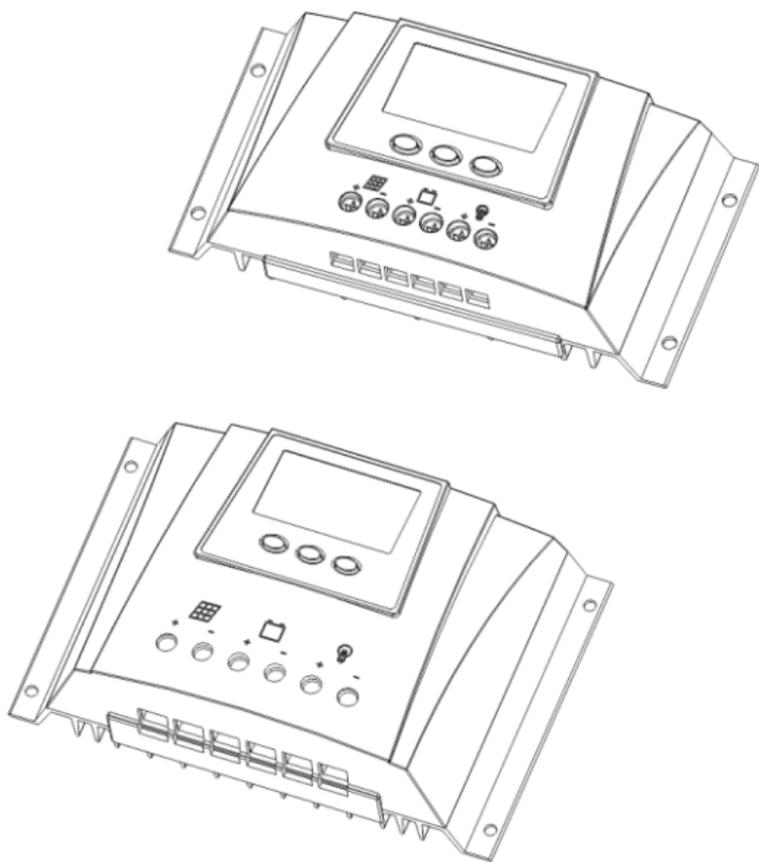


Solar Charge Controller

User's Manual



Please read this manual carefully before using this product

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Dear Customers:

Thank you so much for trusting our company and selecting our products. Your solar power system will be guaranteed with reliable after-sales service!

1. Safety Attentions

- (1) Please avoid exposure to flammable, explosive and corrosive liquids or gases, as well as dust in installation site.
- (2) Please protect the controller from direct sunlight or rain.
- (3) Please avoid any liquid spray and do not insert any foreign object to the controller.
- (4) The battery bank must be comprised of batteries of same type, make, and age.
- (5) Use the controller only for the charging of Gel, Sealed and flooded lead acid batteries.
- (6) It is not recommended to open or maintain the controller by yourself, without informing us or without any guidance from relevant professional.
- (7) After power on, please do not touch terminal blocks to avoid electric shock.
- (8) There are no fuses inside the controller, Install external fuses/breakers as required.
- (9) Check the wiring and connections at least once a year.

2. Introduction of Solar Charge Controller

2.1 Product Overview

The controller is a new series of intelligent, multi-purpose solar charge controllers. Its innovative structured design makes it easy to install and more reliable to use. Optimized charging and discharging management enables the service life of batteries to be greatly boosted. Meanwhile, more system symbols can be displayed in bigger LCD interface. Vivid symbols can show the working status of the system and relevant parameters can be fully displayed. What's more, intelligent control of LED backlight makes it possible to see all symbols and parameters clearly even in the dim light conditions. Various control parameters can be flexibly set to fully meet your various application requirements.

2.2 Product Features

2.2.1 3-stage Charging

Bulk Charge:

Bulk charge is the first stage in the charging process. In Bulk charging stage, the controller will deliver 100% of available solar power to recharge the battery and will try to get the battery voltage up to the absorb voltage setting.

Absorption Charge:

When the battery voltage has recharged to the Absorption voltage setting, constant-voltage regulation is used to maintain battery voltage at the Absorption setpoint. This prevents heating and excessive battery gassing. The battery is allowed to come to full state of charge at the Absorption voltage setpoint. The absorb timer starts to count and the controller stays in absorb until the Absorb Timer counts up to absorb time.

Float Charge:

After the battery is fully charged in the Absorption stage, the controller reduces the battery voltage to the Float voltage setpoint. When the battery is fully recharged, there can be no more chemical reactions and all the charging current is turned into heat and gassing. The float stage provides a very low rate of maintenance charging while reducing the heating and gassing of a fully charged battery. The purpose of float is to protect the battery from long-term overcharge.

Once in float stage, loads can continue to draw power from the battery. In the event that the system load exceed the solar charge current, the controller will no longer be able to maintain the battery at the float setpoint. Should the battery voltage remain below the float setpoint for a cumulative 30 minutes period, the controller will exit float stage and return to Bulk charging.

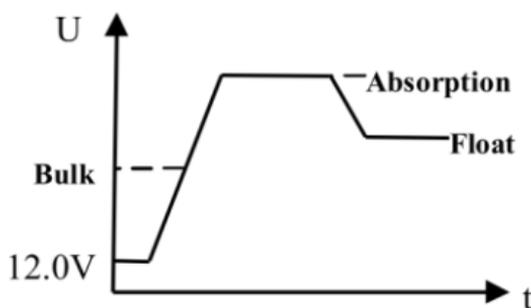


Figure2-1 charge stage

2.2.2 Presets Parameters for 3 Different Types of Battery

Standard charging parameters for “GEL”, “Sealed” and “Flooded” battery are preset. Moreover, a set of user-defined charging parameters are also available, and is shown as follows:

Battery Type	Float Voltage	Absorb Voltage	Absorb Time
GEL	13.8V	14.0V	2h
Sealed	13.8V	14.4V	2h
Flood	13.5V	14.6V	2h
User	13.8V	14.4V	2h

Note: If the battery type is “GEL”, “Sealed” or “Flooded”, above parameters are preset and you can't set them.

2.2.3 Auto-detect the Battery Voltage or Locked to a Fixed Voltage

The “AUTO” setting allows the controller to detect the system voltage automatically on start up and the detected system voltage will never be changed during operation. The auto detect feature should only be used in situations where the system voltage is unknown ahead of time or in systems where the system voltage may change periodically.

2.2.4 Adjustable Charging Voltage

When “User” battery type is selected, float voltage can be adjusted within certain range, default value is 13.7V (for 12V battery). Absorption voltage can be adjusted in a certain range, and the default value is 14.4V (for 12V battery).

2.2.5 Temperature Compensation for Charging Voltage

-4mV/Cell/°C temperature compensation will be applied to the preset voltage for Float charge, Absorption charge and according to the present battery voltage measured by the controller.

For 12V battery, the compensation voltage

$U_{12} = (t-25)*6*(-0.004)$ V. **You can deduce the other voltage**

level like this.

2.2.6 Various Control Modes for Load

There are four control modes for load. they are normal control mode(0), light control on and delayed off Mode(1), light control on and delayed off and one hour before dawn(2), light control mode(3). The delayed duration can be 1-24h. Following are the working introduction for each mode.

Load Mode	Event			
	Dark	End of delay time	1h before dawn	Dawn
0	--	--	--	--
1	Load on	Load off	--	Load off
2	Load on	Load off	Load on	Load off
3	Load on	--	--	Load off

Note: The load will not be on if there is over-current, low voltage of battery or high voltage of battery. Load will be shutdown under any circumstances like short-circuit, over current, low or high voltage of battery. For normal controlling mode, load can only be turned on again when you turn on it by yourself. Load will recover to working normally after clearing the failures like battery low voltage protection, battery high voltage protection, load over-current protection and load short-circuit protection.

For the mode 1, 2, 3 load will be turned on automatically when coming cross a load on event even the load have been turned off by person before. Load will be turned off automatically when coming cross a load off event even you have been turned on the load by person before. If the controller has any of the following situation like battery low voltage protection, battery high voltage protection, load over-current protection and load short-circuit protection, it will make a judgment for the turning on and off logic and then decide when to on or off the load.

2.2.7 Statistical Data of Generated Energy and Consumed Energy

The controller will calculate the following data everyday: total generated Ampere hours, total generated Ampere hours by load.

2.2.8 Communication Function

This is an optional function. If you need this function, please let us know before your order is placed. You can view all the relevant data through computer's COM port and the parameters like float charge voltage, low disconnect voltage, low reconnect voltage can be set. There are other functions like turning on/off the load by remote control and unlock the protection. RS232 or RS485 bus is provided. The communication ID range is from 1-99. For more information about communication protocol, please contact us or consult our dealers.

2.2.9 Protection for Reversed Connection of Battery

If the battery is connected with controller in reversed polarity (not connected with solar panel), controller will not be damaged and will work as normal when correctly connected.

2.2.10 Protection for Reversed Connection of Solar Panel

If the solar panels is connected with controller in reversed polarity, controller will not be damaged and will work as normal when correctly connected.

2.2.11 Protection for Reverse-discharge of Battery

Controllers are able to protect battery from reversed discharging to solar panel at night.

2.2.12 Protection for Input Over-current from Solar Panel

Controller will stop charging when excess current is

detected from the solar panel, and repower automatically after 2 minutes.

2.2.13 Over-current Protection for Load

The load will be turned off when the output current of the load exceeds its rated current for a while, and then be turned on automatically after 20 minutes.

2.2.14 Short Circuit Protection for Load

Controller will enter protection state when the load is detected to be short circuit, and repower automatically after 2 minutes.

2.2.15 Under-voltage Protection for Battery

Controller will turn off the load when the battery voltage is lower than the value preset for under-voltage protection, and turn on the load when the battery voltage reaches the value preset for under-voltage reconnect. The value for under-voltage protection and under-voltage reconnect can be set by users in a certain range.

2.2.16 Over-voltage Protection for Battery

Controller will turn off the load when the battery voltage is higher than the value preset for over-voltage protection, and turn on the load when the battery voltage is 1V lower than the value preset for over-voltage protection.

3. Reference for System Planning

3.1 System Voltage

System Voltage	Power Range
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12V, 24V, 48V are three common voltage type for DC solar power system, and the higher

12V	<800W
24V	<2000W
48V	<6000W

voltage type is, the larger power could be used. Users have to select voltage type according to the power of the load, the work voltage range of the load and some other factors. The table on right is the power range of advice for three kinds of voltage type.

3.2 Configuration of Battery Group

The voltage of battery group should be same as the system voltage. The capacity of battery group is decided by the power of load, daily duration of the load and the spare time for rainy days. In any of the following condition, the bigger battery group is required: 1. the power of load is higher; 2. the load is used longer per day; 3. more time is spared for rainy days.

3.3 Configuration of Solar Panels

Power of solar panels is decided by load power, using time of load one day and sunshine condition. The generated power of solar panels every day should be exceeding the power used by the load and have some reserve. For 12V system, we suggest you to choose a type of solar panel that its Voc is around 22V. If necessary, parallel more panels. The maximum Voc should not exceed 50V for 12V system. For 24V system, we suggest you to choose a type of solar panel that its Voc is around 44V and parallel some if necessary. Maximum Voc should not exceed 50V for 24V system. For 48V system, choose solar panels with Voc around 44V and make 2pcs in series and then parallel some, maximum Voc of series panels should not exceed 100V.

3.4 System Wiring

Cables are supposed to be selected according to the system current, system voltage, temperature rise allowed,

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voltage drop allowed and the material of the cables (copper cable or aluminum cable). It is recommended that the loop voltage loss of the battery to be controlled within 2%, and the loop voltage loss of the solar panel to be controlled within 2.5%.

Wire Size(mm ²)	Distance in meters(feet)			
	30A	40A	50A	60A
9# AWG(6.6mm ²)	1.5m(5.0)	--	--	--
8# AWG(8.3mm ²)	1.9m(6.3)	1.4m(4.7)	--	--
7# AWG(10.5mm ²)	2.4m(7.9)	1.8m(5.9)	1.4m(4.7)	--
6# AWG(13.3mm ²)	3.0m(10)	2.3m(7.5)	1.8m(6.0)	1.5m(5.0)
5# AWG(16.7mm ²)	3.8m(12.6)	2.9m(9.4)	2.3m(7.5)	1.9m(6.3)
4# AWG(21.1mm ²)	--	--	2.9m(9.5)	2.4m(7.9)
3# AWG(26.6mm ²)	--	--	3.7m(12.0)	3.0m(10)
Copper cable, 2% voltage drop, maximum 1-way wire distance for 12 Volt				

3.5 System Over-current Protection

The over-current fusing protection device should be set up for all electronic equipment which is applied to power equipment and the controllers are no exception. Design for sharing anode is applied in this controllers, users are recommended to install over-current fusing protection device in solar cathode loop, and in the cathode loop of battery. And the capacity of the over current fusing protection device should be at least 1.25 times of the rated current.

3.6 System Thunder Stroke Protection

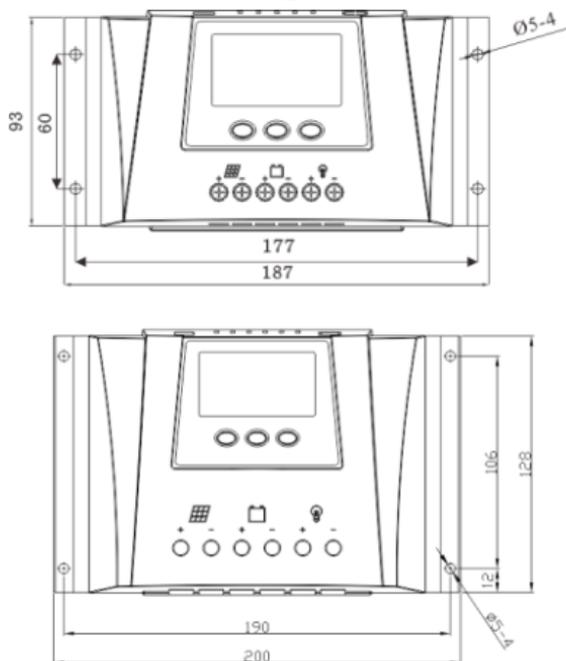
Like many other electronic devices, the controllers may be damaged by thunder stroke. The surge arrester function of controller is limited and users are recommended to install devices for surge arrester on the input side to enhance system reliability.

3.7 System Grounding

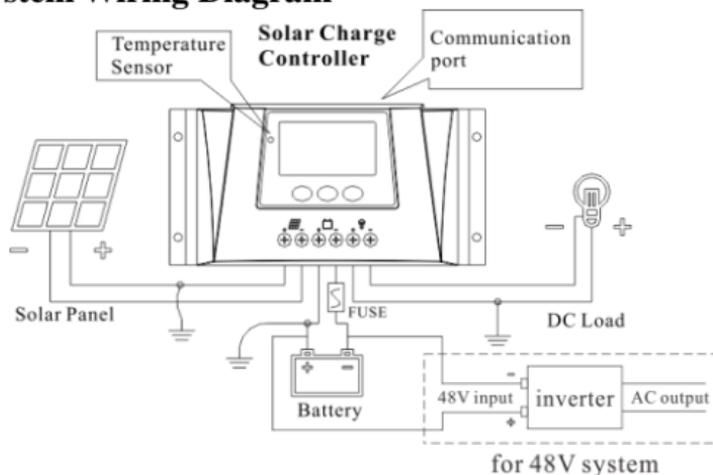
Due to the design of sharing anode scheme, the positive pole, the negative pole of individual solar panel or the negative pole of individual battery can be connected to the ground. But the negative pole of individual solar panel or the negative pole of individual battery can never be connected to the ground at the same time.

4. Installation

4.1 Dimension of the Installing Holes



4.2 System Wiring Diagram



4.3 Communication Port

The hardware interface we used is RJ11-4P4C, as clearly shown in the picture below. One communication cable will be provided for controllers with remote communicate function.

The pins of RS232 and RS485 are different, below detailed function of different pins for your reference.

Pins		1	2	3	4
functions	RS232	GND	NC	RX(controller)	TX(controller)
	RS485	GND	NC	A(+)	B(-)

4.4 Installation Procedure



Note: Please disconnect battery and solar panels before installing controllers. Do not touch the positive and negative terminals of the solar panels or the battery at the same time. Otherwise, you may be danger with electric shock.

- A. Install the controller on a fixed vertical plane and fasten the screws. 10cm should be reserved from all sides to ensure good heat dissipation performance.
- B. Check if the voltage of the battery and the solar panels is within the prescribed range.
- C. Disconnect the over-current fusing protection device or breaker in the loop of battery and solar module.
- D. Connect the cables of load, battery and solar module with the load terminals, battery terminals and terminals for solar module respectively and then fasten them.
- E. If the remote communication function is available, please also connect the communication cable with the controller.
- F. Connect the battery circuit first to see whether the LCD interface is displaying, if the LCD interface is failed to displaying, please handle this problem according to chapter 6.2. Besides, the load will be turned on when the controller is powered on, and you can go further if your load works

normally.

G. Then connect the circuit of solar module. If it is daytime, the controller will start to charge the battery and you can check the present charging current and the voltage of solar panels.

Note: In order to prevent water flowing into the controller along the cables of solar panel, please make a U-shaped bending for the cables of solar panel before connecting with solar controller. Distance between battery and controller should not be too long, otherwise, charge and discharge control accuracy may be affected by the dropout voltage between the terminals of battery and the terminals of controller.

5. Operation

5.1 Instructions for LCD Symbols

Symbol	Meaning
	Controller detected solar panels voltage and judge that now is daytime
	Controller haven't detected solar panels voltage and judge that now is night time
	Solar panels flicker slowly, controller haven't detected solar panels voltage within 24 hours
	Charging circuit is connected, but charging current less than 0.1A
	Charging current more than 0.1A
	Battery fully charged, charging circuit is automatically disconnect
	Flashing quickly means solar panels charging current too large and controller under over current protection state
	Battery capacity percentage, 20% for each cell
	Battery voltage in normal state
	Flicker quickly means battery high voltage protection. Flicker slowly means battery low voltage protection
	Load is turned off by protection action or load off action. under normal controlling mode(mode 0), if this symbol is not display means that the loads id turned off by user

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Symbol	Meaning
	Controller supplying power to load, but load current less than 0.1A
	Load current more than 0.1A
	Current setting of battery type is GEL
	Current setting of battery type is Sealed
	Current setting of battery type is flooded. Not showing any of the battery type means that battery is customized type
	The current data relates to battery temperature
	The current data related to charging
	The current data related to discharging
	The current data related to communication
	Present interface is secondary interface
	The data in present secondary interface can't be set
FLOAT	Current setting data is float charging voltage at interface 2 for main loop, means battery at float charging stage
ABSORP	Current data is absorption voltage setting at interface 2 of main loop, means battery at absorption stage
LVD	The current data is low voltage protection data
LVR	The current data is low voltage reconnect data
	Load controlling mode is one of mode 0 to 3
	Flicker quickly means load under short circuit protection state
	Flicker quickly means load under over current protection state

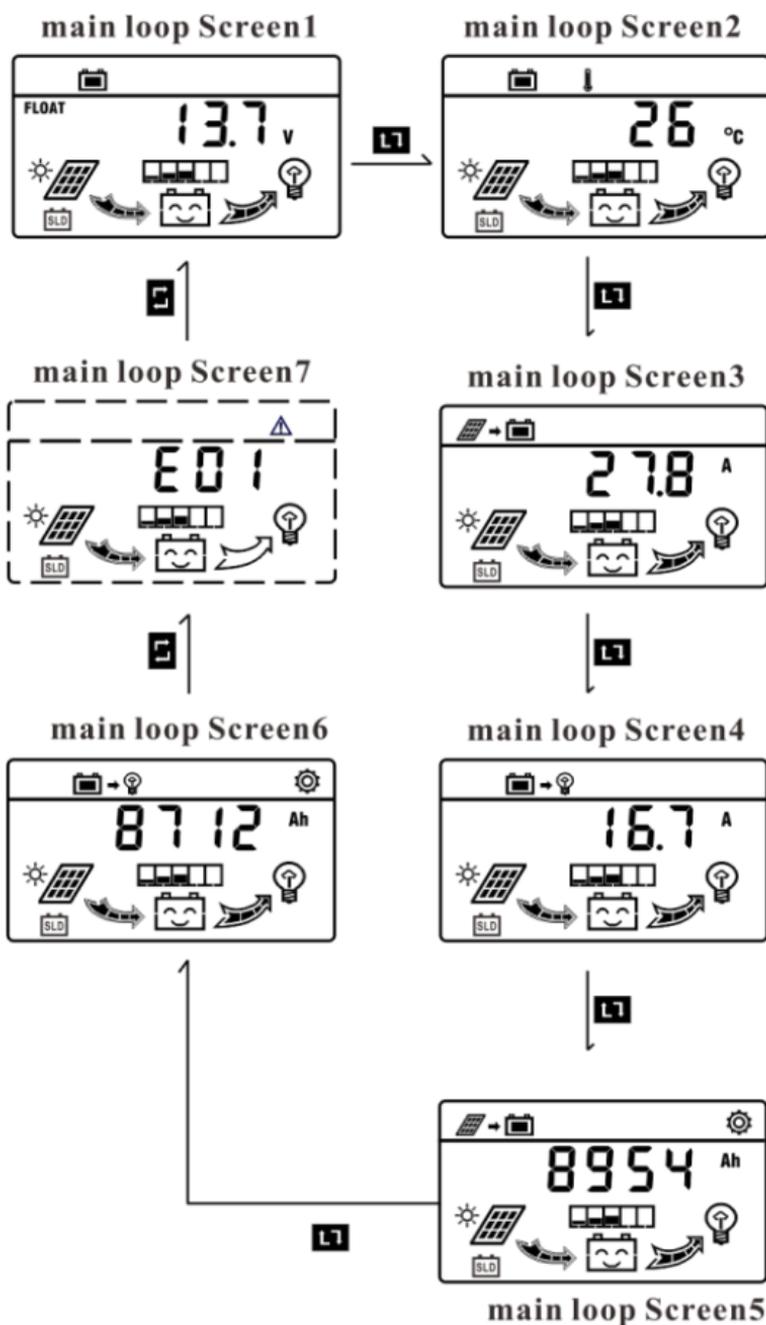
5.2 Instructions for the Function of Buttons

Buttons	Operation	Functions
	 short press	Circulate the menu clockwise in the main loop interface and the secondary loop interface, quit the modification for the parameters and exit the parameter set state
	 long press	Enter into secondary loop interface at the main loop enter into parameter set state in secondary loop save the modified parameters and exit the parameter set state
	 short press	Circulate the menu anti-clockwise in the main loop interface and the secondary loop interface, increase the value in the parameter set state
	 long press	Increase the value automatically in the parameter set state
	 short press	On and off the load at main loop interface. decrease the value in the parameter set state,exit to the main loop interface in the secondary loop interface
	 long press	Decrease the value automatically in the parameter set state

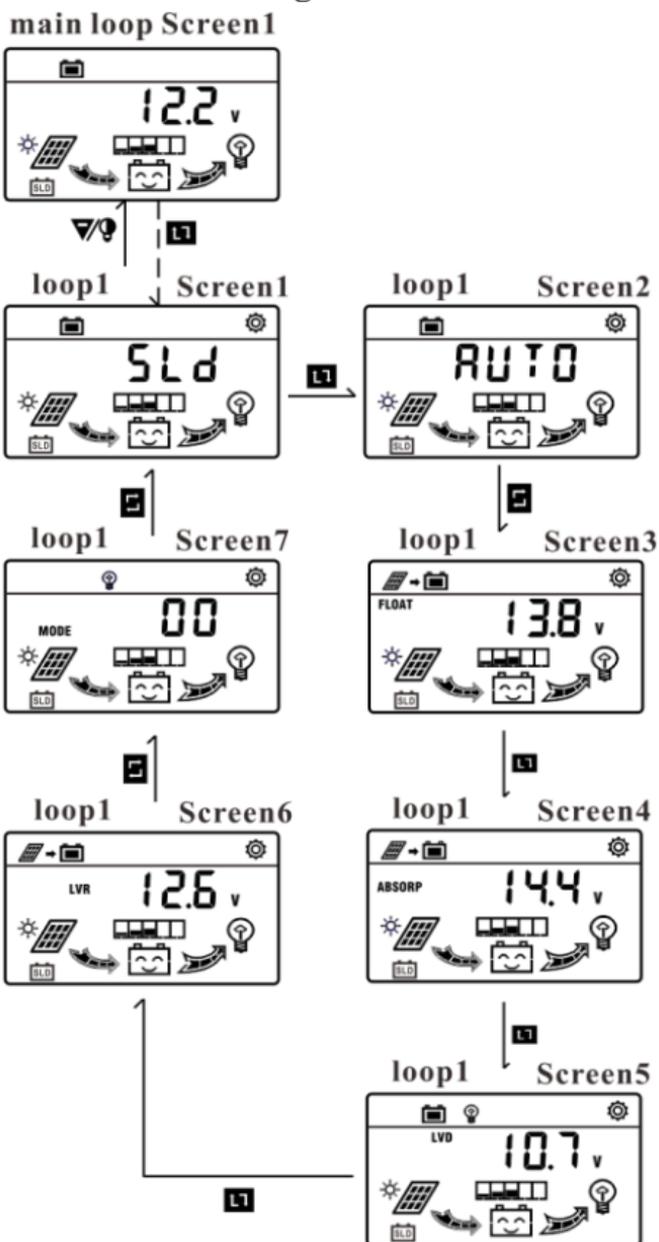
5.3 LCD Main Interface Loop

LCD main loop includes 7 interfaces. They are battery voltage, environment temperature, generating current of solar panels, consuming current of the loads, accumulated charging Ah, accumulated discharging Ah. failure code (not showing this interface when there is no failure). Circulate the interfaces by short press Menu button. It will revert to the main interface if there is no failure and there is no operation on the buttons in 50s. It will skip to failure code display interface if there is failure. It will revert to the main loop interface 1 automatically without saving the setting data if there is no operation on the button in 50s. At the main interface 1, long press Menu will enter into secondary interface loop. At secondary interface loop use Menu to circulate the interface the same as main loop. At secondary interface (not set state) short press Minus to revert to the main loop.

After entering into secondary interface loop, it will show  on the top right corner. If this parameter can not be changed. it will show  on the top right corner. At secondary interface loop, long press Menu to enter into parameter set state and the parameter will start flashing. Long press menu in the parameter set state to save the setting. Short press menu will exit the set state without saving. Long press plus or minus will increase or decrease the value automatically in parameter set state.

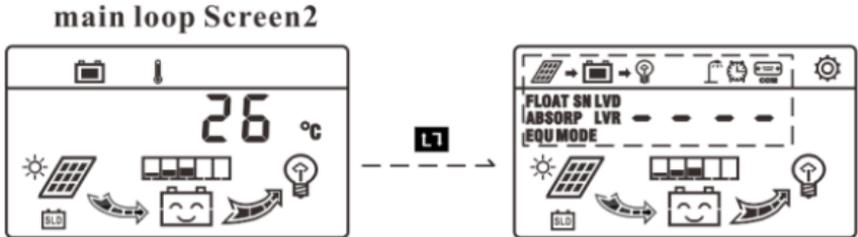


5.4 View and Set Controlling Parameters



5.5 Controlling Parameters Restore to Factory Default Setting

At main loop interface 2, long Press Menu till the symbols in the dotted column starts flashing, then the controlling parameters will recover to the default value. Controller will restart automatically to renew the controlling data.



6. Troubleshooting

6.1 Failure Code Meaning and Trouble Shooting

Error Code	The Cause of Failure	Trouble Shooting
E01	Battery voltage too low, controller has turned off the load	Use AC charger to charge the battery or change a fully charged battery
E02	The load output is over-current, controller has turned off the load	Decrease the load, use Minus button to turn on the load or the load will be automatically turn on by the controller after 20 minutes
E03	Load output is short circuit, the controller has turned off the load	Remove the short-circuit failure of load, use Minus button to turn on the load
E04	Battery voltage too high, controller has turned off the load	Check whether the battery connecting cable is loose, check whether the battery capacity is too small, check whether there is another charger connected with the battery
E05	The output current of solar panels exceeds rated current so that the controller stop to charging	Check whether the power of solar panel has been overpower, decrease the parallel quantity of solar panels and then the controller can be start to charging automatically after 2 minutes

6.2 Common Fault and Handling

Common Fault	Handling
No display on LCD interface after finished the system connection	Check whether the switch of the battery circuit is turned on and fuse protector of battery circuit has been installed and make sure the polarity of connection wire was right
No charging current after finished system connection	Check whether the polarity of solar panels is right. Make sure the connection of wire is complete and no disconnection condition
No working with load after finished the system connection	Check whether you have connected the load with right polarity and whether the controller has over-load, low-voltage or over voltage protection
The load can't be turned on automatically at night when the load has been setting with light control	Check whether the load mode has been correctly set and check whether the solar panels has been shined by other light source

7. Specifications

Model			
Solar Input	Input Voltage	$\leq 50V$	$\leq 100V$
	Rated Input Current	30A/50A/60A	30A/50A/60A
	Charge Loop Voltage Drop	$\leq 0.2V/0.25V$	$\leq 0.35V$
Battery	System Voltage	12V/24V Auto	48V
	No Load Loss	$\leq 13mA$ (Backlight off)	$\leq 18mA$ (Backlight off)
	Battery Type	Sealed, GEL, Flooded, User	
	Charging Mode	3 stage (Bulk, Absorption, Float) PWM	
	Float Voltage	13.8V(12V~15V)*1/*2/*4	
	Absorption Voltage	14.4V(12V~15V)*1/*2/*4	
	Temperature Compensation	-4mV/Cell/°C	
Load	Rated Load Current	30A/50A/60A	30A/50A/60A
	Discharge Loop Drop	$\leq 0.10V/0.12V$	$\leq 0.12V/0.15V$
	Low Voltage Disconnect	10.7V(10V~14V)*1/*2/*4	
	Low Voltage Reconnect	12.6V(10V~14V)*1/*2/*4	
	Over Voltage Disconnect	16.0V*1/*2/*4 (reconnect, 1V lower)	

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Related	Man-machine Interface	LCD with white backlight, 3 red silica gel buttons
	Max Wire Size	16mm ² (AWG 5#) / 25mm ² (AWG 3#)
	Working Temperature	-20°C ~ +55°C
	Storage Temperature	-30°C ~ +70°C
	Working Humidity	10% ~ 90%, no condensation
	Dimension	187mm*98.5mm*49.5mm /200mm*132mm*60.5mm /200mm*132mm*63mm
	Weight	370g/665g/730g
	Case Protection	IP30