Thank you very much for selecting our product!

This manual provides important information and suggestions with respect to installation, usage and troubleshooting, etc. Please read the manual before using the product, especially for the safety instruction.
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1.0 **Safety Instruction**

- Please read all of the instructions before installation.
- There are no user serviceable parts inside the controller. Please do not disassemble or attempt to repair it.
- Avoid direct sunlight where mount the controller outdoor.
- The solar cell model and battery must be disconnected before mount and wire the controller.
- Wearing eye protection glasses when you mount the battery.
- Use insulated tools, do not place any metal near the battery to avoid risk of short circuit.
- Make sure well ventilation around the controller, the acid gases may release when charging.
- Virtual connection point and corroded wire may overheat to melt the wire, burn surrounding materials, or even cause fire. Ensure tight connection and use cable clamps to secure cables and prevent them from swaying in mobile applications.
- Battery connection may be wired to one battery or a bank of batteries. The following instructions refer to a singular battery, but it is implied that the battery connection can be made to either one battery or a group of batteries in a battery bank.
2.0 General Information

Thank you for selecting LMS series solar charge controller. The controller adopts advanced digital control technology, LCD display and automatical operation. With the features of Pulse Width Modulation (PWM) battery charging and unique control technology, the controller will improve the long battery life efficiently. Our controller has many unique features and easy to use.

2.1 Product Overview

The controller could charge battery and discharge automatically for off-grid photovoltaic (PV) systems. The charging process has been optimized for long battery life and improved system performance. The comprehensive self-diagnostics and extensive electronic protection can prevent damage against incorrect wiring or system faults.

★ Features ★

◆ 32 bit MCU with high speed and high performance
◆ 12 bit A/D high-precision sampling to ensure accuracy
◆ Excellent EMC design
◆ 12V/24V nominal system voltage automatic recognition
◆ High efficient Series mode PWM charging, increase the
battery lifetime and improve the solar system performance.

◆ Use MOSFET as electronic switch, without any mechanical switch

◆ Wide feasibility, and automatically recognize day or night

◆ Large LCD display, and 3 buttons combination for full menu operation as HMI (human-machine interface).

◆ Working status display: including charging, battery voltage, solar cell voltage, load current and the accumulative total of generating electricity.

◆ Humanized browser interface design to facilitate the operations

◆ All of control parameters could be set and modified

◆ Several load control methods and memory function are enhancing the load output feasibility. And support to convenient for different demand. For example, solar street light controller, off-grid household power station, outdoor surveillance, etc.

◆ 2 USB interface can provide direct charging for mobile and others equipments.
# 2.2 Product Feature

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>LCD display: Monitoring interface for solar system parameters and running status</td>
</tr>
<tr>
<td>2</td>
<td>USB interface: DC 5V output</td>
</tr>
<tr>
<td>3</td>
<td>Button Combo: 3 buttons for full menu</td>
</tr>
<tr>
<td>4</td>
<td>Load Indicator: Loading</td>
</tr>
<tr>
<td>5</td>
<td>Charge Indicator: Charging</td>
</tr>
<tr>
<td>6</td>
<td>Solar cell module terminal: Connect solar cell</td>
</tr>
<tr>
<td>7</td>
<td>Batteries terminal: Connect battery</td>
</tr>
<tr>
<td>8</td>
<td>Load terminal: Connect load</td>
</tr>
</tbody>
</table>
# 3.0 Installation Instruction

## 3.1 Mount

### Step 1
**Choose Mounting Location**
Locate the controller on a vertical surrounding. Protect against direct sun, high temperature, and water.

### Step 2
**Check and Clean**
Place the controller in the location where it will be mounted. Verify sufficient room to run wires and sufficient room for air flow all-around the controller.

### Step 3
**Holes Marks**
Mark the 4 mounting holes locations on the mounting surface

### Step 4
**Drill Holes**
Remove the controller and drill 4mm holes in the marked locations

### Step 5
**Secure Controller**
Place the controller and align the mounting holes with the drilled holes in step 4. Secure the controller in place using the mounting screws.
3.2 Wiring

Caution: For secure installation, must follow below connect sequence: First battery, second load, and the last photovoltaic panel.

Caution: Load, battery, photovoltaic panel shared the positive (positive ground).

Caution: The solar module(s) high voltage output can cause severe shock and injury. Be careful operation when installing solar wiring.

Loose power connections and/or corroded wires may result in resistive connections that melt wire insulation, burn surrounding materials, or even cause fire. Ensure tight connections and use cable clamps to secure cables and prevent them from swaying in mobile applications.

If nominal system voltage is 12V, make sure battery voltage is higher than 9V before starting the controller. If nominal system voltage is 24V, make sure voltage of battery is no less than 18V; if nominal system voltage is 48V, make sure voltage of battery is no less than 42V. The nominal system voltage can only be automatically identified when controller is powered on automatically.

Controller’s load terminals can be connected to DC electric
equipment whose nominal operation voltage is the same as nominal voltage of battery. The controller supplies power to loads with battery voltage.

**Step 1** Wiring and Switching on

After solar system is wired, check all wirings carefully to make it clear whether all 6 terminals are connected correctly and tightened. Follow the sequence indicated on the image, battery first, loads second and solar module third successively to avoid nominal system voltage identification error.
When controller starts up, liquid crystal display (LCD) displays initialization interface and 2 indicators LED will be blinked once. Check if it is correct. If there are no above procedures, refer to section 6 for troubleshooting.

4.0 Operation

4.1 PWM Technology  
(Series Pulse Width Modulation)

The controller adopts the advanced series pulse width modulation (PWM) charging mode. With range of 0-100%, it can charge the battery quickly and stably under any condition of solar photovoltaic system.

PWM charging mode use automatic conversion duty ratio pulses current to charge the battery. The battery can be fully charged safety and rapidly with the pulse current. Intermissions make oxygen and hydrogen generated by chemical reaction combined again and absorbed. It can eliminate concentration polarization and ohm polarization naturally and reduce the internal pressure of the battery so that the battery can absorb more power. Pulse current charging mode makes battery have more time to react which reduces the gassing volume and makes battery improve the acceptance rate of charging current.
4.2 Battery Charging Information

- **BULK**

In this stage, the battery voltage has not yet reached boost voltage and 100% of available solar power is used to charge the battery.

- **ABS**

When the battery has recharged to the Boost voltage set point, constant- current regulations used to prevent heating and excessive battery gassing. The Boost stage remains 120 minutes and then goes to Float Charge. Every time when the controller is powered on, if it detects neither over discharged
nor overvoltage, the charging will enter into boost charging stage.

● **Float**

After the battery is fully charged in Boost voltage stage, the controller reduces the battery voltage to float voltage stage. 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. In this stage, the charging switches to a smaller voltage, in order to reduce the battery temperature and prevent gassing, and also have scent charging. 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 charge.

● **EQU**

Equalizing charge will active the electrolyte to complete the chemical reaction, balance the battery voltage while the battery showed abnormal. It can boost voltage to gasify the battery electrolyte to enhance the battery life.
4.3 HMI

★ Button Specification

Press: Setting
Hold: Enter/Exist

Selecting up

Selecting down

➢ Charging Indicator:

LIGHT ON when sunlight is available for battery charging and the charging system is normal.
## Load Indicator:

<table>
<thead>
<tr>
<th>Color</th>
<th>Indicator</th>
<th>Charging Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green</td>
<td>Always</td>
<td>ABS</td>
</tr>
<tr>
<td>Green</td>
<td>Flash</td>
<td>BULK/EQU</td>
</tr>
<tr>
<td>Green</td>
<td>Recording</td>
<td>Float</td>
</tr>
<tr>
<td>Green</td>
<td>Off</td>
<td>Off charge</td>
</tr>
</tbody>
</table>

### 4.4 Load Mode

#### 24H mode
Under this mode, controller can 24 hours continuous output unless controller force to shut down for protection as low voltage.

#### H Manual mode
This mode is to turn ON and OFF the load by press button. Default OFF when reconnect power.

#### L Light-controlled mode
The controller will recognize to start the load by 10 second detect the photovoltaic panel voltage lower than load starting...
threshold. If the photovoltaic panel voltage higher than load starting point and last for 1 minute, the load will be shutdown. This setting is in order to avoid the car headlights, lighting or others elements to affect the controller.

➢ **Lt Light-controlled + Timer mode**
The working condition is same as “L Light-controlled mode”, but the load will shut down after set working hours. Working hour: 1-13 hours.

➢ **3L Light-controlled + Time interval mode**
The working condition is same as “L Light-controlled mode”, but the load working hour can be set in 3 time interval. In order to improve the energy efficiency and environment protection, the time interval duration and PWM (0-100%) output can be set to extend the load working hour.
➢ **Ch Charge only mode**  
Only charging under this mode.

## 5.0 Display and Setting

### 5.1 Start and Monitoring Interface

➢ **Initialization Interface**  
When the controller is power on, the following picture will be painted during the initialization.

![Initialization Interface](image)

After initialization, the controller will recognize the battery voltage.
‘12’: Battery voltage; ‘30’: The max rated current. 30A.

Icon Specification:

<table>
<thead>
<tr>
<th>Icon</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Solar Panel Icon" /></td>
<td>Photovoltaic voltage sufficient</td>
</tr>
<tr>
<td><img src="image" alt="Battery Icon" /></td>
<td>Battery power status</td>
</tr>
<tr>
<td><img src="image" alt="Light Icon" /></td>
<td>Load output working</td>
</tr>
<tr>
<td><img src="image" alt="EQU Icon" /></td>
<td>In EQU stage</td>
</tr>
<tr>
<td><img src="image" alt="Bulk Icon" /></td>
<td>In Bulk stage</td>
</tr>
<tr>
<td><img src="image" alt="Float Icon" /></td>
<td>In Float stage</td>
</tr>
<tr>
<td><img src="image" alt="12V Icon" /></td>
<td>Voltage</td>
</tr>
</tbody>
</table>
### Monitoring Interface

**Battery voltage**
After voltage reorganization, controller will auto enter to battery voltage interface.

'b 12.6V' battery offline actual voltage.
- **Solar array voltage**
  Under standby interface, press button 📊 can switch to input voltage monitoring interface. Continual press this button can switch to each monitoring interface.

  `'P 17.8V'`: Solar array actual input voltage 17.8V

- **Controller charging current**
  Under standby interface, continual press button 📊 to switch to controller charging current monitoring interface. It also can switch back to others interface by the same action.

  `'C 6.8A'`: Actual charging current 6.8A

- **Controller load mode**
  Under standby interface, continual press button 📊 to
switch to controller load mode interface. Switching back to others interface by the same action.

‘24H’: Current controller load mode 24H mode

- **Controller discharging current**
  Under standby interface, continual press button 🏃‍♂️ to switch to controller discharging current interface. Switching back to others interface by the same action.

‘L 0.3A’: Current discharging current 0.3A

- **The accumulative total of generating electricity**
  Under standby interface, continual press button 🏃‍♂️ to switch to the accumulative total of generating electricity interface. Switch back to others interface by the same action.
‘6.8 KWH’: The accumulative total of generating electricity 6.8KWH

5.2 Load mode setting

The controller default load mode is 24H mode. Under the standby interface, hold the button \( \Box \) to enter to the interface as below image. The \( \text{Mode} \) icon is flickering in 1Hzh rate, the controller enter to load mode. Controller will save the setting automatically after 20 seconds without any change in load mode setting interface. The setting will active after quit the setting.

\( \Box \) 24H mode setting

Controller in load mode setting interface, press button \( \text{▼} \text{▼} \) to switch the load mode. Current load mode is 24H mode.
Hold the button until back to standby interface, the setting completed.

*Mode setting

*Standby interface

**H manual mode setting**

Controller in load mode setting interface, press button to switch the load mode. Current load mode is H manual control mode. Hold the button until back to standby interface, the setting completed.

*Mode setting

*Standby interface
**Light-controlled mode setting**
Controller in load mode setting interface, press button ▼▲ to switch the load mode. Current load mode is light-controlled mode. Hold the button ▼ until back to standby interface, the setting completed.

**Ch Charge only mode**
Controller in load mode setting interface, press button ▼▲ to switch the load mode. Current load mode is charge only mode. Hold the button ▼ until back to standby interface, the setting completed.
**Lt Light-controlled + Timer mode**

Controller in load mode setting interface, press button **▼ ▲** to switch the load mode. Current load mode is light-controlled + timer mode. Hold the button to **∥** enter the time setting interface. After set the time, hold the button **∥** until back to standby interface, the setting completed.

**3L Light-controlled + Time interval mode**

3L mode only needs to set the first and second time interval, the third one default begin from the end of second time interval to dawn. The load output power can be set individually with range 10-100%. All parameter can be adjusted by the button. **▼ ▲** Detail setting flow as below image.
Press 1st time interval

*Mode setting ↑

Press 2nd time interval

*Standby interface ↓

Hold

Setting Completed

Press 3rd time interval power

1st time interval power

Press 2nd time interval power

2nd time interval power

↓

Standby interface

↑

Mode setting
5.3 Charging and discharging voltage setting

☞ Low battery protection setting
Under load mode setting interface, press the button to switch to below interface.

Press the button \(\downarrow\uparrow\) to set the low battery protection voltage. Hold the button until back to standby interface, the setting completed.

☞ Low battery boost return voltage setting
Under load mode setting interface, press the button to switch to below interface.

Press the button \(\downarrow\uparrow\) to set the low battery boost return voltage. Hold the button until back to standby interface, the setting completed.
Battery maximum charging voltage setting

Under load mode setting interface, press the button to switch to below interface.

Press the button ▼▲ to set the battery maximum charging voltage. Hold ▼ the button until back to standby interface, the setting completed.
6.0 Protection and Troubleshoot

6.1 Protection

◆ If PV array short circuit occurs, clear it to resume normal charge automatically.

◆ If the load current exceeds the rated current of controller 1.3 times, the controller will disconnect the load. Overloading must be cleared up.

◆ Fully protected against load wiring short circuit (≥2 times rated discharge current.) After one automatic load reconnect attempt, the fault must be cleared by restarting the controller or pressing the button.

◆ Fully protection against PV reverse polarity, no damage to the controller will result. Correct the miswire to resume normal operation.

◆ PV is protected against smaller high voltage surge. In lightning prone areas, additional external suppression is recommended.
## 6.2 Troubleshoot

<table>
<thead>
<tr>
<th>Fault</th>
<th>Possibility</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>LCD display and indictor are off after power on</td>
<td>Battery seriously low voltage or disconnected</td>
<td>Please change the battery. Check the battery connection is correct and tight or not</td>
</tr>
<tr>
<td>Charging LED indicator is off during daytime</td>
<td>PV array disconnected</td>
<td>Check the PV connection is correct and tight or not</td>
</tr>
<tr>
<td>Load off working, ‘BatLoW’ icon flickering</td>
<td>Battery over discharge</td>
<td>The controller cut off the output automatically and recovers when fully charged.</td>
</tr>
<tr>
<td>Load indicator recording light and ‘OC’ icon flickering</td>
<td>Over current</td>
<td>Please reduce the number of electric equipments.</td>
</tr>
<tr>
<td>Load indicator flashing and ‘SC’ icon flickering</td>
<td>Short circuit</td>
<td>Check the load connection and wiring</td>
</tr>
<tr>
<td>Soon after charged, the battery power status showing full</td>
<td>Charging over voltage or current</td>
<td>Check the maximum charging current match with battery maximum charging current or not. Revise the charging voltage when necessary.</td>
</tr>
</tbody>
</table>
# Technical Specification

## Parameter

<table>
<thead>
<tr>
<th>Voltage Type</th>
<th>LMS2440</th>
<th>LMS2450</th>
<th>LMS2460</th>
<th>LMS4840</th>
<th>LMS4850</th>
<th>LMS4860</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal Voltage</td>
<td>12/24V</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>48V</td>
</tr>
<tr>
<td>Maximum Battery Voltage</td>
<td>47V</td>
<td></td>
<td></td>
<td>100V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum Charging Current</td>
<td>40A</td>
<td>50A</td>
<td>60A</td>
<td>40A</td>
<td>50A</td>
<td>60A</td>
</tr>
<tr>
<td>Maximum Output Current</td>
<td>40A</td>
<td>50A</td>
<td>60A</td>
<td>40A</td>
<td>50A</td>
<td>60A</td>
</tr>
<tr>
<td>Operation</td>
<td>PWM 3 stage charging mode</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Static Loss</td>
<td>≤12mA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Charging Circuit Voltage Drop</td>
<td>≤0.26V</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Discharging Circuit Voltage Drop</td>
<td>≤0.15V</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>USB</td>
<td>5V/1A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Battery Type</td>
<td>Lead-acid/Gel battery</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Working Temperature</td>
<td>-25℃~+55℃</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Size</td>
<td>220<em>126</em>63mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Net Weight</td>
<td>900g</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


**Voltage parameter**

All coefficients are referred to 12V, and twice in 24V system rate, triple in 36V system rate and quadruple in 48V system rate.

<table>
<thead>
<tr>
<th>Voltage Type</th>
<th>Default</th>
<th>User</th>
</tr>
</thead>
<tbody>
<tr>
<td>Charging Limit Voltage</td>
<td>14.6V</td>
<td>14.4V~16.8v</td>
</tr>
<tr>
<td>Boost Return Voltage</td>
<td>13.2V</td>
<td>-</td>
</tr>
<tr>
<td>EUQ Voltage</td>
<td>14.4V</td>
<td>-</td>
</tr>
<tr>
<td>ABS Voltage</td>
<td>14.2V</td>
<td>-</td>
</tr>
<tr>
<td>Boost Voltage</td>
<td>14.0V</td>
<td>-</td>
</tr>
<tr>
<td>Float Voltage</td>
<td>13.8V</td>
<td>-</td>
</tr>
<tr>
<td>Low Voltage Protection</td>
<td>11.0V</td>
<td>10.0V~12.0V</td>
</tr>
<tr>
<td>Low Voltage Recovery</td>
<td>12.4V</td>
<td>10.8V~12.6V</td>
</tr>
</tbody>
</table>

*User column is the range of manual setting.

**Threshold Voltage Value**

<table>
<thead>
<tr>
<th>Project</th>
<th>12V controller</th>
<th>24V controller</th>
<th>48V controller</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light-controlled Threshold Voltage</td>
<td>5V</td>
<td>10V</td>
<td>15V</td>
</tr>
<tr>
<td>Light-controlled Start delay</td>
<td></td>
<td>10S</td>
<td></td>
</tr>
<tr>
<td>Light controlled shut down delay</td>
<td></td>
<td>60S</td>
<td></td>
</tr>
</tbody>
</table>
- **Dimension**

  Length Unit: mm

![Dimension Diagram](image-url)
Final interpretation right of the manual belongs to limutech. Any changes without prior notice!