auto" item of SU12G is set to "Yes", set "Dim V" and "Dim %" at the same time, press the "Send" key to set up the controller. when the battery voltage is lower than the voltage of "Dim V" , it starts to dimming automatically. Battery voltage reduces per 0.1V, load current decreased according to the set of "Dim %".

Example:



※ **1**.If the controller is set to "Dim" or "Auto Dim", the minimum output power can be as low as 100mA.

2. The power drop point should not be greater than the overcharge protection voltage. When the battery voltage is close to the low voltage protection point, it is directly reduced to the minimum power operation.

11. Faults and Alarms

Fault	Status	Reason	Remedy
Load are not powered	Low voltage protection	Battery capacity is low	Load will be reconnected when battery is recharged
		Inconsistent voltage system between mains and battery	Power on again according to the wiring steps in section 5.3
	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
		Only connected to mains power (DC), not connected to battery	Connect the battery terminal of the controller to the storage battery
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. Safety Features

●Waterproof protection
waterproofing grade: IP67
●Lithium battery BMS overcharge detection protection
When the controller detects that the BMS is overcharged, the controller immediately stops charging to prevent the high voltage of the photovoltaic end from being added to both ends of the BMS for a long time, resulting in high voltage damage to the BMS.
●Lithium battery low temperature charging protection
When 0 ° C is enabled and the ambient temperature is lower than 0 ° C, the controller stops charging to prevent irreversible damage to the lithium battery caused by low temperature charging.
●High temperature protection
When the ambient temperature or the internal temperature of the controller is higher , the controller stops charging and discharging to prevent the risk of damage to the lithium battery or controller due to excessive temperature.
●Battery reverse connection protection
After the battery is reversed, the system does not work and will not burn the controller.
●PV input overvoltage protection
If the input voltage of the PV panel is too high, the controller automatically cuts off the PV input.
● PV input reverse protection
When the photovoltaic array polarity is reversed, the controller will not be damaged, and will continue to work normally after correcting the wiring error.
● Load limit power protection
When the customer sets the load current is too large, the controller load power output is rated power to ensure that the controller and LED load will not be damaged.
● Load short circuit protection
When a short circuit occurs, the controller immediately cuts off the load output to prevent damage to the controller. After the load short-circuit condition is lifted, the controller automatically restores the output within a moment.
● Load open circuit protection
When the LED load light is on normally and the load connection is suddenly disconnected, the controller can immediately turn off the load output to protect the controller from damage. After the load connection is restored, the controller automatically restores the output within 1 minute, or press the test button of the remote control to restore the output.
● Anti-charge protection at night
Prevent the battery from discharging through the panel at night.
● TVS lightning protection

13. Technical Data

	Item		MPPT1060-DC120HG
Battery Parameters	System Voltage		12V/24V automatical recognization
	Max Charging Current		10A
	Max volt on Bat. Terminal		35V
	Battery Type		Liquid, Gel, AGM and Lithium（Programmable, default: Lithium）
	Liquid, Gel and AGM	MPPT Charging Voltage	<14.5/29.0V@25℃
		Boost Voltage	14.5/29.0V @25℃
		Equalization Voltage	14.8/29.6V @25℃（Liquid, AGM）
		Float Voltage	13.7/27.4V @25℃
		Low Volt. Disconnect	10.8~11.8V/21.6~23.6V（Programmable,default: 11.2V/22.4V）
		Reconnect Voltage	11.4~12.8V/22.8~25.6V（Programmable,default: 12.0V/24.0V）
		Overcharge Protect	15.5/31.0V
		Temp. Compensation	-4.17mV/K per cell (Boost, Equalization)， -3.33mV/K per cell (Float)
	Lithium	Charging voltage target	10.0~32.0V(Programmable, default: 14.4V)
		Charging voltage recovery	9.2~31.8V(Programmable, default: 14.0V)
		Low voltage disconnect	9.0~30.0V(Programmable, default: 10.8V)
		Low voltage reconnect	9.6~31.0V (Programmable, default: 11.8V)
		0℃ Charging protection	Yes, Slow, No(Programmable)
Panel Parameters	Max volt on PV terminal		60V *1
	Max input power		130W/260W
	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
Mains	Mains mode		External DC power supply
	Power supply voltage		10V~14V(12V system); 20V~28V(24V system)
Load Parameters	Output Power		10~60W/20~120W
	Output Voltage		15~60V/35~60V
	Current setting range（Programmable）		0.1~4.0A（Programmable）
	Min current		100mA（Dimming）
	Current precision		≤2%±30mA
	Dimming		0~100%（Programmable）
	Voltage of start dimming		11.8~12.5V/23.6~25.0V(Gel,AGM and Liquid); 10.0~32.0V(Lithium)
	Dimming percentage		1~40%（Programmable）
System Parameters	Max tracking efficiency		>99.9%
	Max charge conversion		97.5%
	Max LED driver efficiency		96.5%
	communication mode		2.4G
	Self consumption		6~23mA
	Dimensions		113*115.3*29.8mm
	Net weight		520g
	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.**