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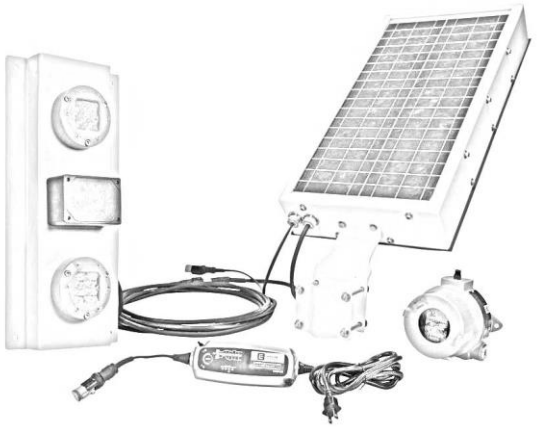
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LarsonElectronics®

24W LED Signal Stack Light

Operation Manual



Model

WAL-TL-2X12W-C-EXWR-SOL

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Installation

1. Begin by mounting the solar panel in a location where it will receive an adequate amount of sun throughout the day. For round/square pole mounting, loosen or remove the 4 bolts at the base to mount the solar panel. Replace these bolts tightly once mounted. The solar panel can also be secured to a flat surface with the 4 mounting holes.

2. Mount the lights within range of the provided cord. There are 4 mounting holes on the aluminum back plate for mounting the light panel to a flat surface.



WARNING:
THE WIRELESS REMOTE CONTROL CAN BE USED WITHIN HAZARDOUS ENVIRONMENTS, BUT THE FIXTURE AND PANEL MUST BE INSTALLED OUTSIDE THE HAZARDOUS AREA!



THIS IP68 RATED SIGNAL STACK LIGHT IS APPROVED FOR USE IN WET LOCATIONS AND MARINE ENVIRONMENTS.

3. Connect the lights to the solar panel by plugging in the deutsch connection. A click indicates the connector is locked in place. There is a power switch located on the side of the solar panel. Move this switch to its **ON** position and the traffic light will illuminate. Moving this to its **OFF** position will turn off the traffic light.

The power switch will not affect the charging state of the solar panel. The solar panel will continue charging regardless of the power switch position.

The system will power the lights for approximately 12 hours on a fully charged battery. Charging time for the battery is 5 hours in direct sunlight.

4. Use the included remote control to altenate the traffic light to each color individually. A momentary push button switch on the wireless remote control will illuminate each light independently.

5. The included 120V battery charger can be used to provide continuous charge or a power boost when little to no sun is available to the solar panel. Plug this into the secondary deutsch connector on the solar panel when necessary.

Replacing the Remote Control Battery



WARNING: DO NOT OPEN THE REMOTE INSIDE THE HAZARDOUS AREA!

1. Place the remote control with the glass lens facing up.
2. Loosen the set screw and unscrew the lens of the enclosure.
3. Once inside, remove the old battery.
4. Insert a new battery with the correct polarity.
5. Test the remote.
6. Close the unit tightly to maintain explosion proof rating!

Solar Panel Battery Maintenance

Two 8aH sealed lead acid batteries are contained in the solar panel. A voltage regulator prevents the unit from completely depleting the batteries to help prolong battery life. The charge controller indicates the battery status. Read *Battery Replacement* below for instructions on how to open the solar panel and view the battery status on the charge controller.

Battery Replacement (video: https://youtu.be/p7cAKhOtvYQ)



WARNING: Shock Hazard

1. Open the solar panel. Take it down from its mounted location and lay it flat on a non-abrasive surface to protect the panel.

2. Use a 3/16” allen wrench to remove the 10 bolts securing the back plate. Lift the panel lid off revealing 2 12V batteries inside.

3. Use a pair of needle nose pliers to remove the hot (red) connection from each battery first. Then, remove the neutral (black) wire from each battery.

4. Once all connections to the battery have been disconnected, remove each battery. You may need to use a flat head screw driver or mallet to help pry and free each battery.

5. Insert two new 12V batteries. Battery voltage must be greater than 6 volts to power the controller. Use a rubber mallet to gently tap them back in place. Make sure they are secured tightly.

6. Reconnect the neutral (black) wires to each battery. Then replace the hot (red) connection. At this point, the controller should show a green light indicating the batteries are connected and full.

7. Replace the back panel with the 10 allen bolts removed earlier. The solar panel is ready to be placed back in service.

Inspection

The following inspections and maintenance tasks are recommended at least two times per year for best controller performance.

- Tighten all terminals. Inspect for loose, broken, or corroded connections.
- Verify that all wire clamps and tie-downs are secure.
- Check that the controller is mounted in a clean, protected environment; free of dirt, insects, nests, and corrosion.
- If applicable, check enclosure ventilation and air flow holes for obstructions.
- Verify LED indication is consistent with the present system conditions.

Common Problems

Problem: No LED indications
Solution: With a multi-meter, check the voltage at the Battery terminals on the controller and the Solar terminals on the controller. The solar module must be in good sun and battery voltage must be at least 1 V to power the controller and activate the dead battery charging function.

Problem: The controller is not charging the battery.
Solution: If the Status LED is solid or flashing red, see Error Indications. If the Status LED is off, measure the voltage across the Solar input terminals of the controller. Input voltage must be greater than battery voltage. Check fuses and solar wiring connections. The solar module must in full natural sunlight.

Problem: No load output.

Solution: If the battery status indication is Solid Red, the controller is in the Low Voltage Disconnect (LVD) condition. The load will automatically switch on when the battery recharges to the Low Voltage Reconnect (LVR) threshold voltage. See the specifications in section 7.0 for LVD & LVR settings.

NOTE: If the controller model is SS-6-12V or SS-10-12V (no load control feature), the controller may be damaged.

Controller Status LED Error Indications

• Solar overload	Flashing Red
• High Voltage Disconnect	Flashing Red
• High Temperature Disconnect	Flashing Red
• Damaged local temp. sensor	Solid Red[1]
• Damaged heat sink temp. sensor	Solid Red[1]
• Damaged input MOSFETs	Solid Red[1]
• Firmware Error	Solid Red[1]

1 - A heartbeat indication flickers the Status LED off briefly every 5 seconds.

A solid red Status LED indicates that a critical fault has been detected. Critical faults typically indicate that the controller is damaged and requires service.

Battery Status LED Error Indications

• High Voltage Disconnect	R - G Sequencing
• High Temperature Disconnect	R - Y Sequencing
• External Wiring Error	R&G - Y Sequencing
• Load Overcurrent	R&G - Y Sequencing
• Load Short Circuit	R&G - Y Sequencing
• Self-test Error	R - Y - G Sequencing

Note:

LED error indications can be interpreted as follows:
“R - G sequencing” means that the Red LED is on, then the Green LED is on, then Red LED is on....
“R&G - Y sequencing” means that both the Red LED and Green LED are on, then just the Yellow LED is on, then Red and Green LED are on....

Battery Status LEDs

	Falling V	Rising V	
G to Y	12.1	13.1	Y to G
Y to Flash R	11.7	11.8	Flash R to Y
Flash R to R	11.5	12.6	R to Y

LED Indications

STATUS LED

The Status LED indicates charging status and any existing solar input error conditions. The Status LED is on when charging during the day and off at night. The Status LED will flash red whenever an error condition(s) exists. Table 1 lists the Status LED indications.

Color	Indication	Operating State
None	Off (with heartbeat[1])	Night
Green	On Solid (with heartbeat[2])	Charging
Red	Flashing	Error
Red	On Solid (with heartbeat[2])	Critical Error

[1] Status LED heartbeat indication flickers ON briefly every 5 seconds

[2] Status LED heartbeat indication flickers OFF briefly every 5 seconds

Table 1. Status LED definitions

BATTERY SOC LEDS

Three (3) battery “state of charge” (SOC) LEDs indicate the level of charge on the battery. The SOC indication is based only on battery voltage set points, which only provides an approximation of the actual state of charge of the battery. Table 2 lists the SOC LED indications

SOC LED	Indication	Battery Status	Load Status
Green	Fast Flashing (2 Flash / sec)	Full Battery: Equalize Charge	Load On
Green	Med. Flashing (1 Flash / sec)	Full Battery: Absorption Charge	Load On
Green	Slow Flashing (1 Flash / 2 sec)	Full Battery: Float Charge	Load On
Green	On solid	Battery Nearly Full	Load On
Yellow	On solid	Battery Half Full	Load On
Red	Flashing (1 Flash / sec)	Battery Low	LVD Warning (Load On)
Red	On solid	Battery Empty	LVD (Load Off)
None	No LEDS On	Battery Missing	Load Off

Table 2. Battery SOC LED definitions



NOTE:
An error condition exists if multiple Battery SOC LEDs are flashing. See Error Indications for more information.

Battery Charging Information

The controller has a 4-stage battery charging algorithm for rapid, efficient, and safe battery charging. Figure 9 shows the sequence of the stages.

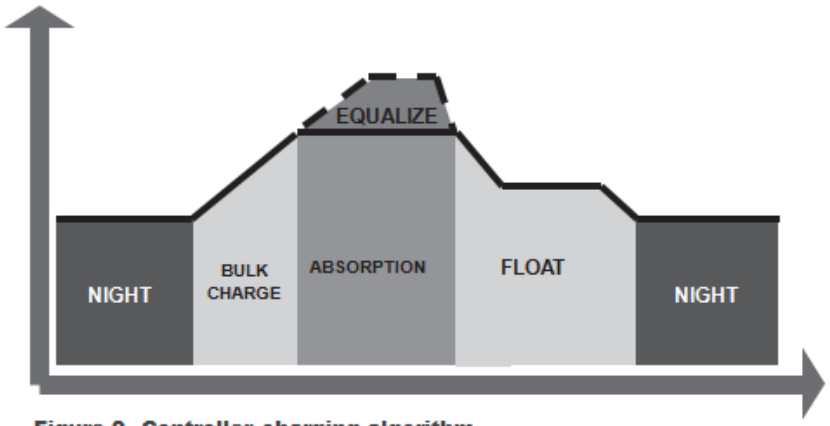


Figure 9. Controller charging algorithm.

Bulk Charge

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

Absorption

When the battery has recharged to the Absorption voltage setpoint, constant-voltage regulation is used to prevent heating and excessive battery gassing.

Float

After the battery is fully charged the controller reduces the battery voltage to a float charge which is sometimes called a trickle charge.

Depending on battery history, the battery remains in the absorption stage for 3 or 4 hours before transitioning to the float stage.

Dead Battery Charging

The controller has a special charging function to recover batteries that have discharged too low. If the terminal voltage of the battery is greater than 1 Volt, the controller will detect the battery and provide approximately 85% of available charge current until the battery reaches the minimum operating voltage of the controller. When the battery has recharged to the minimum operating voltage of the controller, 100% of available charge current will flow to the battery and normal operation will resume.

Load Control Information

The primary purpose of the load control function is to disconnect system loads when the battery has discharged to a low state of charge and reconnect system loads when the battery is sufficiently recharged. System loads may be lights, pumps, motors, DC appliances, and other electronic devices. The total current draw of all loads must not exceed the controller maximum load rating.

NOTE:
Do not wire an AC inverter of any size to the load terminals of the controller. Damage to the load control circuit may result. Connect inverters directly to the battery or battery bank.

Load Control Settings

Load control is fully automatic. The load will be disconnected and reconnected based upon the Low Voltage Disconnect (LVD) and Low Voltage Reconnect (LVR) voltage thresholds. The LVD and LVR thresholds are listed in the back of the manual.

LVD Warning

As the battery discharges the Battery Status LEDs will transition from green to yellow and then from yellow to flashing red. The flashing red indication is a warning that a low voltage disconnect event will occur soon. The amount of time between a green SOC indication and load disconnect will depend on many factors including:

- rate of discharge (amount of load draw)
- capacity of the battery
- health of the battery
- LVD setpoint

If the battery discharges to the LVD setpoint the load will disconnect and a solid red Battery Status LED indication will be displayed.

Protections

Solar Overload

(Charging Status LED: Red flashing) If the solar current exceeds the maximum solar rating, the controller will stop charging until the solar current returns to within its operational rating. See *Section 7.0 Technical Specifications* for more information.

Load Overload

(Battery Status LEDs: G&R - Y sequencing) If the load current exceeds the maximum load current rating, the controller will disconnect the load. The controller will attempt to reconnect the load two (2) times approximately 10 seconds apart. If the overload remains after the first two (2) attempts, the fault must be cleared by removing and reapplying power.

Solar Short Circuit

(Charging Status LED: off) Solar input power wires are short-circuited. Charging automatically resumes when the short is cleared.

Load Short Circuit

(Battery Status LEDs: G&R - Y sequencing) Fully protected against load wiring short-circuits. After two (2) automatic load reconnect attempts (10 seconds apart), the fault must be cleared by removing and reapplying power.

PV Reverse Polarity

(Charge Status LED: off) Fully protected against reverse solar connection. No damage to the controller will result. Correct the mistake to resume normal operation.

Battery Reverse Polarity

(Battery Status LED: G&R - Y) Fully protected against reverse battery connection. No damage to the controller will result. Correct the mistake to resume normal operation.

Damaged Local Temperature Sensor

(Battery Status LED: R - Y - G sequencing, Charge Status LED: R on solid) The local ambient temperature sensor is short-circuited or damaged. Charging stops to avoid over- or under-charging. This is a critical error. Contact your authorized Morningstar dealer for service.

Damaged Internal Temperature Sensor

(Battery Status LED: R - Y - G sequencing, Charge Status LED: R on solid) The internal heatsink temperature sensor is damaged. This is a critical error. Contact your authorized Morningstar dealer for service.

High Temperature

(Battery Status LED: R - Y sequencing) The heatsink temperature has exceeded 85 °C and the solar and load is disconnected. The controller will automatically reconnect when the heatsink cools to 80 °C.

High Voltage Disconnect

(Battery Status LED: R - G sequencing) The battery voltage has exceeded the controller's maximum regulation limit. The solar and load will be disconnected until the battery voltage decreases to the controller's High Voltage Reconnect threshold. See Section 7.0 Technical Specifications for more information.

Technical Specifications

Electrical

Nominal system voltage	12 V
Max. solar input voltage	30 V or 60 V
Max. solar current	6.5 A or 10 A or 20 A
Battery voltage range	6 V – 15 V or 30 V
Self-consumption	< 8 mA
Voltage Accuracy	1.0 %
Transient Surge Protection	1500 W per connection

Protections (Solar & Load): short circuit, over-current, reverse polarity, high temperature, high voltage

Battery Charging

Regulation Method	4 stage PWM
Temp. Compensation Coefficient	12 V: -30 mV / °C (25°C reference)
Temp. Compensation Range	- 30°C to + 60°C
Temp. Compensated Setpoints	Absorption Float Equalize

Battery Setpoints (@ 25°C)

	Sealed 12 V
Absorption Voltage	14.1 V
Absorption Duration	3 hr
Float Voltage	13.7 V
Equalize Voltage	none
Equalize Duration	none
Equalize Calendar	none
Max. Regulation Voltage[1]	15 V
Low Voltage Disconnect	11.5 V
Low Voltage Reconnect	12.6 V
High Voltage Disconnect	15.3 V
High Voltage Reconnect	14 V
Start-Up LVD	11.7 V
Instant LVD	10.0 V

1 Not temperature compensated. 15 V @ 12 V nominal



NOTE: Temperature compensation increases regulation voltage in cold temperature. A 15 V maximum battery voltage limit prevents damage to sensitive DC loads.

Environmental

Ambient Temperature Range	-40°C to +60°C
Storage temperature	-55°C to +80°C
Humidity	100% N.C.