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## 1.0 Warnings and Precautions

The following symbols indicate important safety warnings and precautions throughout this manual:



WARNING indicates that serious bodily harm or death may result from failure to adhere to the precautions.



CAUTION indicates that damage to equipment may result if the instructions are not followed.



NOTE suggests optimal conditions and provides additional information.

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## 1.1 Warranty Disclaimer

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This manual will familiarize you with the features, operation standards, and installation of Carmanah's SEPS P1. Failure to comply with the use, storage, maintenance, installation or placement instructions detailed in this manual could void the warranty.

## 1.2 Standards

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Perform all installation, wiring, grounding and maintenance in conformance with local building and electrical codes. Adherence to the National Electrical Code (NEC) is mandatory to comply with any certification markings. Non-adherence to code may void the warranty.

## 1.3 Safety and Usage Precautions

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Batteries are shipped fully charged. Use extreme caution when handling the batteries as they can generate hazardous short-circuit currents. Remove all jewelry (bracelets, metal-strap watches, etc.) before handling the batteries.



Solar panels produce DC electricity when exposed to light and can therefore produce an electrical shock or burn. To render solar panels inoperative, remove them from sunlight or fully cover their front surface with an opaque material.



Before lifting any heavy or bulky equipment, ensure the load is secured so moving parts do not shift, and that it can be lifted as far as needed without back strain or loss of grip. Installation may require more than one person.



Ensure the equipment is not powered during installation and wiring of the system.



Recheck all completed wiring for proper polarity prior to energizing the system.



The SEPS P1 products use a constant-current LED output circuit. Not all LED fixtures are compatible with this output. Please contact Carmanah for additional information and guidance when adding or replacing beacons or other hardware.



Changes or modifications to Carmanah equipment not expressly approved by Carmanah could void both the user's authority to operate the equipment and the warranty.

## 2.0 General Information

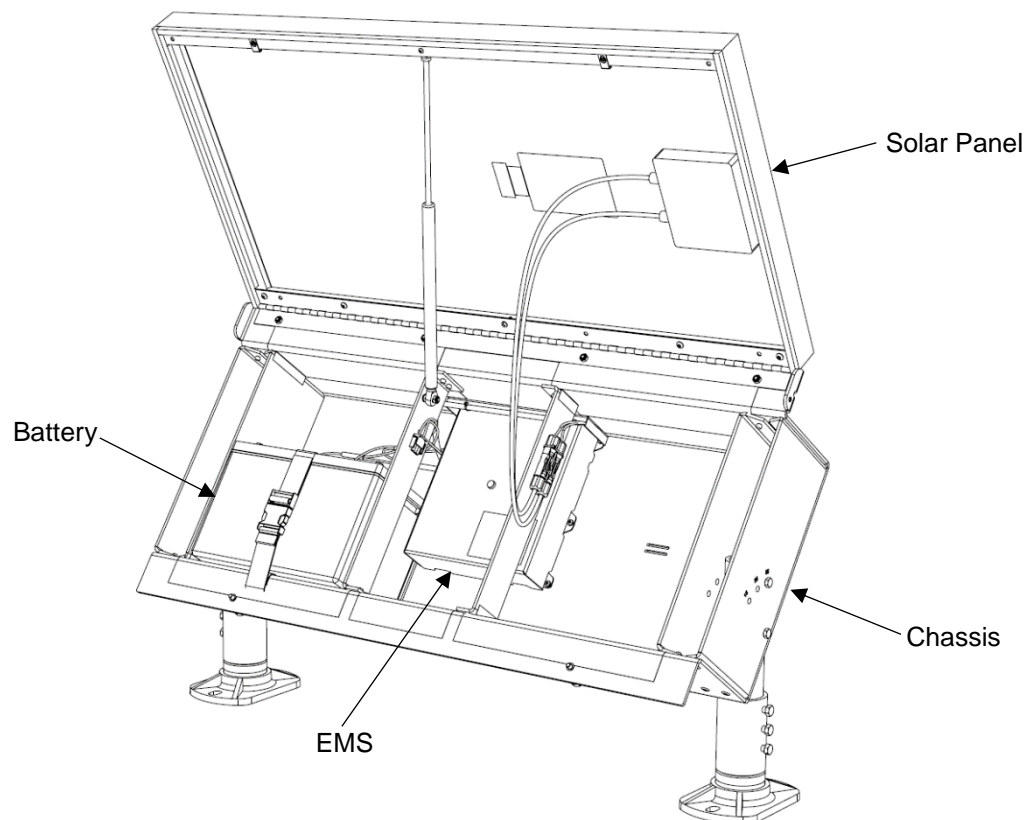
This manual describes how to install, maintain and troubleshoot the SEPS P1. The Carmanah SEPS P1 is a solar power supply and LED driver. The SEPS P1 is available in four models:

- The SEPS P1 ERGL is configured to power an Elevated Runway Guard Light. It has two LED output channels that drive two round LED beacons in an ERGL fixture in a wig-wag flash pattern. The drive current is fixed at 350mA and is on 24h per day.
- The SEPS P1 Signs can power up to two airfield sign LED light bars at a fixed drive current of 162mA each. The LED output is turned on from dusk to dawn each night based on solar panel voltage measurements made automatically by the product's charge controller.
- The SEPS P1 ERGL and Signs are both available in Wireless versions that can be controlled using Carmanah's Wireless Handheld Controller.

## 2.1 Components

The Carmanah SEPS P1 consists of the following components:

- Solar panel, which converts solar energy into electrical energy
- Battery, which stores electrical energy from the solar panel
- Energy Management System (EMS), which consists of a charge controller, LED driver(s), flasher unit (for ERGL systems), an enclosure and harnessing. The EMS charges the battery from the solar panel and uses battery energy to drive the LED fixture(s). Optional wireless versions also contain a radio module and antenna.
- Chassis, which houses the above components



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## 2.2 Charge Controller Operation, SEPS P1 ERGL

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The SEPS P1 ERGL EMS uses a third-party charge controller that continuously powers an LED driver, which is connected to a flasher unit that alternately drives each of the two round LED beacons in a DC ERGL fixture at 350mA.

Other SEPS P1 ERGL charge controller features include:

- Low Voltage Disconnect (LVD) mode which disconnects the LED load when the battery voltage stays below 11.7V to prevent battery damage. LVD mode is exited automatically once the solar panel recharges the battery.



For SEPS P1 ERGL with optional wireless control, if the charge controller enters LVD, the ERGL won't turn on in AUTO modes, but will continue to operate normally in TEMP and SEQ modes. Operating a wireless SEPS P1 ERGL in TEMP or SEQ modes when the charge controller is in LVD may damage the batteries.

- Indicator LEDs that provide system status information. Please see the included charge controller operation manual for more information.

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## 2.3 Charge Controller Operation, SEPS P1 Signs

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The SEPS P1 Signs EMS uses a third-party charge controller that uses solar panel voltage measurements to turn the DC LED sign light bars on at night and off during the day. Two separate LED drivers drive each of the two channels at approximately 162mA.

Other SEPS P1 Signs charge controller features include:

- Low Voltage Disconnect (LVD) mode which disconnects the LED load when the battery voltage stays below 11.7V to prevent battery damage. LVD mode is exited automatically once the solar panel recharges the battery.



For SEPS P1 Signs with optional wireless control, if the charge controller enters LVD, the signs won't turn on in AUTO modes, but will continue to operate normally in TEMP and SEQ modes. Operating wireless SEPS P1 signs in TEMP or SEQ modes when the charge controller is in LVD may damage the batteries.

- Indicator LEDs that provide system status information. Please see the included charge controller operation manual for more information.
- Test button: pressing the Test button turns on its output (and the LED drivers) for 5 minutes, day or night.

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## 2.4 Wireless Handheld Controller

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SEPS can be controlled using the Wireless Handheld Controller (HHC) in a similar manner to Carmanah's wireless solar lights. For detailed information on the operation of the wireless control system, see the HHC User Manual.

The following sections outline some distinctions in operation between SEPS Wireless Signs and SEPS Wireless ERGL:

### Wireless Signs Operation

When IR commands are sent by the HHC, SEPS Wireless Sign systems will turn off, if they were on. This is true of TEMP IR and AUTO IR commands.

Unless the charge controller is in LVD, when Autonomous non-IR commands (LOW, MED or HIGH) are issued by the HHC, SEPS Wireless Sign systems will turn on during the day and off at night. SEPS Wireless Signs operate at their preset intensity whether LOW, MED or HIGH commands are selected.

When Temporary non-IR commands (LOW, MED or HIGH) are sent by the HHC, SEPS Wireless Signs systems will turn on for 15 minutes and then revert to their previous state.

When SEQ non-IR commands (LOW, MED or HIGH) commands are sent by the HHC, SEPS Wireless Sign systems will turn on until a LIGHTS OFF command is sent.



If the charge controller enters LVD, the signs will continue to operate normally in TEMP and SEQ modes, which may cause battery damage. Avoid unnecessary operation in TEMP or SEQ modes if the charge controller is in LVD.

### Wireless ERGL Operation

Wireless SEPS ERGL operate continuously, day or night, unless a LIGHTS OFF or IR (AUTO, TEMP, or SEQ) command is sent from the HHC. In any TEMP, AUTO, SEQ, LOW/MED/HIGH, or FLASH mode, SEPS Wireless ERGLs will be on.



If the charge controller enters LVD, the ERGL will turn on for 15 minutes if a TEMP command is issued, and in SEQ mode will operate until turned off or until the battery cannot sustain the load. Avoid unnecessary operation in TEMP or SEQ modes if the charge controller is in LVD.

## 3.0 Installation

### 3.1 Site Preparation

#### NOTE

Shading even a small portion of the solar panel will significantly reduce its ability to collect solar power.

#### NOTE

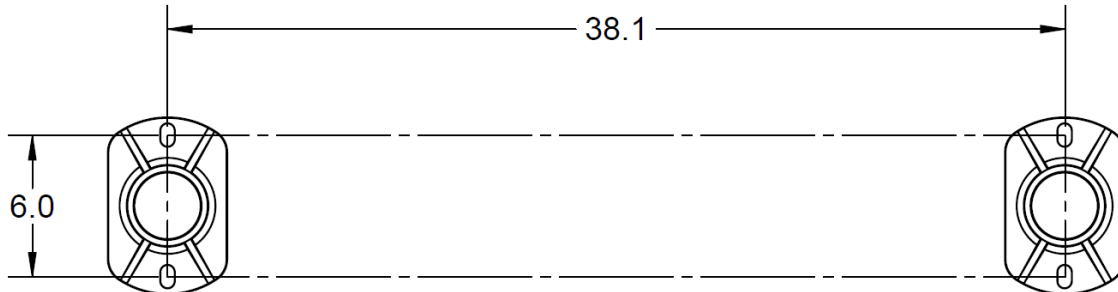
Full solar exposure is critical to the performance of the SEPS. Ensure that the SEPS installation location has year-round, unrestricted sun exposure throughout the day. The bottom edge of the solar panels should be installed at a minimum height to clear growing vegetation and snow at the site.

#### NOTE

For LED signs installations (which operate dusk to dawn), make sure there isn't significant ambient light at night where the SEPS will be installed, which could prevent the EMS from sensing nightfall.

1. Any concrete pad design should meet FAA AC 150/5340-30:
  - a. Above ground wiring: install a level concrete pad within 20 ft. of the load that SEPS will be powering. Mounting to wood, soil, or asphalt may work but is not recommended since they will not have the strength required for high wind loads.
  - b. Below ground wiring: install a level concrete pad with L-867B base can and base plate or conduit within 20 ft. of the load that SEPS will be powering.

- Use the below template (in inches) to mark 4 mounting points for the 2 floor flanges. Note that the centerline of SEPS should be parallel to the equator, so that the installed solar panel will face south in northern latitudes and north in southern latitudes.



- At each of the 4 mounting points, install a ½-13 UNC anchor bolt or stud.

## 3.2 SEPS Assembly

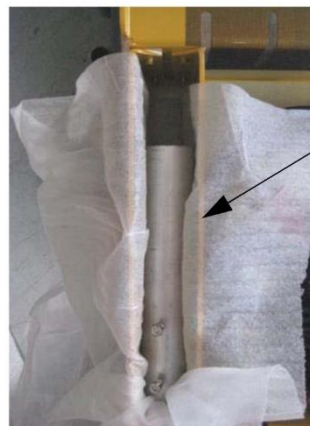
Follow these steps to assemble the SEPS:

- Open SEPS solar panel lid by loosening two knobs under front bottom lip.

### NOTE

Hold the lid while slowly opening. Lid can open quickly when lying flat on the ground during preparation.

- Unpack two mounting posts and their fasteners from within SEPS.

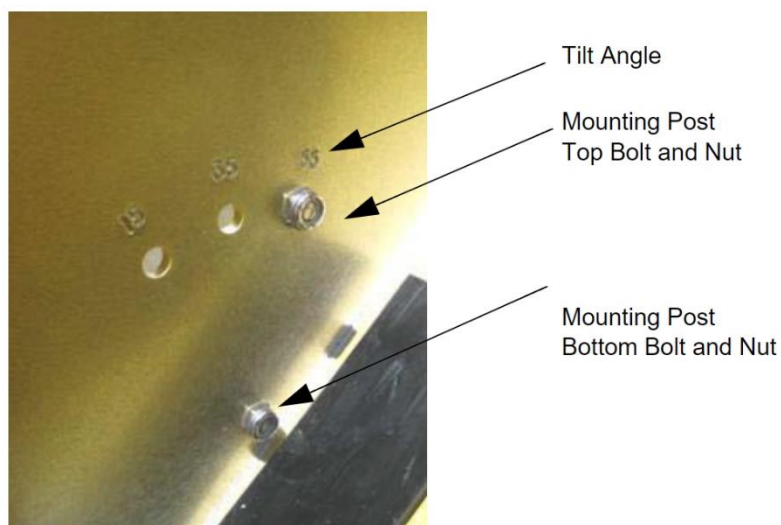
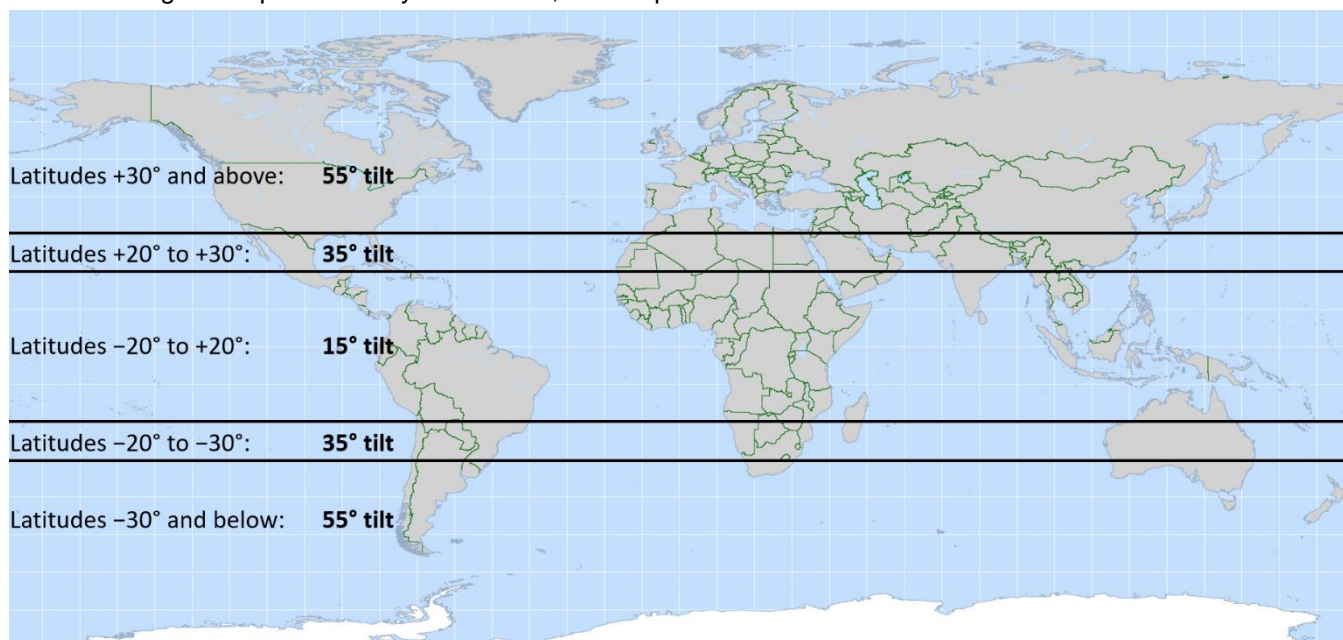


Mounting Post inside SEPS

- Slide mounting post down into its oblong hole. Align mounting post's bottom bolt hole with bottom bolt hole in chassis. Loosely install 5/16"-18 bolt from outside and nut on inside. Note this bolt does not have extra length; when tightened it will pull the chassis frame members together.



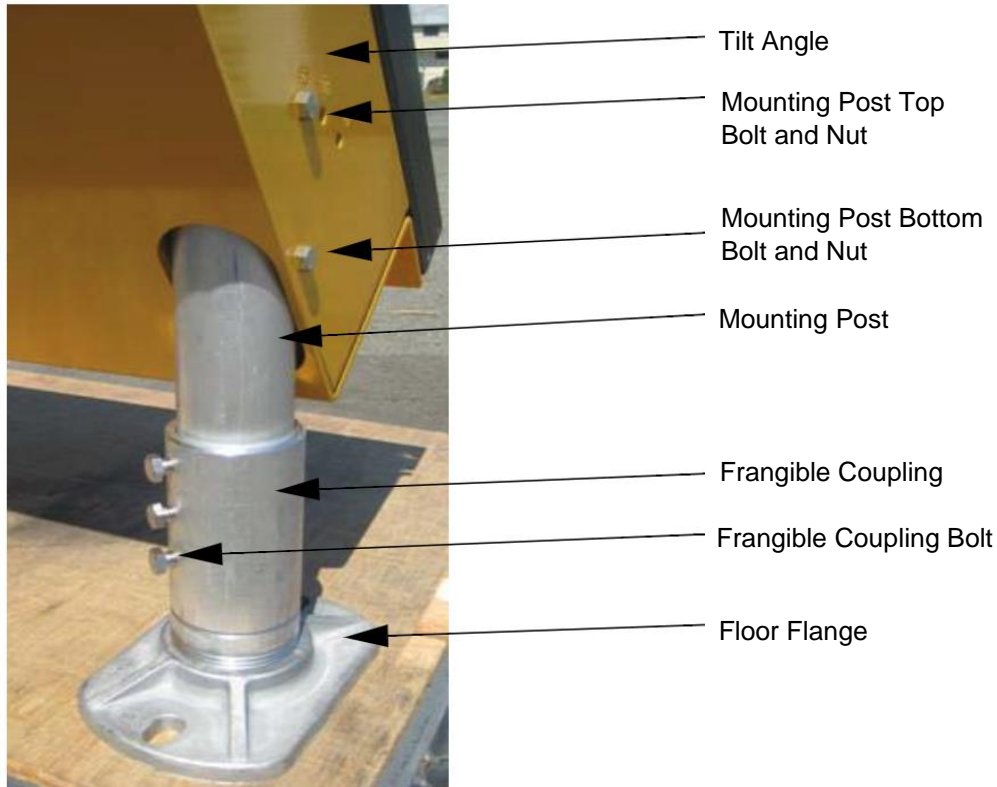
4. Tilt mounting post to desired tilt angle and install top bolt and nut. Tighten both top and bottom fasteners. Tilt angle is dependent on your location, see map and table below.



5. Repeat above steps for second mounting post.
6. Close the lid and finger tighten the knobs to better balance the unit.
7. Thread the frangible coupling into the floor flange until tight. Install the frangible coupling's 3 bolts. Repeat for second subassembly.



8. Slide the frangible coupling subassembly onto the mounting post. Finger tighten 1 of the frangible coupling's screws to hold the subassembly onto the mounting post. Repeat for second subassembly.



9. Pick up the SEPS and set down over the 4 anchor bolts installed above. If required, loosen frangible coupling bolts to adjust the rotation of frangible coupling. Do not loosen the floor flange and frangible coupling thread.
10. Tighten all frangible coupling bolts. Tighten all anchor bolts.
11. For wireless SEPS: slowly open the lid and remove the antenna subassembly on the right side. Remove 8-32 thumb screw and its toothed washer from right side of SEPS.



12. Slide antenna cable back through hole to remove slack.

13. Ensure antenna and bracket are vertical and re-install thumb screw and toothed washer.
14. Route cable as shown below.



### 3.3 Grounding



Failure to install an appropriate grounding system may cause a safety risk or increase the risk of system damage in the event of lightning strike, electrostatic discharge (ESD), or damaged cabling

Surges resulting from lightning strikes in the proximity of the installation are one of the most common causes of solar system failure. Installation of an appropriate grounding system allows the static electricity that accumulates in the solar panel and mounting structure to discharge. In addition to preventing the attraction of lightning, a properly grounded installation may divert the surge associated with lightning from electrical circuitry, limiting the potential for damage.

SEPS is negatively grounded. The solar panel frame, solar panel negative terminal, battery negative terminal, chassis, and grounding lug are all electrically connected.

SEPS should be grounded as follows:

1. Install a 14 – 2 AWG stranded grounding wire (not included) into the grounding lug under the bottom lip of the chassis.
2. Connect the grounding wire to an appropriate grounding stake and install the stake in the ground.

3. Note that the load cable does not provide any grounding for the load. The load should also be properly grounded to prevent damage to it and SEPS.

Grounding techniques vary depending on site specifics and local electrical authorities. Consultation with a local grounding expert is recommended.

## 3.4 Wiring

Wiring occurs in three steps. It's important to follow the following installation order to prevent damage to the SEPS EMS:

1. Connect LED wiring
2. Install and connect battery wiring
3. Mate solar panel connectors

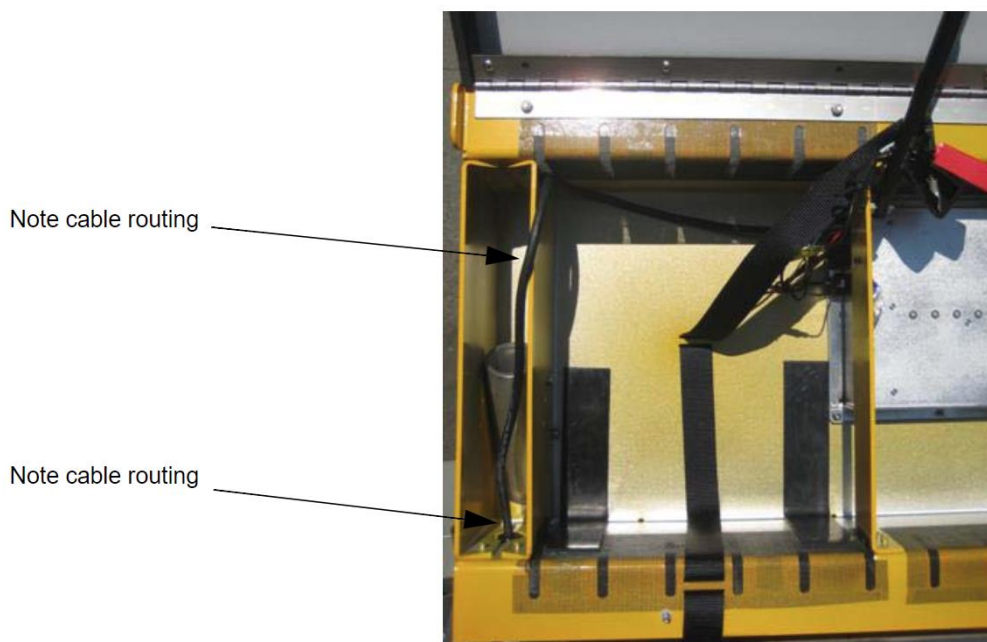
### 3.4.1 LED Connection



The SEPS P1 products use a constant-current LED output circuit. Not all LED fixtures are compatible with this output. Please contact Carmanah for additional information and guidance when adding or replacing beacons or other hardware.

Connect the LED load to SEPS as follows:

1. Uncoil the load cable. The cable is stiff and should be routed above where the battery will be installed.
2. For installations with cabling going into the ground, feed the load cable down either mounting leg. The liquid tight cable fitting on the front left of the SEPS may be replaced with the included 7/8 in. hole plug.
3. For installations with cabling lying on the surface of the ground, feed the load cable out through the liquid tight cable fitting. Tighten fitting.



4. Pull the loose end of the load cable into the appropriate junction box to connect to the load.

5. For airfield signs: connect the red (Channel A+) and black (Channel A-) wires to one light bar, and the blue (Channel B+) and green (Channel B-) wires to the other light bar (if present). If only one light bar is present, insulate the Channel B wires in a suitable manner.
6. For ERGL applications: connect the red (Channel A+) and black (Channel A-) wires to one of the round LED signals, and the blue (Channel B+) and green (Channel B-) wires to the other round LED signal.

### 3.4.2 Battery Installation and Connection



#### **ELECTRICAL SHOCK HAZARD.**

**DO NOT LET THE BATTERY TERMINALS COME INTO CONTACT WITH ANY EXPOSED METAL.**



Batteries are shipped fully charged. Use extreme caution when handling the batteries as they can generate hazardous short-circuit currents. Remove all jewelry (bracelets, metal-strap watches, etc.) before attempting to handle the batteries.



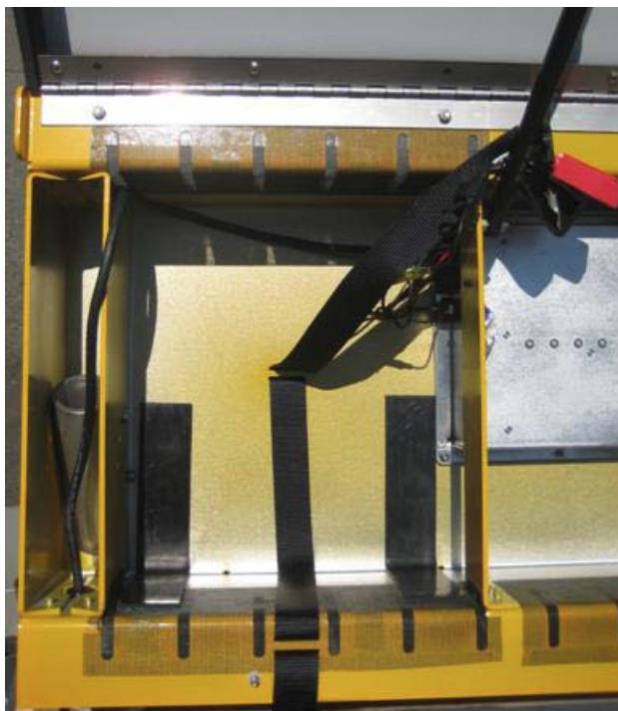
Batteries are heavy. Ensure that you use proper lifting techniques when moving batteries.

These batteries are rechargeable lead-acid AGM batteries. Consult your local municipal bylaws for information on recycling when replacing.

The SEPS battery must always be installed after site preparation, assembly, grounding, and load connection. There is no switch to power up the system; once the battery and its fuse are installed, the SEPS EMS turns on.

The battery sits in the left-hand cavity inside SEPS. To install the battery:

1. Remove the battery fuse from the battery harness.
2. Release the battery strap buckle and loosen the buckle to the end of the strap.
3. Loop the strap buckle and battery harness leads out of the way.



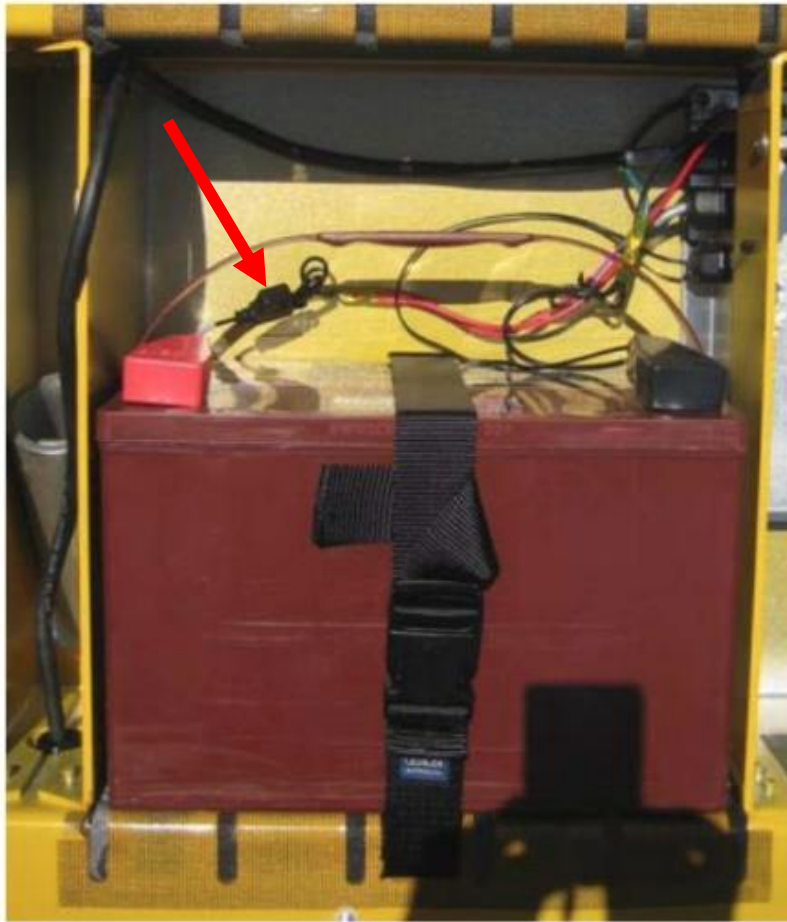
4. Balance the battery on the bottom lip of the SEPS chassis and then slowly let it drop back into its cavity. Do not let the battery fall backwards or crush any electrical connections.



5. Battery terminals should be closest to you, with the positive (+) on the left and negative (-) on the right.
6. Loop the battery strap under the battery handle. Connect the battery strap buckle. Tighten the battery strap and fold loose end underneath itself.
7. Loop the positive (+) harness lead under the battery handle. Apply anti-corrosion compound (not included) to the terminal. Connect the harness lead to the terminal and slide on the red, positive, battery terminal boot. Use supplied 5/16-18 UNC nut and lock washer.
8. Loop the negative (-) harness lead and its temperature sensor under the battery handle. Apply anti-corrosion compound (not included) to the terminal. Connect the harness lead first and then the temperature sensor to the terminal and slide on the black, negative, battery terminal boot. Use supplied 5/16-18 UNC nut and lock washer.



9. Install the battery fuse.

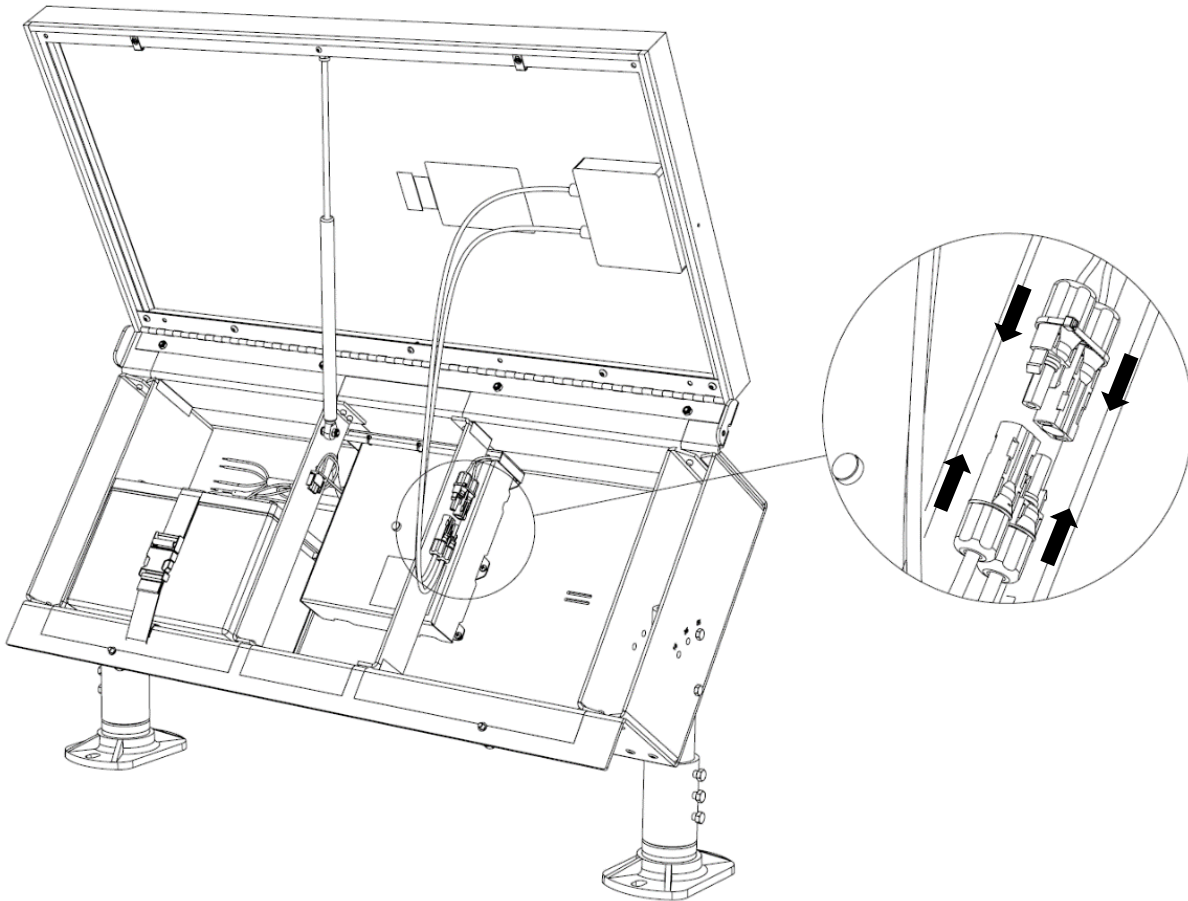


### 3.4.3 Solar Panel Connection



Cover the solar panel with an opaque material (like a sheet of cardboard) to prevent electrical arcing when mating or disconnecting the solar panel connectors.

Mate the two pairs of connectors between the solar panel and EMS wires. The connectors are keyed to prevent improper connection. Push together until a loud click is heard. Close the SEPS solar panel lid and tighten the two solar panel lid knobs.





## 4.0 Maintenance and Product Care

The SEPS is designed to operate reliably for years with virtually no need for maintenance. Carmanah recommends routine inspections of the solar panel to ensure that they are unobstructed by anything that may prevent effective solar charging, including:

- Dirt and dust
- Snow
- Leaves
- Debris
- Shade that may have developed after installation due to adjacent plant growth.

The frequency of the inspections depends on location and local weather patterns. A yearly visual inspection of the solar engine is typically enough. The system is designed to be maintenance free, but maximum system performance is achieved when the LED lenses and solar panels are clean. When inspecting the interior, ensure that the vent screens are undamaged and that the vents are clear and allow airflow.

### 4.1 Battery Replacement



#### **ELECTRICAL SHOCK HAZARD.**

**DO NOT LET THE BATTERY TERMINALS COME INTO CONTACT WITH ANY EXPOSED METAL.**



Batteries are shipped fully charged. Use extreme caution when handling the batteries as they can generate hazardous short-circuit currents. Remove all jewelry (bracelets, metal-strap watches, etc.) before attempting to handle the batteries.



Batteries are heavy. Ensure that you use proper lifting techniques when moving batteries.



**Do not discard batteries in the garbage – please recycle!**

To replace the SEPS battery:

1. Remove the battery fuse from the battery harness.
2. Slide back the black, negative, battery terminal boot. Disconnect the negative (–) harness lead and the temperature sensor.
3. Slide back the red, positive, battery terminal boot. Disconnect the positive (+) harness lead.
4. Release the battery strap buckle and loosen the buckle to the end of the strap.
5. Loop the strap buckle, harness leads, and temperature sensor above the solar panel's gas shock and out of the way.
6. Pull on the battery's handle to lever the battery up onto the front sill of the SEPS chassis and away from the electrical connections on the EMS. Then, lift the old battery clear.
7. Balance the new battery on the bottom lip of the SEPS chassis and then slowly let it drop back into its cavity. Do not let the battery fall backwards or crush any electrical connections.
8. Battery terminals should be closest to you, with the positive (+) on the left and negative (–) on the right.
9. Loop the battery strap under the battery handle. Connect the battery strap buckle. Tighten the battery strap and fold loose end underneath itself.

10. Loop the positive (+) harness lead under the battery handle. Apply anti-corrosion compound (not included) to the terminal. Connect the harness lead to the terminal and slide on the red, positive, battery terminal boot.
11. Loop the negative (–) harness lead and its temperature sensor under the battery handle. Apply anti-corrosion compound (not included) to the terminal. Connect the harness lead and then the temperature sensor to the terminal and slide on the black, negative, battery terminal boot.
12. Install the battery fuse.

## 4.2 Energy Management System (EMS) Replacement



### **ELECTRICAL SHOCK HAZARD.**

**DO NOT LET THE BATTERY TERMINALS COME INTO CONTACT WITH ANY EXPOSED METAL.**



Batteries are shipped fully charged. Use extreme caution when handling the batteries as they can generate hazardous short-circuit currents. Remove all jewelry (bracelets, metal-strap watches, etc.) before attempting to handle the batteries.



Cover the solar panel with an opaque material (like a sheet of cardboard) to electrical arcing when mating or disconnecting the solar panel connectors.

To replace the EMS:

1. Open the SEPS solar panel cover.
2. Cover the solar panel with an opaque material and disconnect the two solar panel connectors on the right side of the EMS.
3. Remove the battery fuse.
4. Disconnect the battery terminals.
5. Cut the cable ties that fasten the solar panel and battery harnesses to the yellow SEPS chassis.
6. Undo the thumbscrew on the top of the EMS cover. Tilt the cover up at the bottom and then slide toward you to remove.
7. Disconnect the load terminals at the end of the load harness and pull the harness back into the SEPS chassis.
8. Remove the seven Philips head screws holding the EMS enclosure to the SEPS chassis.
9. Remove the EMS with load, battery, solar and antenna harnesses.
10. Remove the cover of the replacement EMS and install fasten it to the SEPS chassis with the seven Philips head screws.
11. Route and reconnect the load harness.
12. Install new cable ties to fasten the new EMS battery, solar and antenna harnesses to the SEPS chassis as before.
13. Connect the battery harness terminals to the battery.
14. Reinstall the battery fuse.
15. Connect the solar panel connectors.
16. Remove the opaque material from the solar panel.
17. Confirm correct operation, replace EMS cover and thumbscrew and close and tighten the SEPS solar panel cover.

### 4.3 Energy Management System (EMS) Recycling

Production of the EMS required the extraction and use of natural resources. The EMS may contain substances that could be harmful to the environment or human health if improperly handled at the product's end of life. To avoid release of such substances into the environment and to reduce the use of natural resources, we encourage you to recycle the EMS in an appropriate way that will ensure most of the materials are reused or recycled appropriately. Check your local municipality for electronics recyclers.

## 5.0 Troubleshooting

Symptom	Possible Cause and What to Check
LED fixture won't turn on.	<p>This can be caused by a wiring issue, low battery voltage, or a failure of an EMS component (charge controller or LED driver).</p> <p>Check the wiring to the LED fixtures for continuity and make sure the wires are not pinched anywhere. Also check that the wiring polarity is correct on the LED fixtures.</p> <p>Check the battery fuse. Replace if necessary with a 15A cartridge style fuse, Littelfuse 0314015 or equivalent.</p> <p>Check the battery terminals for signs of corrosion. Clean if necessary and apply a battery terminal anti-corrosion product.</p> <p>Inspect the indicator LEDs on the EMS charge controller. Remove the EMS cover by unscrewing the thumbscrew and tilting the cover up at the front and sliding it toward you. See charge controller operation manual for indicator LED details.</p> <p>Using a voltmeter, measure the battery voltage. Battery voltage should be a minimum of 12 volts, with 12.6 volts being nominal normal voltage. If the voltage is very low, charge or replace the battery and monitor the system for proper operation. Ensure that the solar panel is clean, clear of debris, and is not shaded by buildings or vegetation. If the solar panel is covered or shaded, this will prevent proper battery charging.</p>
One ERGL LED fixture flashes, but other does not.	<p>This is likely caused by improper wiring of the fixtures. Ensure that the wire colors and polarities match the instructions in this manual. Check that the electrical connections are secure.</p>
LED fixture won't turn on at night but works when TEMP or SEQ commands sent from wireless remote.	<p>The charge controller may be in LVD, see charge controller operation manual for details. Ensure that the solar panel is clean, clear of debris, and is not shaded by buildings or vegetation. If the solar panel is covered or shaded, this will prevent proper battery charging.</p>
LED Sign will not turn on at night but turns on when the Test button is pressed.	<p>This can be caused by excessive artificial light hitting the solar panel at night preventing the EMS from sensing nightfall. Remove or baffle the source of light so that it doesn't hit the SEPS solar panel or install SEPS in darker location.</p> <p>This can also be caused by the charge controller entering LVD mode. Ensure that the solar panel is clean, clear of debris, and is not shaded by buildings or vegetation. If the solar panel is covered or shaded, this will prevent proper battery charging.</p>

<p>Signs won't turn on when Test button pressed.</p>	<p>This can be caused by a wiring problem with the fixtures. Check the wiring to the LED fixtures for continuity and make sure the wires are not pinched anywhere. Also check that the wiring polarity is correct on the LED fixtures.</p> <p>If the unit is in LVD, the Test button will only work 3 times to avoid damaging the battery. If the system enters LVD after the Test button has been pressed, the load output will turn off. Wait 5 minutes before pressing the test button again to turn the LED fixture(s) on.</p>
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## Notes



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