GRAND VALLEY STATE UNIVERSITY
SCHOOL OF ENGINEERING

Solar Suction Surgery System

Unit #1

USER MANUAL

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Installation

Panel Mounting

1. Select the mounting area on the roof that provides the most support for the mounts to be placed. Additionally, the mounting area should be selected such that there is as little shading on the panel as possible throughout the day. If roof is slanted place panel such that it is facing north (for southern hemisphere).

2. Place and secure four mounting brackets on the panel as per Figure 1 and Figure 2.

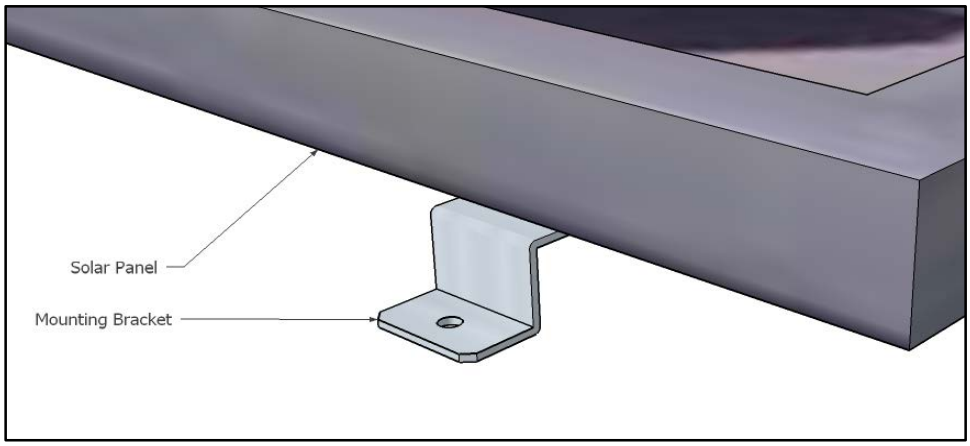

Figure 1: Single mounting bracket placement on solar panel

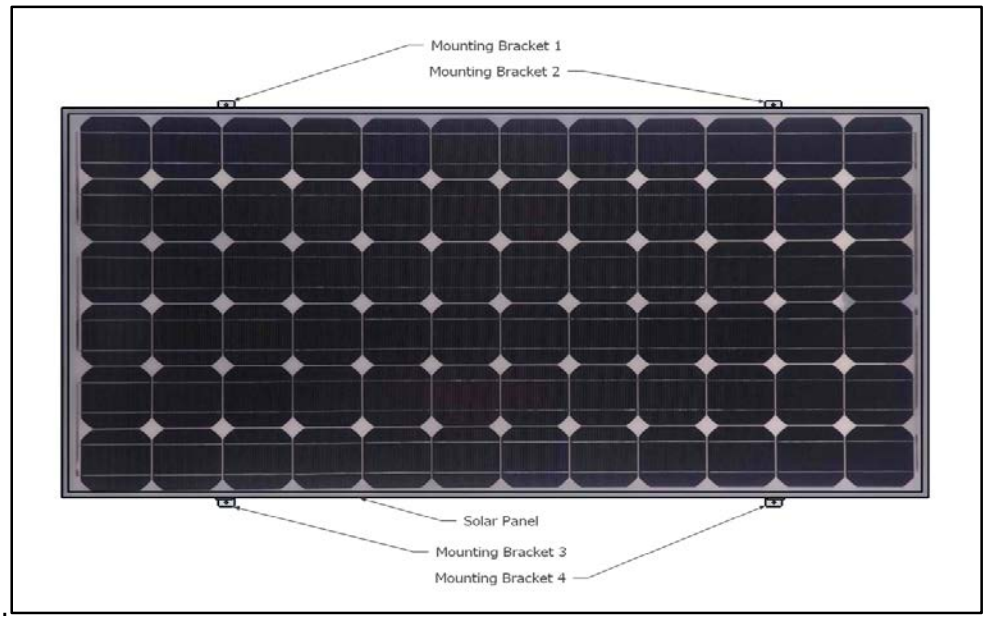

Figure 2: Placement of four mounting brackets

3. Clean the mounting area to prevent potential damage to the solar panel.

4. Place panel flat of the roof. Use appropriate screws and anchors to secure the panel.

5. Ground the panel's frame to prevent damage from lightning.

WARNING

The solar panel's frame must be connected to earth ground to provide a path for lightning. Failure to provide a path to ground may result in damage to the solar panel, S4, or people.

Panel Connection to S4

1. Connect one end of each of the two solar cables to the panel (Figure 3).

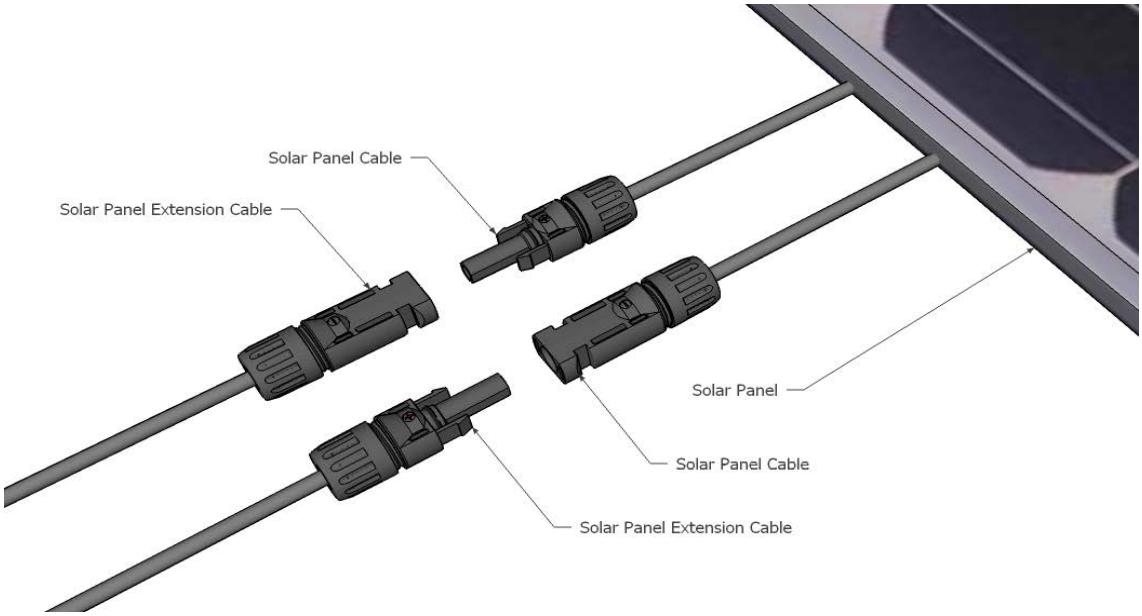

Figure 3: Solar panel extension cable connections to solar panel

2. Secure the two solar panel extension cables near the panel and roof to prevent accidental disconnects.

3. Run the two solar panel extension cables inside to where the S4 is stored, and secure the cables close to the wall.

4. Connect the ends of the two solar panel extension cables to the S4 to begin charging via solar power.

Wall Outlet Connection to S4

If sunlight is not available, the S4 can be charged using a wall outlet. Connect the S4 to the wall power as per Figure 4. Before connecting to AC power ensure the battery charger inside the case is set to 230 V and not 115 V. Refer to the Maintenance section for faceplate removal instructions.

WARNING

Connect only one charging source at a time.
Do not connect both the solar panel and wall outlet to the S4 at the same time.

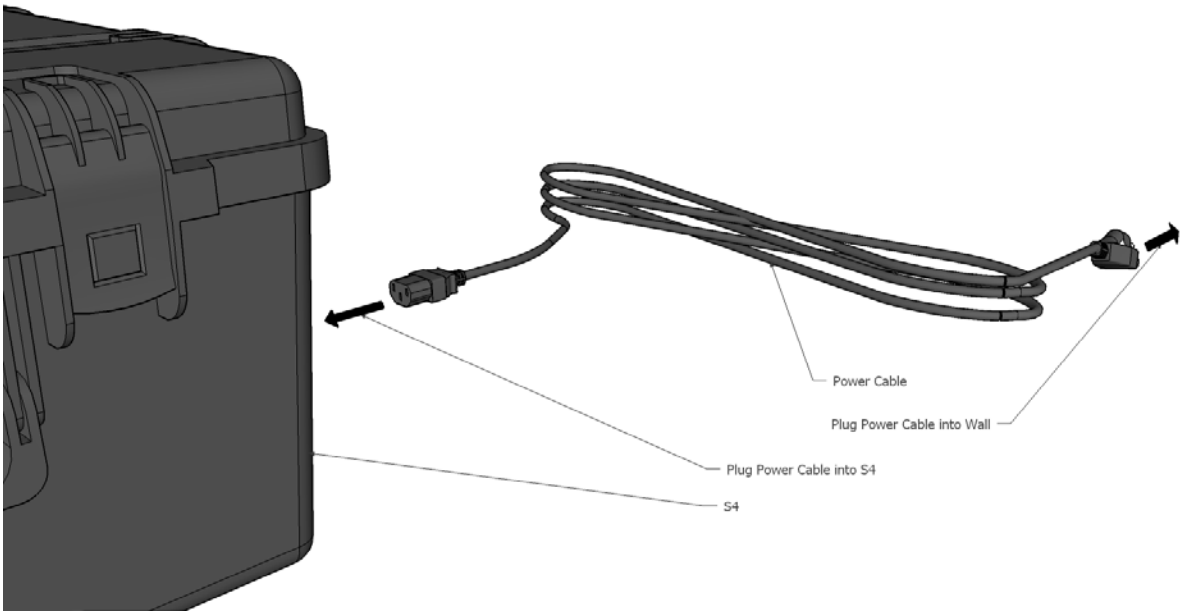

Figure 4: S4 to wall outlet cable connection

Charge Controller Setup

1. Click the menu button and use the up, down, and enter buttons (Figure 5) to change different parameters.

Figure 5: Charge Controller control buttons

2. To set the time/date and device ID use the up and down buttons to scroll to “Device/Set” and select the item.

3. Use the Enter and Back buttons to select each number and use the up and down buttons to increase or decrease the selected number. The date should be entered in the DD/MM/YYYY form.

4. Once the date and time are correct press “Enter” until prompted to save. Select “Save” and click the Enter button.

5. Next the device ID and Backlight duration can be set. Set the ID to 001. Set Backlight to 60 sec.

6. Save changes.

7. Set the desired temperature unit by selecting “Cel” (Celcius) or “Far” (Fahrenheit) and pressing the Enter button.

8. Save changes.

9. In the main menu select “Rated Value” and press the Enter button.

10. Change the settings to match Figure 6 below.

Figure 6: Charge Controller control buttons

Operation

Understanding the Charge Controller

The Charge controller is responsible for charging the battery and supplying power to the load. If the battery does not have sufficient charge the power to the load will be disconnected automatically. Figure 7 shows the charge controller. If the warning indicator lights up red please refer to the charge controller's manual to resolve the issue.

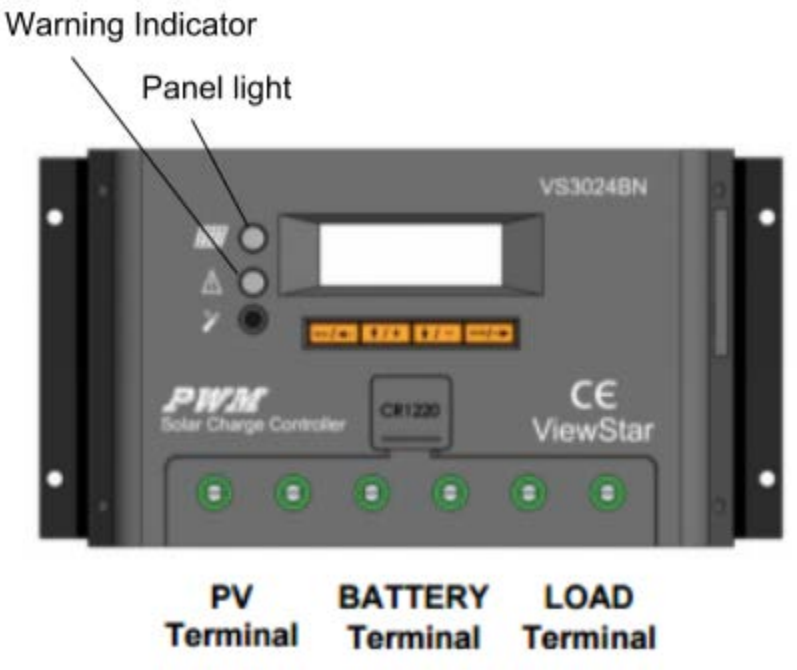

Figure 7: Charge controller Terminal Connections and Indicators [1]

When "Monitoring" is selected from the main menu the system's performance can be monitored. Figure 8 shows the available monitoring screens.

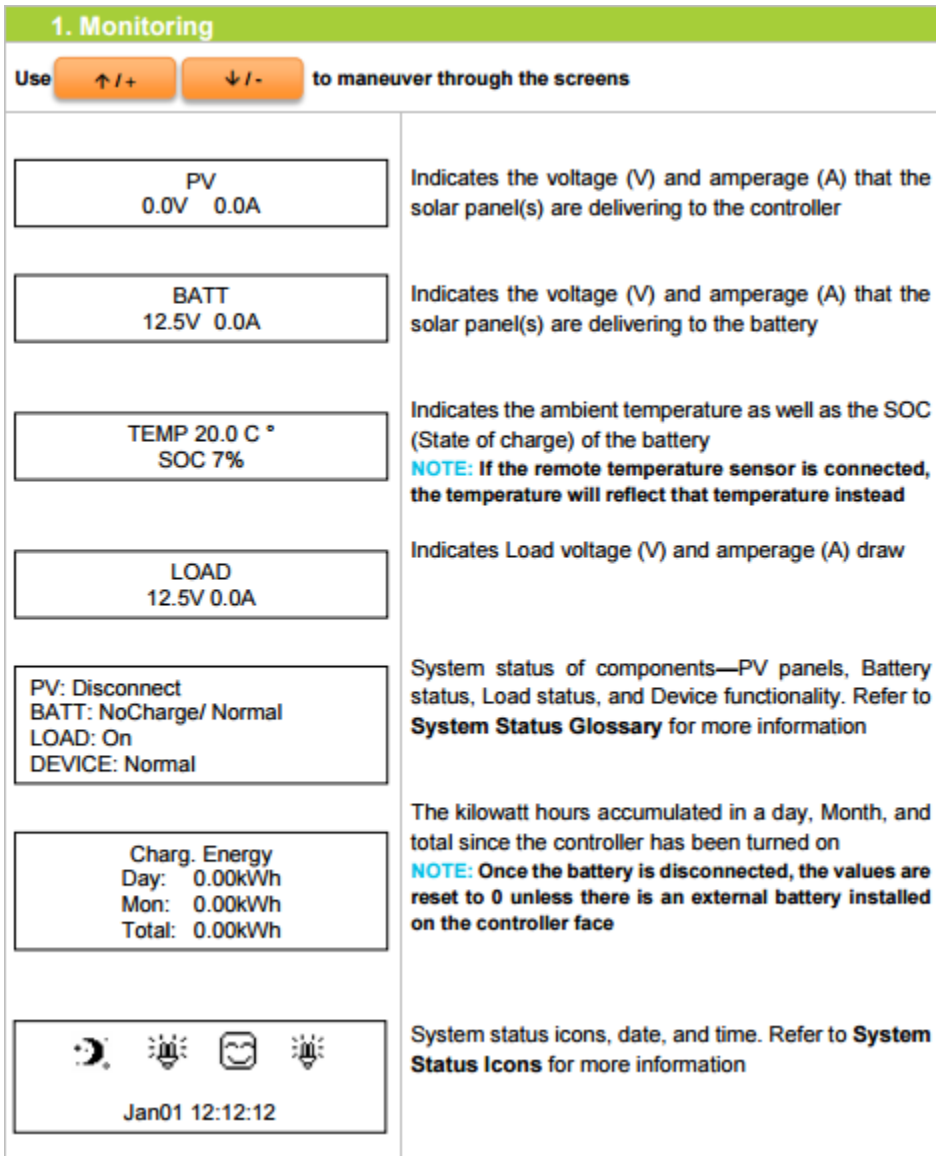

Figure 8: Monitoring screens of the Charge Controller [1]

The monitoring screen should be set to show the system status icons. The icons can be interpreted as per the descriptions in Figure 9. If an overvoltage warning appears (OVW) please disconnect the panel from the S4. If a low voltage disconnect status (LVD) please disconnect all loads from the system and connect either the solar panel or wall charging cable to supply power to the S4.

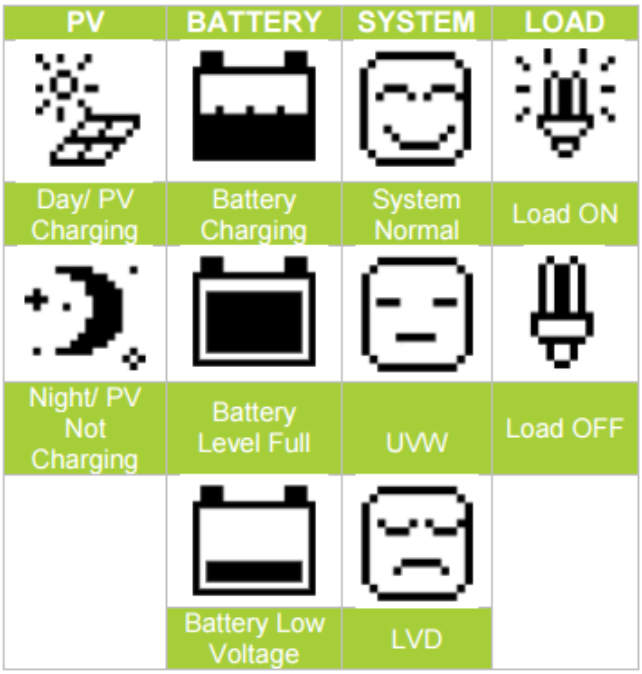

Figure 9: System Status Icons

Charging the Battery

The battery can be charged using either the solar panel or power from a wall outlet but not both.

> Warning: Do NOT connect both the solar panel and wall outlet to charge the battery.

Connecting Devices

Up to five devices can be connected. The system is designed for the following simultaneous connections.

Table 1: Outlet number and corresponding connection

Outlet Number	Purpose	Amperage Draw	Usage*
1	Phone/Tablet	Up to 2.1 A	3 hours/day
2	Phone/Tablet	Up to 2.1 A	3 hours/day
3	Suction Machine	Up to 4 A	3 hours/day
4	Light #1	Up to 0.4 A	12 hours/day
5	Light #2	Up to 0.4 A	12 hours/day

*A maximum of two days of full load use is allowed if the battery is not being charged.

Using devices other than those specified may result in a reduced system run time. Using specified devices for longer than specified over the two day period will result in reduced run time of the other devices over that two day period. Ensure that power usage is prioritized for the most important devices with each available charge.

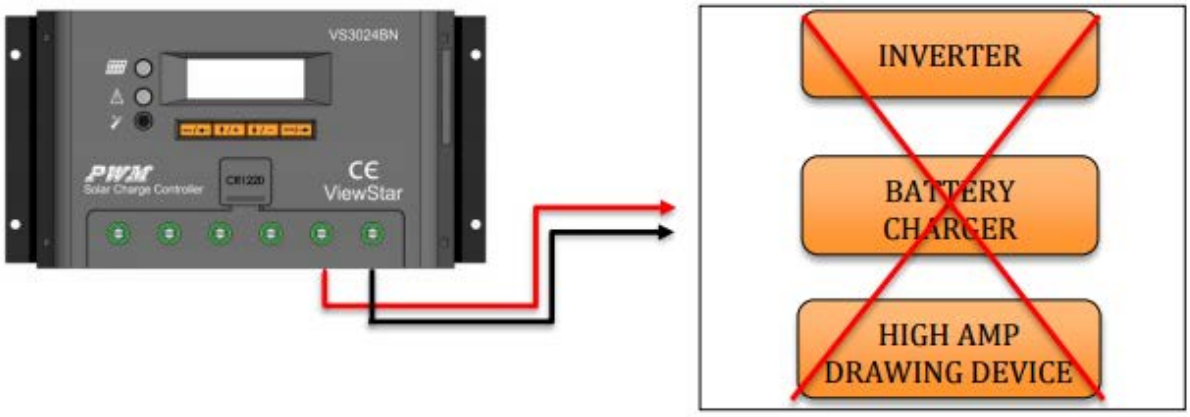

Figure 10: S4 load connections that are not allowed.

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WARNING
RISK OF INJURY OR DEATH
High Current.
Improper handling of the S4's internal components may destroy the S4.
Maintenance of the S4 should be performed by a trained technician.

Maintenance

NOTE: Remove connected power sources (panel or wall outlet connections) and all connected devices before performing a maintenance task.

Removing the Faceplate

1. Unscrew the 4 screws securing the faceplate
2. Slowly lift the faceplate from the bottom half of the case using the charge controller
3. Lay the faceplate in the open upper half of the case.

Replacing Fuses

1. Follow procedure for removing the faceplate
2. Remove the faceplate cover
3. Determine the fuse to be placed through inspection
    - If no blade fuse needs replacing, check the inline fuse
4. Replace fuse with one of the same rating
5. Place fuse cover back in place

Replacing the Battery

1. Follow procedure for removing the faceplate
2. Unscrew the wingnut on the negative battery terminal
3. Remove the two wires from the post
4. Unscrew the wingnut on the positive battery terminal
5. Remove the two wires from the post
6. Remove the screws securing the three battery supports (located on the outside of the case)
7. Remove the battery supports
8. Replace the battery

9. Place the battery supports (support 1 towards the hinges, support 3 towards the side handle)

Re-inserting the Faceplate

1. Ensure there are no loose connections
2. Place the faceplate into bottom half of the S4 unit
3. Replace the four faceplate screws
4. Tighten till snug

Additional Material

[1] View Star Series Pulse Width Modulation Solar Charge Controller Manual. Renogy. <http://renogy.com/wp-content/uploads/2015/05/10A-20A-30A-Viewstar-Charge-Controller.pdf>.