



## manual of inteligent solar controller

### intelligent solar controller

#### **abstract**

Thank you for choosing our solar controller product. This product manual will include product function properties, installation, usage, trouble clearance and so on. Before use, customer must read this manual. For any doubt, please contact us by the contact ways included in this manual. We will try our best to serve you.

 **Warm tips:**When connect to the connector, please first connect the load, then battery, and solar panel at last.

## Safety warning

During the installation and usage, please make sure to obey by the following safety regulations and notes to avoid the damage to controller.

- There is no maintainable part in the controller. User must not disassemble or repair the controller without permission.
- Before installing and adjusting the connection of controller, please make sure to disconnect the connection of photovoltaic panel and the fuse or breaker around battery terminals.
- It's suggested that suitable fuse or breaker should be installed outside of the controller.
- After installation, check all the wire connections are reliable to avoid heat accumulation for virtual earth.

## 1. Product properties

The intelligent solar controller is equipped with industrial-grade STM 8 microprocessor to control the charge and discharge process and has perfect and reliable battery charge and discharge period management. The charge circuit is characterized by high efficiency and low consumption by controlling the MOSFET of ultralow internal resistance with PWM. This controller has multiple load control modes and is adaptable to different industries. The product can be applied to the following occasions:

- Outdoor environment monitoring system
- Automatic control system for agriculture and garden
- Solar power system
- Communication station, WIFI hotspot
- High-power household system
- Ship power supply system

## 1.1 Specification parameters

Items	EL-SC20	EL-SC30	EL-SC40	EL-SC50	EL-SC60
System voltage	12V/24V				
Max voltage of PV	24V/48V				
Max output voltage	12V/24V				
Max charge current	22A	33A	44A	55A	66A
Charge way	4-stage PWM charge				
Compatible battery	lead-acid cell				
DC5V port	5V/1A				
Temperature compensation	√				
Dimension	150*85*35mm (20A, 30A)		220*126*63mm (40A,50A,60A)		
Weight	230g(20A,30A)		900g(40A,50A,60A)		
Working and storage temperature	-35°C~ +55°C				

**Tab 1.** controller configuration

This product is a new-generation solar charge and discharge controller for lead-acid battery. The product includes but is not limited to the following functions and properties:

- LCD displayer
- Excellent heat balance design and natural air cooling
- 4-stage charge period management(EQU、Bulk、ABS、Float)
- Temperature compensation function. The controller can automatically adjust the charge parameters of battery by environment temperature to lengthen the service life of battery
- Sophisticated electronic protection production, including overcurrent protection, load short-circuit protection and low-voltage protection.
- Comprehensive and reliable load control mode can identify the day and night.
- Well-designed charge loop can effectively improve the efficiency of charge and discharge, and reduce the heat consumption in charge and discharge.
- Statistics of charge volume of battery.

## 1.2 Charge management

The intelligent solar controller contains built-in 4-stage charge management. The controller can charge the battery rapidly, effectively and safely in PWM way according to preset charge parameters from 0~100% impulse width. Charge process is shown in Fig 1 .

- Equilibrium charge(EQU)

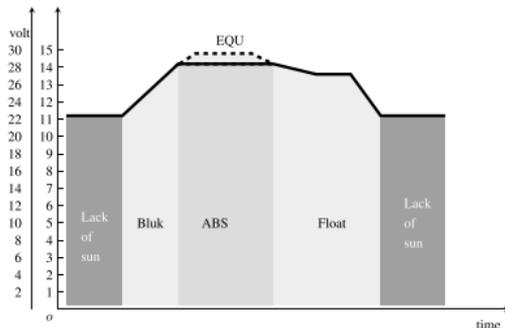
This stage will be activated only when the battery recovers from over-discharge to normal charge. Similar to direct-charge stage, photovoltaic panel charges the battery rapidly with full power until the battery voltage gets close to equilibrium. In the status of equalizing charge, continuous charging with high current and voltage will help to activate the battery and prevent the aging due to over-discharge.

- Direct-charge(Bulk)

Direct-charge is also called as quick charge. During this stage, photovoltaic panel charges the battery quickly with full power. When the battery gets close to constant voltage charge stage, the charge stage is shifted to constant voltage charge.

- Constant-voltage charge(ABS)

Under constant-voltage charge status, photovoltaic panel voltage will be stabilized to the voltage of ABS (mean value) by PWM chopped wave in order to limit the charge rate of battery. It is beneficial to the conversion between electric energy and chemical energy in the battery and guarantees the full



**Fig 1.** charge control period

conversion of charge current. When offline voltage of battery is close to constant regulated voltage, the battery is fully charged.

- **Floating charge(Float)**

In floating charge status, voltage of photovoltaic panel is stabilized to the rated voltage of floating charge (mean value) to limit the charge rate of battery. This charge status is to continuously supplement the battery and make up the energy loss caused by self-discharge. In the loaded condition, voltage of floating charge also provides electric energy of photovoltaic panel for load.

Some kinds of batteries are benefited from regular equalizing charge which can stir electrolyte and balance the voltage of battery to complete chemical reaction. Equalizing charge raises battery voltage and makes it higher than standard supplemented voltage, and gasifies battery electrolyte.

It should be noted that the conversion of charge process has stages, for example, direct-charge is the only way to enter constant-voltage charge stage. Before the end of direct-charge stage, constant-voltage charge stage will not be activated. Only when battery voltage is lower than charge return voltage, controller enters into direct-charge stage, and then into constant-voltage charging stage after quitting direct-charge status until battery is finally full-charged. When battery is firstly connected to controller, if voltage of battery is higher than charge return voltage, charging will not be started even though voltage of photovoltaic panel is sufficient to charge the battery.

### **1.3 Load control mode**

The intelligent solar controller has 6 built-in load control modes which can meet most requirements of light control of solar lighting system. The 6 built-in load control modes are as follow:

- **Pure light-operated mode (L mode)**

by the voltage of photovoltaic panel. The controller controls load output by 100%, 50% and 30% PWM to lengthen the opening duration of load in 3 time sections.

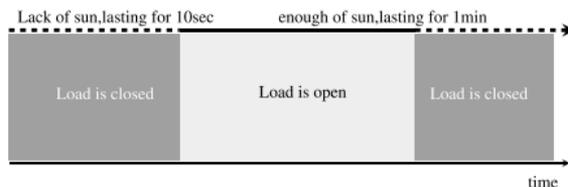
- **Manual mode (H mode)**

In manual mode, the opening or closing of load is manually controlled by ▲ button.

- Normal open mode (24H mode)  
In normal open mode, load will be outputted continuously, which is the so called 24h working mode.
- Charge mode (Ch mode)  
Load control takes no effect in this mode. That means controller only activates battery charge function and load is closed.

Indicator light status	Charge status(Green Light)	Load status(Red Light)
OFF	Insufficient voltage of photovoltaic panel, charge process is stopped.	Load is closed
Constant ON	Ongoing constant-voltage charge	Load is opened
Slow blinking	Battery is getting close to full-charge and float charge ongoing.	Load is overcurrent
Quick blinking	Ongoing direct-charge or equilibrium charge	Load is short-circuit

**Tab 2.** status of charge/load indicator light



**Fig 2.** light-control mode

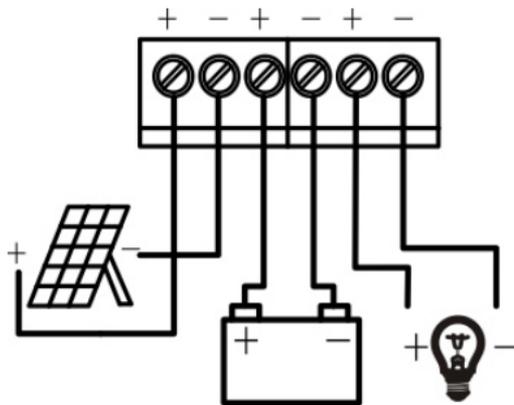
In all related modes of light control, the controller can judge whether environment lighting is low enough to open the load according to the voltage of photovoltaic panel. In making the judgment, the controller must detect the voltage of photovoltaic panel lower than light-control load starting threshold for continuous 10sec. At this time, load is opened normally. When the voltage of photovoltaic panel is recovered to the value above light-control load starting threshold and remains the value for continuous 1min, the load is closed normally. The continuous threshold detection lasting for 10sec and 1min is to prevent false judgment caused by car light, lighting and other lights from circumstance.

- Light & timing mode (LT mode)  
Similar to solo light-control mode, photovoltaic panel will judge the openness of load by current ambient brightness. What is different is that after load is opened, even though the voltage of photovoltaic panel is lower than the load-closing threshold within 1~13h, the controller will still shut down the load by timing and re-start the load again at dark.
- 3 Light-control stages (3L mode)  
Similar to solo light control mode, the controller judges whether it is necessary to open or close the load

## 2. Installation method

The intelligent solar controller will be heated during operation. It is a must to mount it to the surface made of nonflammable materials. Installation on large-sized metal piece is more beneficial to heat dissipation. Please follow the steps below in installation:

- Choose well-ventilated area to install the controller.
- First connect the Load, then battery, and battery panel finally.
- Though the controller has inverse connection protection function, it is better to avoid the inverse connection of photovoltaic panel in engineered installation.
- Connection should be strong and reliable. Contact area of connector should be large enough to prevent virtual connection and heat accumulation caused by oxidation at connection.



**Fig 3.** System connection

## 3. Control and interface instruction

Controller is equipped with a LCD display and can be conveniently switched between modes and parameter configuration. Operation is convenient and simple.

### 3.1 LCD instruction

LCD display description, as shown in Fig 6 .

### 3.2 Start-up interface

After powered, the controller will detect battery voltage and display the model, for example, 1240, as shown in Fig 5.

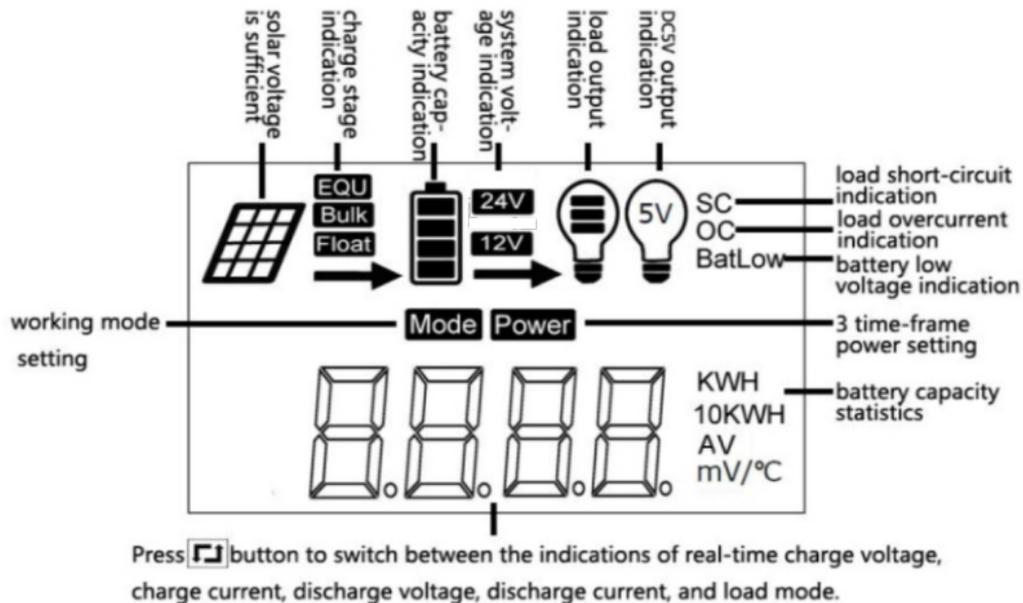
### 3.3 main interface

Displayed contents of main interface include battery voltage(Fig 7), voltage of photovoltaic panel(Fig 8), charge current(Fig 9) ,load control mode(Fig 10) ,load output current(Fig 11), charge energy(Fig 12),and ambient temperature(Fig 13). Press  button to switch between the contents.

In the main interface,▲、▼ can be used as shortcut key button: ▼ button can be used to control the output of DC5V, and ▲ button can be used to control the output of Load ( when the load control mode is set to be H mode).



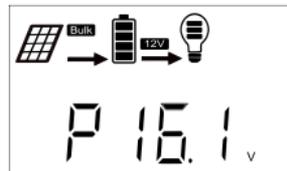
Fig 5. Start-up interface



**Fig 6.** LCD display description



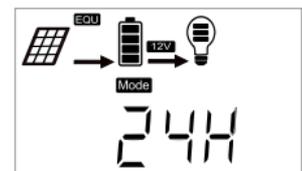
**Fig 7.** battery voltage



**Fig 8.** PV voltage



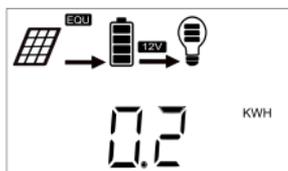
**Fig 9.** charge current



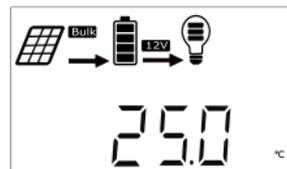
**Fig 10.** Load control mode



**Fig 11.** load current



**Fig 12.** charge energy



**Fig 13.** ambient temperature

### 3.4 Enter and exit interface setting

Long press  button until the content of the LCD is updated as Fig 14. Release the button, the controller would enter the setting interface.

In the setting mode, use  to choose the setting items; All the parameters of the setting items should be changed by these 、 buttons.

After finishing the setting, please long press the  button until the LCD is updated to the main interface, then exit the setting interface.

The controller would exit the setting interface and return to the main interface 20s after there is no any operation of any buttons.

### 3.5 Load parametes setting

Load control parameters setting includes: Load control mode, light control timing mode, 3-time-section duration setting and power percentage setting of 3-time-section.

- Load control mode setting

Press 、 button to select one load control mode, including 24H (normally on mode), CH (charge mode), H (manual mode), L (solo light control mode), Lt (light-control timing mode) and 3L (light-control 3-time-section mode).

When load control mode is set as H mode, press  button to open and close the load.

- Load control mode setting

When load-control mode of controller is set as Lt (light-control timing mode), press  button to select until the display of LCD is shown in Fig 15. And then, press 、 button to adjust the duration in the range of 1~13h.

- 3-time-section duration setting

When load control mode of controller is set as 3L (3-time-section mode), press  button to select until the display of LCD is shown in Fig 16 and Fig 17. Set the duration of first and second time section, and then press upward and downward button to adjust duration within the range of 1~13h. If duration is set as zero, it indicates invalid time section. The third time duration will be set by the controller by the formula: night duration – first time duration-second time duration.

- power percentage setting of 3 time-sections

When load control mode is set as 3L (3-time-section mode), press  button to select until the display of LCD is as shown in Fig 18, Fig 19 and Fig 20. Adjust the power percentage of 3 time sections within the range of 1~100%.

### 3.6 Battery working voltage setting

Battery working voltage setting includes the following setting items: Battery low-voltage protection value setting(Fig 21)、 Battery low-voltage return value setting(Fig 22)、 Battery overvoltage setting(Fig 23)、 Temperature compensated voltage(Fig 24)。

- Battery low-voltage protection value setting

Battery low-voltage protection setting is shown in Fig 21 and the range is shown in Tab 4.

- Battery low-voltage return value setting

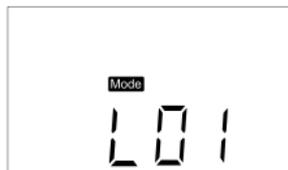
Setting of low-voltage protection value is shown in Fig 22, the range is shown in Tab 4. To prevent the fluctuation of load at starting and closing, low-voltage protection value and low-voltage return value must have at least 0.2V voltage difference.

- Battery overvoltage setting

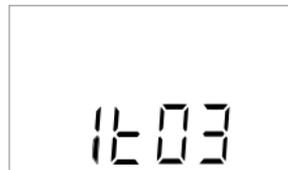
Setting of low-voltage protection value is shown in Fig 23, the range is shown in Tab 4.



**Fig 14.** Load control mode setting



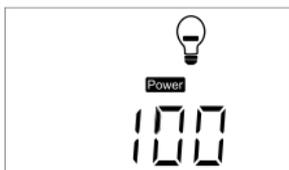
**Fig 15.** Light-control timer setting



**Fig 16.** first time section duration setting



**Fig 17.** second time section duration setting



**Fig 18.** first time section power setting



**Fig 19.** second time section power setting



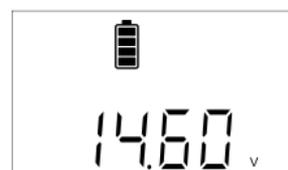
**Fig 20.** third time section power setting



**Fig 21.** Battery low-voltage protection value setting



**Fig 22.** Battery low-voltage return value setting



**Fig 23.** Battery overvoltage setting



**Fig 24.** Temperature compensated voltage

- Temperature compensated voltage

The temperature compensated voltage is shown in Fig 24, the range is shown in Tab 4.

## 4. Troubleshooting and maintenance

If the following abnormal situations happen in use, please check Tab 3. If technical support is required, please record fault phenomenon and status of indicator light, and then contact us.

Abnormal phenomenon	Possible cause	Solution
Though there is sufficient sunshine, charge indicator light is off.	photovoltaic panel is disconnected or connected inversely.	Check if photovoltaic panel is intact and polarity is correct.
Load indicator light blinks slowly.	Load is overcurrent.	Check if the load is normal.
Load indicator light blinks quickly.	Load is in short circuit	Check if the load is normal or connection is in short circuit.
When load is closed, it shows sufficient energy; When load is opened, it enters low-voltage protection mode.	Bad connection of battery or wire diameter is too small.	Check connection wire of battery or replace it with larger wire diameter.
Status shows full-charge soon after charge process is started.	Overvoltage or overcurrent of charge	Check if maximum charge current setting fits the maximum charge current of battery. If necessary, modify charge correcting voltage to lower down charge voltage.

**Tab 3.** Faults and Solutions

## 5. Technical parameters

Voltage parameters are shown in Tab 4. Threshold parameters are shown in Tab 5.

Voltage parameter	12V	24V	Remark
Over	14.6V 14.4V~16.8V	29.2V 28.8V~33.6V	Maximum charge voltage
ChRet	13.2V	26.4V	When charge return voltage and battery voltage is lower than this set value, controller will enter Direct-charge.
EQU	14.4V	28.8V	Equilibrium charge
Bulk	14.0V	28.0V	Direct-charge
ABS	14.2V	28.4V	Voltage of constant voltage charge
Float	13.8V	27.6V	Floating voltage
Close	11.0V 10.0V~12.0V	22.0V 20.0V~24.0V	Low-voltage protection voltage. When battery voltage is lower than this value,controller closes the load and enters into protection.
ClsRet	12.4V 10.8V~12.6V	24.8V 21.6V~25.2V	Low-voltage return voltage. After entering into low-voltage protection,battery voltage will re-sume this set value and open the load again.
Coeff	-21mV -21mV~-30mV	-42mV -42mV~-60mV	Single cell temperature compensated voltage range: -3.5mV~-0.5mV

**Tab 4.** battery voltage parameters

Parametes	EL-SC20	EL-SC30	EL-SC40	EL-SC50	EL-SC60
Light-control start threshold(PV)	5V/10V				
Light-control start delay	10S				
Light-controly termination delay	60S				
Load overcurrent threshold	22A	33A	44A	55A	66A

**Tab 5.** Threshold parameters