Instruction manual for 18Ah lithium solar lighting system

1. Your solar lighting kit:

1.1 This kit is designed for use as a remote or portable lighting system. The built-in battery and solar controller collect and store power, which is then used for lighting, USB charging or other small 12V DC loads.

1.2 The kit comes with the main unit, containing battery and control systems with LED indicators, and four 5W LED lights with 5m leads. The kit also includes two cable adapters for connecting various compatible solar panels – depending on the type of solar panel supplied with your kit you should use one cable adapter or the other:
- the cable adapter with two black connectors (MC4 connectors) is designed for connecting any solar panel that comes with cable with standard MC4 compatible connectors on the end;
- the other cable adapter with a single DC socket is suitable for connecting a solar panel that has a cable with a matching DC plug on the end. This adapter can also be used for connecting an optional mains charger to top up the system battery when there is limited solar power available, e.g. in the winter season (mains charger is purchased separately, product code: **SL-CH-3A**).

2. Safety measures and precautions:

2.1 Do not use the equipment near flammable or explosive substances or sources of heat

2.2 Avoid any contact of system components with water (apart from the solar panel which can be used in rain)

2.3 Keep the system out of reach of children

3. Installation and operations:

3.1 Position the solar panel outdoors in a location where it will receive maximum bright direct sunlight and will be exposed to the largest possible area of sky, with minimal obstructions. Ensure that there is no shading – prolonged shading of the solar panel surface will reduce the output significantly. Fix the solar panel to your roof or wall with suitable Z-brackets, timber, clamps, an angled frame, angled brackets or metal wires / ropes using the mounting holes on the back. Alternatively, if your surface is flat (such as a metal roof), bond the solar panel frame to the roof surface with a suitable sealant or adhesive rated for outdoor applications. Connect the ends of the solar panel cables to the solar adapter using MC4 connectors. Ensure the positive and negative wires are connected with correct polarity.

Please do not use the solar panel indoors even if it is next to a window which receives regular sunlight. If the solar panel is positioned indoors, the charging time will increase substantially and the battery lifetime will be reduced.

Use all other system components indoors only, including the system case, switches and LED lights.

3.2 Turn the master switch on and connect the solar panel or mains adapter (**SL-CH-3A**) to the control unit. The battery LED light will switch on. If the solar panel or mains adapter is producing energy, the solar charging LED light will also switch on, indicating that the solar panel has begun to charge the battery.

If using the system for the first time after purchase, charge it from the solar panel or mains adapter until the battery is full. When the battery becomes fully charged, the solar LED light will change from red to green. Please note that when you charge your system from the solar panel, the charging time could vary considerably from several hours to several days depending on the size of your solar panel, weather conditions, country and season. Charging from the mains adapter (SL-CH-3A) usually takes several hours.

When the battery is full, you can start using the system to power the LED lights.

IMPORTANT:

Check that your solar panel is compatible. Do not connect any solar panel (or a combination of solar panels) with the combined power higher than 100W, or solar panel(s) with the open circuit voltage higher than 25V, otherwise the control unit will be damaged immediately.

3.3 The main system control panel:

1. Master switch
2. 12V output switch
3. 12V DC output sockets
4. 5V output USB
5. Solar charging: **green** = battery is full, **red** = charging, **green** and **red** = float charging (final stage of charging).
6. Battery (**green** = ready, **red** = low power)
7. 12V load (**green** = ON)
8. 5V load (**green** = ON)
9. 5V output switch
10. Solar panel input socket (also used for main charger input)

Note: the actual appearance of the front side of the control unit may be different from the photo

The master switch can be used to activate/deactivate the entire control unit. If the master switch is turned off, everything will be turned off including charging from the solar panel or mains adapter to the battery. The 12V switch controls the LED lights and allows to switch them on/off simultaneously (the cable of each LED light also has a separate switch to turn each light on/off individually). The 5V switch controls the USB port, so that charging of connected USB devices (phones etc.) can be switched on and off.

3.4 If there is enough voltage from the battery, the 12V load LED will be on (powering the LED light sockets) when you turn the 12V switch on. Plug the LED lights into the front sockets and switch them on/off when needed. When the battery voltage becomes too low, the battery LED indicator will turn **red**. If the LED lights remain in use, the 12V indicator will switch off and the LED lights will turn off automatically to retain battery power. Please do not use LED lights or any other loads / USB charging if the battery LED is **red**. Keep the battery on charge until the battery light is **green** again. Avoiding deep discharge of the battery will ensure a long service life.
Note: when the master switch is in the 'OFF' position, the battery is not being charged even if the solar panel or mains adapter is connected to the control unit. The master switch should be 'ON' to enable charging.

3.5 The control unit has a built-in solar charge controller which prevents over-charging of the battery and stops any reverse current flow from the battery to the solar panel at night. There is no need to disconnect the solar panel in the evening and reconnect in the morning. Leaving the solar panel permanently connected to the system will ensure that the battery is being charged, even in cloudy or low light conditions. Only a suitable 12V solar panel or the mains adapter should be connected to the input socket, or this could damage the system.

3.6 The amount of time you can run the LED lights from solar power mainly depends on the season (length of day and whether the sun is low or high in the sky) and also position/orientation of the solar panel. It is also influenced by the temperature, age of the battery and the number of previous battery cycles. The general principle is that the less the battery is discharged each time you use the system, the longer the lifetime of the battery will be. Avoid situations where the battery becomes too low, and whenever possible, allow it to recharge significantly before using the lights again. Adjust power consumption or supplement solar power with mains charging in the winter season when the battery requires longer to charge.
Note: if the battery LED turns from red to green while charging, it doesn't mean that the battery has become fully charged. The battery will continue to charge for some time after this point.

3.7 The system comes with 5W 12V LED lights. If any additional 12V load is used in conjunction with the LED lights, ensure that the total power consumption is within 24W. Note that if the USB port is used for fast charging

at maximum 2A output, the amount of energy used from the battery during 1 hour of USB charging will be approximately the same as 1 hour of running 2 x 5W LED light bulbs. Therefore, using USB charging whilst running LED lights may discharge the battery quicker and is therefore not recommended.

IMPORTANT:
To avoid loss of battery capacity and permanent damage to the system, ensure that:
- When the solar panel is disconnected and the system is not in use for longer than 1 week, the master switch is in the "off" position.
- When the solar panel is connected, but the system outputs are not expected to be used for 6 weeks or longer, the master switch is turned "off" and the system is treated as "in storage".
- When the system is placed in storage, it is kept at room temperature 15ºC – 25ºC. Avoid storing the battery for long periods on full charge, as lithium batteries should only be partially charged for storage. Always keep the master switch in the "off" position while in storage.
If the system unit is left for a long period of time without charging, and with the master switch in "on" position, the battery will fully discharge over time and the system will not start. Reconnection of the solar panel or mains charger will not recover the system. Only an experienced and qualified person will be able to remove the battery from the system and attempt to recharge / recondition it by other means, which is not always possible.

4. Troubleshooting

4.1 Charging LED indicator is off, battery LED is on: **No input power**. Please inspect the solar panel cable for potential damages or cuts (which are often caused by pets or rodents); check the end connector for a short circuit. Check whether the solar panel is exposed to enough light and that it is properly connected to the control unit; if possible, open the black connection box at the back of the solar panel to examine the connections. If the problem is not found, a qualified skilled person with experience of using a digital multimeter will need to measure the output from the solar panel connectors in the black connection box on the back of the solar panel to determine whether the problem is with the solar panel or with the cable connecting the panel to the control unit.

4.2 All LED indicators on the unit are off even when the master switch is turned on: **The battery is fully discharged.** The battery is fully drained below the point where the solar panel or mains adapter can begin charging. An appropriately qualified and skilled person will need to open the system cover, measure the voltage from the battery terminals with a digital multimeter. If confirmed discharged, the battery should be recharged / reconditioned by using a suitable charger or replaced.

4.3 No load output. 12V load indicator is off, the battery LED is red: **The battery is very low**. Please disconnect or turn off all the LED lights, turn the load switches off and charge the battery from the solar panel or mains adapter until full. This may range from several hours in bright summer weather to 7-10 days in the winter depending on location and size of your solar panel.

4.4 No load output. 12V load indicator is off, the battery LED is green, the 12V switch is on: **12V rocker switch problem.** If the system has been used in an area affected by high humidity, rocker switches may get dirty or develop corrosion inside with time. A qualified and skilled person may need to take out the red rocker part of the switch with a small flat headed screwdriver, clean the contacts and reinstall the switch.

4.5 No USB charging output. 5V load indicator is off, the battery LED is green, the 5V switch is on: **5V rocker switch problem.** If the system has been used in an area affected by high humidity, rocker switches may get dirty or develop corrosion inside with time. A qualified and skilled person may need to take out the red rocker part of the switch with a small flat headed screwdriver, clean the contacts and reinstall the switch.

4.6 One of the LED lights cannot be switched on, but the other LED lights work well: **Light bulb / bulb holder, cable or a push-switch problem**. Please swap the light bulb with a working light bulb to check if the cable / switch / and the light bulb holder for the LED light which didn't work has now started working. If the LED bulb was faulty, please replace it. If the problem is the cable / light bulb holder, please disconnect it from the system

and try lifting the central contact tag in the holder using a screwdriver with a flat head. This should improve the contact with a light bulb in case if it is not screwed into the holder deeply enough.

4.7 The LED lights switch on only for a short period of time, and then switch off or flicker: **The battery is very low**. This is an over-discharge protection function of the system. When the battery is low, the system prevents further discharge to avoid damage to the battery. Disconnect all LED lights cables, turn the load switches off and leave the unit to charge from the solar panel or mains adapter until the battery is full.

4.8 The battery discharging time is shorter than normal: **The battery is only partially charged**. When you started using the system, the battery was not yet full. Allow the system to charge from the solar panel or mains adapter for longer to raise the level of the battery.

4.9 Difficult to screw the light bulb into the plastic light bulb holder: This happens occasionally with some light bulb holders when they are made for a tight fit. Find the point on the light bulb where the thread spiral starts, and make sure it touches the corresponding point on the light bulb holder where the internal thread spiral starts. Ensure that you keep the light bulb perfectly straight in relation to the holder, then gently push the light bulb in, rotating it at the same time. If the light bulb changes angle or tilts to the side as you screw it in, has not caught the thread correctly. In such case, unscrew it and start again.

4.10 The unit has been on charge from solar for 10 days (no use of LEDs during this period) but the solar light has not turned to green yet (or green and red flashing): This is most likely due to the low light winter season or obstructions in front of the solar panel. It is often difficult in the winter for the solar panel to raise the battery voltage to the fully charged level during the final charging stage. If you left the system on the initial charge for 10 days after purchase and the solar light has not turned to green yet, you can start using the system.

4.11 I can only use the LED lights for half an hour each day in the winter: It should be noted that in some countries and locations the winter day is short and the sun is very low in the sky. This results in up to 10 times less solar energy per day than in the summer. Please try adjusting the solar panel angle to 50-60 degrees to the ground so that the panel faces the sun directly during the day when the sun is low in the sky. This should improve the winter performance of the solar panel, in certain cases doubling the daily output compared to a more shallow or flat angle in the winter. Alternatively, use the mains adapter (SL-CH-3A) to periodically top up the battery.

5. Specifications

Solar lighting system	**SL-L18AH**
Rated charging current	6A
Rated discharge current	2A
Rated working voltage	12V
Maximum solar input power	100W
Solar panel open circuit voltage (Voc)	18 – 25V
Solar panel maximum power voltage (Vmp)	17 – 20V
Battery	LiFePO4 12.8V 18Ah
Maximum USB charging output	2A
Low-voltage protection	11V
High-voltage protection	14.6V
No-load current	14mA
Working temperature	0 – 40 °C
Storage temperature	-10 – 50 °C

System components	**SL-L18AH**
Solar panel cable (2x MC4 to 1x silver 2-pin DC plug)	1 x 20cm
Solar panel cable (1x 1-pin DC socket to 1x silver 2-pin DC plug)	1 x 20cm
LED lights (with 5m cable, DC plug)	4 x 5W 12V
Control unit with battery	1