

Appendix A

Voltmeter Readings

The values in the table below are estimates and will vary depending on the accuracy of your meter, the size of your loads, and the length of time the batteries have been resting with no load or panel connected. Villager III display meters may read as much as 0.2 volts lower or higher than actual value.

% Charged	Voltage While Charging	Voltage After Discharging and Resting 10 Min.
90% to 100%	≥ 13.7 V	≥ 13.3 V
About 75%	13.5 V	13.2 V to 13.3 V
About 50%	13.3 V	13.1 V
About 25%	13.1 V	12.9 V
Fully Discharged	12.9 V	12.7 V

Appendix B

Maximum Wattages

Solar panel input – 120 watts (panel rating)

Combined DC output, both sockets – 145 watts

Optional Vanson DC-DC converter output – 100 watts

Villager III

User Instructions



GTIS Power Systems

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Introduction



Villager III powering a convertible tablet with a DC-DC adapter

The Villager III Power Bank provides 12-volts dc power at up to 145 watts from both sockets combined. The optional Vanson DC-DC converter supplies 5 V on a USB connector for charging tablets and cell phones, and can also provide 15 V to 24 V regulated DC for laptops, BGANs, etc.

The Villager III can store 216 watthours of energy. Your repeating daily loads should be about 100 watthours or less, which is sufficient to run a netbook or ultrabook computer for 8 hours plus it's built-in 2 W LED strip in the evening. See <http://power.sil.org/how-many-watt-hours/> for an explanation of watthours and estimates of watthours needed for various electronics, and how to estimate the solar panel size you need.

Precautions

Water

The Villager III is not waterproof. Do not leave it outdoors in the rain or immerse it in water. If water gets inside the case, turn off the toggle switch and allow the Villager III to dry thoroughly before using it.

Heat

Cooler temperatures will improve the lifetime of the batteries and electronics. Whenever possible, avoid leaving the Villager III in hot locations or in direct sunlight.

Battery Failure

The Villager III contains three separate LiFePO4 smart battery packs. When one of the batteries gets old and fails, its internal electronics board will prevent it from charging or discharging, resulting in sharply reduced capacity for the Villager III. When one fails, all three batteries should be replaced at the same time. **Do not attempt to bypass the circuit board inside the battery and force charge a failed battery** because it can catch on fire!

Contact power_systems@sil.org for replacement batteries or parts.

Low Voltage Disconnect note:

If the Villager-III is not recharged within a few days after entering low voltage disconnect the batteries will self-protect making the system appear dead. The meter will not display a voltage and the indicator LED will not illuminate. Simply connect a working solar panel and disconnect any loads and the system will “wake up” and recharge.

Storage

The batteries in the Villager III keep best in a partially charged state while in storage. Run the batteries partially down to a resting voltage of 13.0 V to 13.2 V and turn off the rocker switch.

Recharge and partially discharge the batteries every six months.

Store the Villager III at temperatures below 35°C (95°F).

Testing After Prolonged Storage

If your Villager III is left in storage without recharging for over a year, especially if at high temperatures, you should test each of the three internal batteries individually before using it.

Have a technician remove the batteries and charge each one individually on a test bench at <2 amperes until the battery voltage reaches 14.2 V. A flameproof container and ventilated area are recommended since ***there is a small chance a bad cell could burst and even ignite***, but this is very unlikely.

Discharge each battery to 12.0 V and recharge all three batteries to 14.2 V before reassembling them into the Villager III. The electronic “BMS” board inside each battery should stop the charge or discharge cycle if there are internal problems with any of the cells. In that case the battery is bad and needs replacing. Contact power_systems@sil.org for replacement parts.

Charging

Usually a 50 to 100 watt solar panel is used to charge the Villager III, depending on the user's loads. The toggle switch must be in the “on” position to charge.

120 watts is the maximum recommended solar panel size. Panels larger than 120 W will shorten the battery lifetime and panels over 145 W could destroy the charge controller. Solar panels should be of the “12-volt” type, with an open circuit voltage (V_{oc}) between 19 V and 23 V.

GTIS Power Systems can supply you with the correct connector (NEMA 6-15P) for the solar panel. Proper polarity for the solar panel connector is shown below (the T-slot is positive; the flat slot is negative; the ground slot is not used). Accidentally reversing solar panel polarity will prevent charging, but will not damage the panels or Villager III.

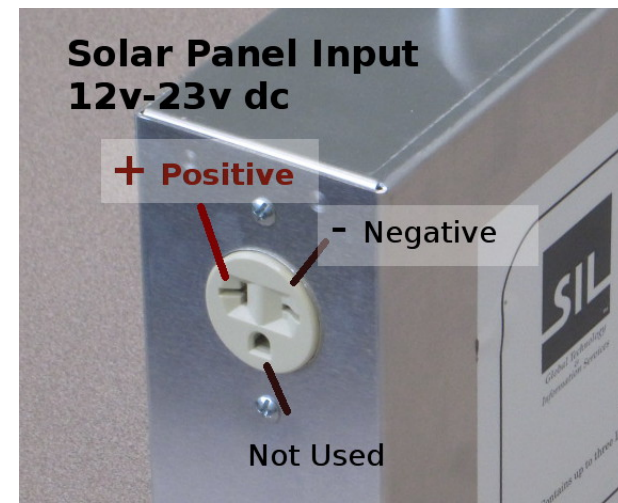
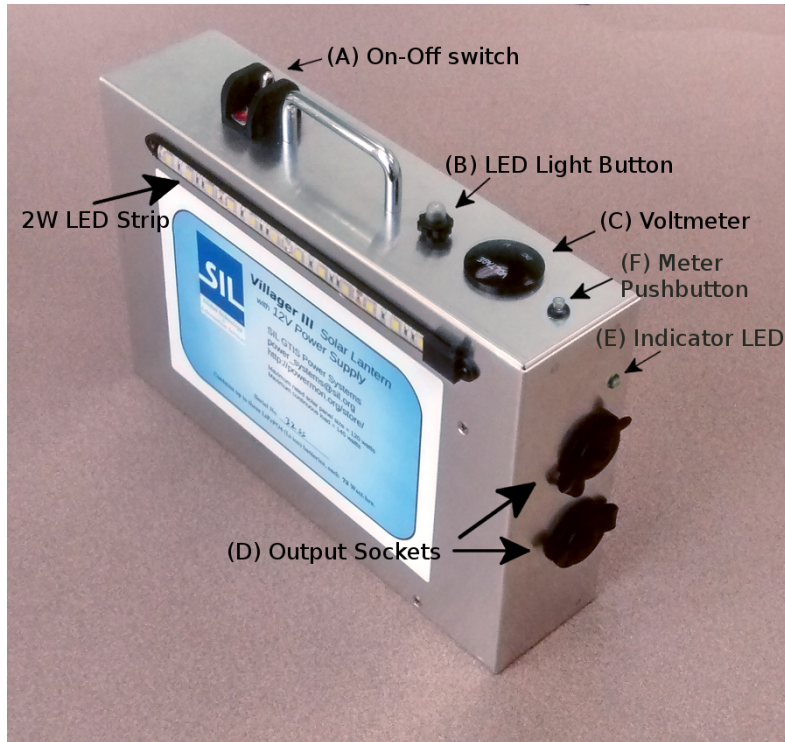


Figure 2: View showing solar panel input

You can tell if your panels are producing power by watching the voltmeter before and after you plug in the solar panels. The voltage should immediately increase by 0.1 V or 0.2 V when the panels are connected.

Using the Villager III

The On-Off toggle switch (A) must be in the “On” position for the Villager III to operate. Turn it “Off” only for transport or long term storage.



View showing 12 V outputs and controls

There are two 12-volt output sockets (D) that may be used to charge devices. You may plug in any DC adapter or inverter designed for automotive use, however, **do not exceed 145 watts of load.**

The voltmeter (C) will show the battery voltage when you press the small pushbutton next to it. The meter can be used for troubleshooting or to estimate the charge level of the Villager III (See Appendix A). The 2W LED strip light is lit by pushing the “LED Light” button (B).

The indicator LED (E), if present, indicates system status and gives a rough indication of the Villager III battery charge level. (See replica of the label below.) If the system has shut down due to low voltage, the LED will blink orange slowly. You must recharge the batteries.

In an **overload** condition, the status LED (E) will flash orange rapidly and output power will cut off. This means the loads are exceeding 145 W. The Villager III will try to restart after a 12-second delay. Unplug all loads and check to make sure there are no short circuits in the system. If the overload is not removed quickly, the Villager III will try to restart every 15 minutes. You can speed this up by turning off the main on-off switch and turning it back on after correcting the overload condition.

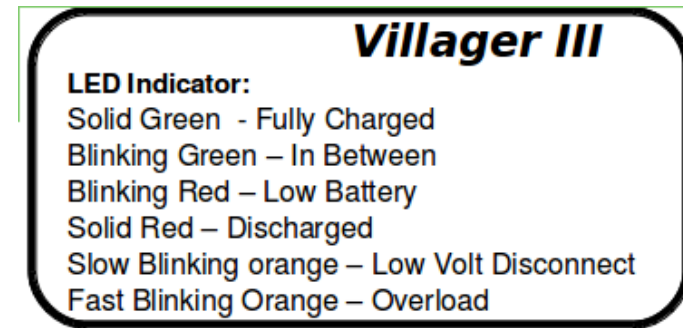


Figure 4: LED indicator label

Some Villager-III units, with a SS designation on the end of their serial number, do not have an indicator light. You can use the built-in meter to determine the charge level. (See appendix A) When you have depleted the battery to the Low Voltage disconnect point the voltmeter and LED strip will no longer light up, indicating you need to recharge it. An overload will also extinguish the meter and LED, but will automatically reset one minute after removing the overload.