

# **Smart-DC series Solar charge controller (Constant Current, Boost)**

## **User Manual**

# Solar charge controller Smart-DC series User Manual

## Dear Clients,

Thanks for selecting the **Smart™-DC** series solar controller. Please take the time to familiarise yourself with this user manual, as it will help you take full advantage of the features.

## 1. Description of Function

Smart-DC series intelligent solar controller, is programmable and especially for boost mode LED solar street light system.

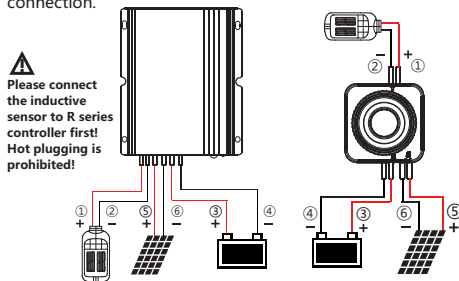
It comes with some outstanding features, such as:

- Can output constant current
- Adjustable 5-stage timer for load output
- Human infrared induction.
- Monitoring of the running status and parameters
- Suitable for Gel, Liquid, AGM and Lithium battery
- 12V/24V system voltage automatic recognition
- Automatic temperature compensation(Liquid/GEL)
- Four stages charge: fast, boost, equal, float(Liquid/GEL)
- If battery voltage is low, it can be set to dimming automatically
- Dimming start voltage and percentage can be set
- Auto sleeping during transportation(Lithium)
- When BMS power off because of LVD, it can activate the system automatically (Lithium)
- Charging target and recovery voltage can be set(Lithium)
- 0°C Charging Protection(Lithium)
- Day/Night threshold can adjust automatically
- Configurable with an LCD remote programmer
- Waterproof IP67, Strong and durable aluminum case
- Full automatic electronic protect function

## 2. Installation

### 2.1 Connection sequence

The following diagram provides an overview of the terminals. Please make sure to follow the proper order of connection.



1. As the chart, Connect the load first with corresponding brown(positive) and blue(negative) cables, then seal them with tape.
2. Connect the battery with corresponding positive and negative cables, the load will be on after 8s;
3. Connect panel with the corresponding red(positive) and black(negative) cables, the load will be off after 4s, and the controller begins to charge.
4. Confirm the LED display status.

- Make sure the wire between battery and controller is as short as possible.
- Recommended minimum wire size:

10A: 2.5mm<sup>2</sup>; 20A: 4 mm<sup>2</sup>

### 2.2 Transportation mode(Load off)

#### 2.2.1 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.

#### 2.2.2 Press the "Test" key in factory mode

Press the "Back" and "Backlight" key at the same time more than 3s, the remote controller will work in transport mode.

Press the "Test" key in the transport mode, the remote controller displays "Transport OK" and will keep a long sound, the controller enters into transport mode.

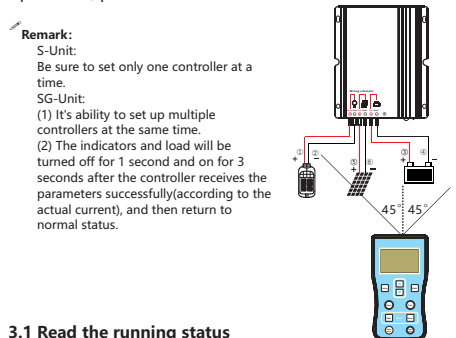
If the controller enters transport mode, the red LED will flash(0.2s/5s) and the remote control displays "Open CP".

#### 2.2.3 Exit the transportation mode

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

## 3. Remote controller, Default setting

When Smart-DC series controller is connected to the system, you can setting the controller with S/SG-Unit remote controller, as shown below! Detailed setting operations, please read S/SG-Unit User Manual.



### 3.1 Read the running status

Press the "Status" key of the S-unit to read the running status of the controller.

Num	Name	Name describe	Unit
	Status:	Charge	
1	Batt V	Battery voltage	V
2	Load I	Load current	A
3	Load V	Load voltage	V
4	PV V	PV voltage	V
5	PV I	PV current *	--
6	Energy	Total generating capacity	AH
7	OD Times	Over discharge times	Times
8	FC Times	Fully charge times	Times
9	Day1-HV	A day ago highest voltage	V
10	Day1-LV	A day ago lowest voltage	V
11	Day2-HV	Two days ago highest voltage	V
12	Day2-LV	Two days ago lowest voltage	V
13	Day3-HV	Three days ago highest voltage	V
14	Day3-LV	Three days ago lowest voltage	V

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### 3.2 Read the parameters

Press the "Parameter" key of the S-unit to read the setting parameters of the controller.

Num	Name	Factory Default
1	Time1	4H
2	Dim1	100%
3	Time2	0H
4	Dim2	100%
5	Time3	0H
6	Dim3	100%
7	Time4	0H
8	Dim4	0%
9	Time5	0H
10	Dim5	100%
11	D/N Thr	5.0V
12	D/N Dly	0m
13	Load I	0.3A
14	Dim Auto	Yes
15	Dim V	12.2V
16	Dim %	8%
17	Battery	Li
18	CVT	14.4V
19	CVR	13.8V
20	LVD	10.0V
21	LVR	11.0V
22	0°C Chg	Yes
23	Delay off	10s
24	Dim NP	10%
25	Password	0000

Password only applies to SG-Unit.

### 3.3 Test function

Press the "Test" key of S-Unit, the controller will turn on load for 30s. During daytime, the testing function can help users to verify correct installation or for system trouble shooting. 30s later the load will automatically turn off.

"Test" press times	Output power
1	Set Dimming1
2	Set Dimming2
3	Set Dimming3
4	Set Dimming4
5	Set Dimming5
6	End of test function

## 4. Starting up the controller

### 4.1 Self Test

As soon as the controller is powered, it starts a self test routine. After this, the LED display will change to normal operation.

### 4.2 System Voltage

The controller applies to Lithium, AGM, Liquid and Gel battery. It is your responsibility to check and ensure that these settings are correct for your battery, otherwise they must be amended.

SMR-DC is suitable for lithium battery when it is set to Lithium battery, the charging target voltage and charging recovery voltage can be set according to customer requirements.

The controller adjusts itself automatically to 12V or 24V system voltage when it is set to Gel, Liquid or AGM battery. If the battery voltage on start-up is 0V-15V then the controller infers a 12V system. If the battery voltage is 20V-30V the controller infers a 24V system. If the battery voltage is not within the normal operating range at start-up, please refer to **Faults & Alarms**.

### 4.3 0°C Charging Protection(Lithium Battery)

"0°C Chg" can be set to "Yes", "Slow" or "No". When the controller detects that the ambient temperature is higher than 0°C, the charging function is normal. when the ambient temperature is low than 0°C, if the "0°C Chg" is set to "Yes", the charging function is normal, else if the "0°C Chg" is set to "slow", the max charging current is 20% of the rated current, else if the "0°C Chg" is set to "No", the controller does not charge the battery.

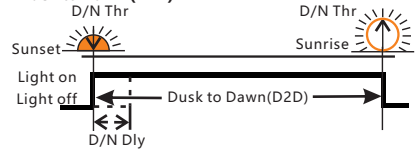
The user can select the appropriate charging method.

## 5. Streetlight Function

For controllers with infrared sensing function( R series), if work mode is set to "Five-stage Night Mode" or "TOT mode", "DelayOff" and "Dim NP" work in "Time3" and "Time4".

"DelayOff" setting range: 10~150s.

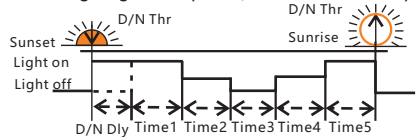
### 5.1 Dusk to Dawn (D2D)



If "Time1" is set to "D2D", the controller works in dusk to dawn mode.

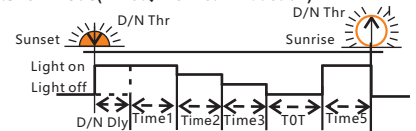
1. Smart-DC controller is set to D2D mode, the corresponding dimming setting is still valid.
2. If "Time1" is set to D2D mode, "Time4" can not be set to TOT mode.

### 5.2 Five-stage Night Mode(Time3, Time4 can induction)



You can set the Time 1-5 and Dim 1-5 with S/SG-Unit.

### 5.3TOT mode(Time3, TOT can induction)



If "Time4" of the S-Unit is set to "TOT", this mode is TOT mode.

\* If "Time4" is set to "TOT", "Time1" can not set to D2D mode.

### Induction function Parameter setting example:

Time1: 1.0H/100%    Time2: 2.0H/80%    Time3: 3.0H/60%  
Time4: TOT/40%    Time5: 2.0H/100%

DelayOff: 10s    Dim NP: 10%

The controller works as follows:

After the arrival of the evening the first time the load is lit for 1 hour (full power 100%), the second time the load is lit for 2 hours (power 80%), the third time load light for 3 hours (when people is near the lamp then the load is 60% light, when people is away from the lamp the load is 60% \* 10% light), and then the controller according to the actual night time automatically calculate the length of the fourth paragraph (when people is near the lamp then the load is 40% light, when people is away from the lamp the load is 40% \* 10% light), the fifth time load light 2 hours (full power 100%).

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## 6. LVD, LVR, Threshold, Dimming

### 6.1 Low Voltage Disconnect (LVD)

When the battery voltage drops below the LVD voltage, the controller will disconnect the load to prevent deep discharge of the battery. If this occurs, the battery should be well charged before resuming use.

**Gel, Liquid and AGM Battery:** 12V: 10.8~11.8V  
24V: 21.6~23.6V

**Lithium Battery:** 12V: 8.0~15.0V  
12/24V: 8.0~30.0V

### 6.2 Low Voltage Reconnect (LVR)

If the low voltage disconnect is triggered, the controller will restore load connection only when the battery voltage increases above the LVR voltage.

**Gel, Liquid and AGM Battery:** 12V: 11.4~12.8V  
24V: 22.4~25.6V.

**Lithium Battery:** 12V: 8.6~15.0V  
12/24V: 8.6~31.0V.

For SMR1006-DCN5LiG/ SMR1012-DCN5LiG and SMR2012-DCN5LiG, the LVD and LVR setting range are as follow:

Battery low voltage protection (LVD) : 9.4v ~ 30.0V.  
Controller low voltage recovery (LVR) : 10.0v ~ 31.0V.

### 6.3 Day/Night Threshold, Day/Night Delay

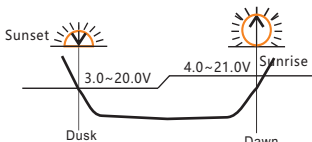
The controller recognizes day and night based on the solar array open circuit voltage. This day/night threshold can be modified according to local light conditions and the solar array used.

Day/Night threshold setting range:

Lithium: 3.0~8.0V/3.0~20.0V;

Gel, AGM and Liquid: 3.0~8.0/6.0~16.0V.

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 threshold voltage of load disconnect is 1/2V higher than the setting data, means the load will disconnect when the solar voltage at 4~9/8~18V(Gel/Liquid/AGM) / 4.0~21.0V(Lithium).
- 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

### 6.4 Auto Dimming

The "Dim Auto" item of S/SG-Unit 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 %", the minimum output current is 10% of the setting current.



- Dimming voltage should not be greater than the voltage of "CVT"(Charging voltage target).
- If the controller is set to "Dim" or "Auto Dim", the minimum output current can be as low as 50mA.

## 7. LED indications and Faults & Alarms



### 7.1 LED Display Explanation

LED	Status	Function
Green LED	On	Not charging
	Flash(0.5/2s)	Charging
	Flash(0.5s/0.5s)	Equal or Boost charging
Yellow LED	Slow flash(0.5s/2s)	Float charging
	Off	Over voltage protection
	On	Battery is normal
Red LED	Slow flash(0.5/2s)	Battery voltage is low
	Fast flash(0.1/0.1s)	Low voltage protection
	Off	Work normal
Red LED	On	The output power is 0.
	Slow flash (0.2s on/5s off)	Normal Operation (Only SMR1006-DCN5MLiR)
	Fast flash(0.1/0.1s)	Short circuit or Over current protection
	Flash(0.5/0.5s)	Over temperature protection
	Super slow flash (0.2s on/5s off)	Open circuit or transport mode. *1
3 LEDs are on 3s and off for 1s at the same time.		Send parameters successfully

\*1.If the controller is in transport mode, the red LED is super slow flash(0.2s on/5s off), the green and yellow led is off.

\*2.Detailed fault information can be read by S/SG-Unit remote controller.

### 7.2 Faults & Alarms

Fault	Status	Reason	Remedy
Loads are not powered	Low volt. protection	Battery capacity is low	Load will be reconnected when battery is recharged
	Overcurrent, short circuit protection	Loads are over current or short circuit	Switch off all loads, remove short circuit, load will be reconnected after 1 minute automatically
	Over temp. protection	Controller temp. is too high	Load reconnects after temp. reduces
High voltage at battery terminal	Over voltage protection	High battery voltage > 15.5/31.0V * Battery wires or battery fuse damaged, battery has high resistance.	Check if other sources overcharge the battery. If not, controller is damaged. Check battery wires, fuse and battery.
Can't recognize system voltage	All LED fast flashing	Battery voltage is not in right range	Charge or discharge, make battery voltage in the right range
Battery is empty after a short time	Low voltage protection	Battery has low capacity	Change battery
Battery can't be charged	Green LED is on	PV panel fault or reverse connection	Check panels and connection wires

\* Lithium: Battery voltage > CVT+0.2V

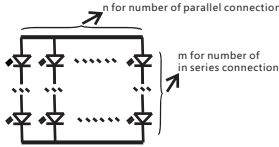
Gel, Liquid and AGM: Battery voltage > 15.5/31.0V

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## 8. Load and Sensor

### 8.1 Load

Following connect ways is for the LED lights  
(Vf: 2.9V~3.4V; I: 300mA, Power: 1W )



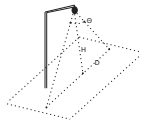
	Output Voltage	Load	Connect
SMR1012-DCN5Li(G) SMR2012-DCN5Li(G) SMR1006-DCN5XLi(G)	(Vb+2V) ~55V	0.15~4A	M=5~18 N=1~13
SMR1006-DCN5MLi(G) SMR1006-DCN5ELi(G)		0.15~2.0A	M=5~18 N=1~6
SMR1006-DCN5MLiE(G)	(Vb+2V) ~33V	0.15~1.3A	M=5~10 N=1~4

For example: 1W LED chips, for a 20W lamp, m=10, n=2.  
If the LED current of each string is 300mA, you can set the load current to 0.6A.

**Note:** If the current setting requirements exceed the current range of the controller, then the controller is unable to set successfully.

### 8.2 Sensor

Infrared sensor  
θ(Angle): 60°  
H(Height): 7m  
D(Width): 8m



- 1) The sensor which installed in the plastic and glass lampshade will reduce the sensitivity.
- 2) Sensor range will change with temperature, light conditions and so on, subject to the actual measurement.
- 3) The distance between any inductive sensors should be greater than 3m.
- 4) Please ensure that there are no moving signals around the sensor, such as fan, DC motor, sewer pipe, air outlet, etc., the sensor may generate false trigger.
- 5) Hot plugging is prohibited.

## 9. Safety Features

	Solar terminal	Battery terminal	Load terminal
Reverse polarity	Protected	Protected	Protected*1
Short circuit	Protected*2	Protected *3	Switches off immediately
Over current	—	—	Switches off with delay
Reverse Current	Protected	—	—
Over voltage	Max.55V *4	Max. 40V*5	—
Low voltage	—	—	Switches off
Over temp.	If the temperature reaches the set value, the controller cuts off the load.		

\*1. Controller can protect itself, but load might be damaged.

\*2. When the PV doesn't charge, the controller will not be damaged if short-circuit just happened in the PV array.

**Warning: It is forbidden to short-circuit the PV array during charging .Otherwise, the controller may be damaged.**

short-circuit just happened in the PV array.

\*3. Battery must be protected by fuse.

\*4. Please refer to "11. Technical Data" to get the max voltage of PV panel.

\*5. Please refer to "11. Technical Data" to get the max voltage of battery.

**Warning: The combination of different error conditions may cause damage to the controller. Always remove the error before you continue connecting the controller.**

## 10. Safety instructions and waiver of liability

### 10.1 Safety

① The solar charge controller may only be used in PV systems in accordance with this user manual and with solar panels specifications in line with the requirements of this controller. No energy source other than solar panels may be connected to the solar charge controller.

② Batteries store a large amount of energy, never short-circuit a battery under any circumstances. We strongly recommend connecting an in-line fuse or circuit-breaker on the "+" wire between the battery and controller, no more than 15cm from the battery terminal.

③ Batteries can produce flammable gases. Avoid sparks and flames near the batteries. Make sure the battery is installed in a well ventilated area.

④ Avoid touching or short circuiting wires or terminals. Be aware that the voltages on special terminals or wires can be several times greater than the battery voltage. Use isolated tools and only perform any work in a dry environment.

⑤ Keep children away from batteries and the charge controller.

### 10.2 Liability Exclusion

The manufacturer shall not be liable for damages to the controller or battery caused by use other than as instructed in this manual, or if the battery manufacturer's recommendations are neglected. The manufacturer shall not be liable if there has been service or repair carried out by any unauthorised person, unusual use, incorrect setup, or bad system design.

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## 12. Technical Data

	Model	SMR1006-DCN5MLiR	SMR1006-DCN5MLiE	SMR1006-DCN5MLiEG
Battery Parameters	Max Charging Current	10A	8A	
	System Voltage	12V		
	Max. battery voltage	20V		
	Battery type	Lithium		
	Charging Volt. target	10.0~17.0V(Programmable)		
	Charging Volt. recovery	8.5~16.8V(Programmable)		
	Low Volt. disconnect	8.0~15.0V(Programmable)		
	Low Volt. reconnect	8.6~16.0V(Programmable)		
0°C Charging protection	Yes, No, Slow(Programmable)			
Panel Parameters	Max. panel voltage	25V		
	Day/Night threshold	3.0~8.0V (Programmable)		
	Day/Night delay time	0~30min (Programmable)		
Load Parameters	Output power	1~30W		
	Output current	0.15~2.0A(Programmable)	0.15~1.3A(Programmable)	
	Min. Load current	50mA (Dimming)		
	Output voltage DC	(Vbat+2V)~55V	(Vbat+2V)~33V	
	Current precision	±2%		
	Dimming	0~100%(Programmable)		
	Auto dimming	Yes, No, 365(Programmable)	Yes, No(Programmable)	
	Voltage of start dimming	9.0~Charging voltage target (Programmable)		
	Dimming percentage	1~20% (Programmable)		
	Induction delay off time	10~150s(Programmable)		
	Dimming when no people	0~100%(Programmable)		
	Work Mode	5 Stages, D2D, T0T(Programmable)		
Max. LED driver efficiency	95%			
System Parameters	Remote control mode	Infrared		Wireless remote control, 0.5~30 meters can be set
	Dimensions	68*68*39mm	76.4*52*20.7mm	
	Weight	150g	125g	
	Wire size	2.5mm <sup>2</sup>		
	Self consumption	10mA	6mA	
	Ambient temperature	-35°C ~ +60 °C		
	Degree of protection	IP67		
	Max. Altitude	4000m		

\*G series is 2.4G communication, R series have PIR function

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	Model	SMR1006-DCN5ELiG	SMR1006-DCN5XLiG	
Battery Parameters	Max Charging Current	10A		
	System Voltage	12V	12V/24V automatical recognition	
	Max. battery voltage	20V	40V	
	Battery type	Gel, Liquid, AGM and Lithium		
	Gel, Liquid and AGM	Fast Charging Voltage	<14.5V@25°C	<14.5/29V@25°C
		Boost Voltage	14.5V@25°C	14.5/29V @25°C
		Equalization Voltage	14.8V@25°C	14.8/29.6V @25°C (Liquid, AGM)
		Float Voltage	13.7V@25°C	13.7/27.4V @25°C
		Low Volt. Disconnect	10.8~11.8V	10.8~11.8V/21.6~23.6V(Programmable)
		Reconnect Voltage	11.4~12.8V	11.4~12.8V/22.8~25.6V(Programmable)
		Overcharge Protect	15.5V	15.5/31.0V
		Temp. Compensation	-4.17mV/K per cell (Boost, Equalization), -3.33mV/K per cell (Float)	
	Lithium	Charging voltage target	10.0~17.0V(Programmable)	10.2~32.0V(Programmable)
		Charging voltage recovery	8.5~16.8V(Programmable)	9.8~31.8V(Programmable)
Low voltage disconnect		8.0~15.0V(Programmable)	9.4~30.0V(Programmable)	
Low voltage reconnect		8.6~16.0V(Programmable)	10.0~31.0V(Programmable)	
0°C Charging protection		Yes, No, Slow(Programmable)		
Panel Parameters	Max. panel voltage	25V	25V/50V	
	Day/Night threshold	3~8/6~16V(Programmable)		
	Day/Night delay time	0~30min (Programmable)		
Load Parameters	Output power	1~40W	1~60W	
	Output current	0.15~2.0A(Programmable)		
	Min. Load current	50mA (Dimming)		
	Output voltage DC	( Battery voltage + 2V) ~ 55V		
	Current precision	±2%		
	Auto dimming	Yes、No(Programmable)		
	Dimming	0~100%(Programmable)		
	Voltage of start dimming	Lithium: 9.0~Charging voltage target (Programmable)		Lithium: 9.5~CVT
		Gel, AGM and Liquid: 11.8~12.5/23.6~25.0V(Programmable)		
	Dimming percentage	1~20% (Programmable)		
	Work Mode	5 Stages, D2D, T0T(Programmable)		
Max. LED driver efficiency	95%			
System Parameters	Remote control mode	Wireless remote control, 0.5~30 meters can be set		
	Dimensions	85.8*55*23.1mm	85*72*22.6mm	
	Weight	200g	255g	
	Wire size	2.5mm <sup>2</sup>		
	Self consumption	10mA		
	Ambient temperature	-35°C ~ +60 °C		
	Degree of protection	IP67		
	Max. Altitude	4000m		

\*G series is 2.4G communication, R series have PIR function

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	Model	SMR1012-DCN5LiG	SMR2012-DCN5LiG	
Battery Parameters	Max Charging Current	10A	20A	
	System Voltage	12V/24V automatical recognition		
	Max. battery voltage	40V		
	Battery type	Gel, Liquid, AGM and Lithium		
	Gel, Liquid and AGM	Fast Charging Volt.	<14.5/29V@25°C	
		Boost Voltage	14.5/29V @25°C	
		Equalization Voltage	14.8/29.6V @25°C (Liquid, AGM)	
		Float Voltage	13.7/27.4V @25°C	
		Low Volt. Disconnect	10.8~11.8V/21.6~23.6V(Programmable)	
		Reconnect Voltage	11.4~12.8V/22.8~25.6V(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	10.2~32.0V(Programmable)	
		Charging Volt. recovery	9.8~31.8V(Programmable)	
Low voltage disconnect		9.4~30.0V(Programmable)		
Low voltage reconnect		10.0~31.0V(Programmable)		
0°C Charging protection		Yes, No, Slow(Programmable)		
Panel Parameters	Max. panel voltage	25V/50V		
	Day/Night threshold	Lithium: 3.0~20.0V (Programmable) Gel, AGM and Liquid: 3.0~8.0/6.0~16.0V(Programmable)		
	Day/Night delay time	0~30min (Programmable)		
Load Parameters	Output power	3~60W/3~120W		
	Output current	0.15~4.0A(Programmable)		
	Min. Load current	100mA (Dimming)		
	Output voltage DC	( Battery voltage + 2V) ~ 55V		
	Current precision	±2%		
	Auto dimming	Yes, No(Programmable)		
	Dimming	0~100%(Programmable)		
	Voltage of start dimming	Lithium: 9.5~Charging voltage target		
		Gel, AGM and Liquid: 11.8~12.5/23.6~25.0V(Programmable)		
	Dimming percentage	1~20% (Programmable)		
Work Mode	5 Stages, D2D, T0T(Programmable)			
Max. LED driver efficiency	95%			
System Parameters	Remote control mode	Wireless remote control, 0.5 ~ 30 meters can be set		
	Dimensions	103*85*25mm		
	Weight	320g		
	Wire size	2.5mm <sup>2</sup>	4mm <sup>2</sup>	
	Self consumption	10mA		
	Ambient temperature	-35°C ~ +60 °C		
	Degree of protection	IP67		
	Max. Altitude	4000m		

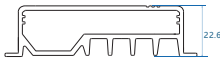
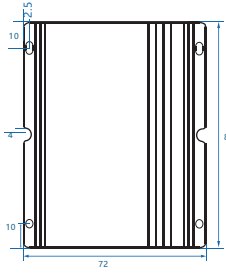
\*G series is 2.4G communication, R series have PIR function



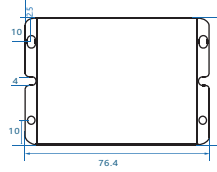
# Solar charge controller Smart-DC series User Manual

## Dimensions

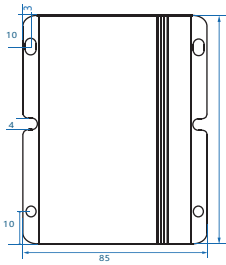
### Controller



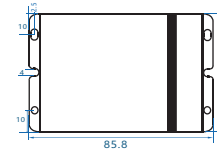
SMR1006-DCN5XLiG



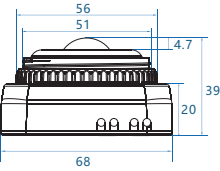
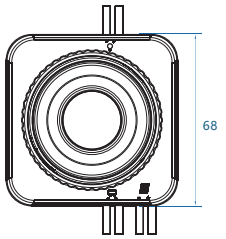
SMR1006-DCN5MLiE(G)



SMR10/2012-DCN5LiG

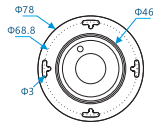
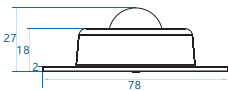


SMR1006-DCN5ELiG



SMR1006-DCN5MLiR

### Sensor



Sensor lines length: 400mm  
Hole diameter:  $\varnothing 52$