Controller Battery

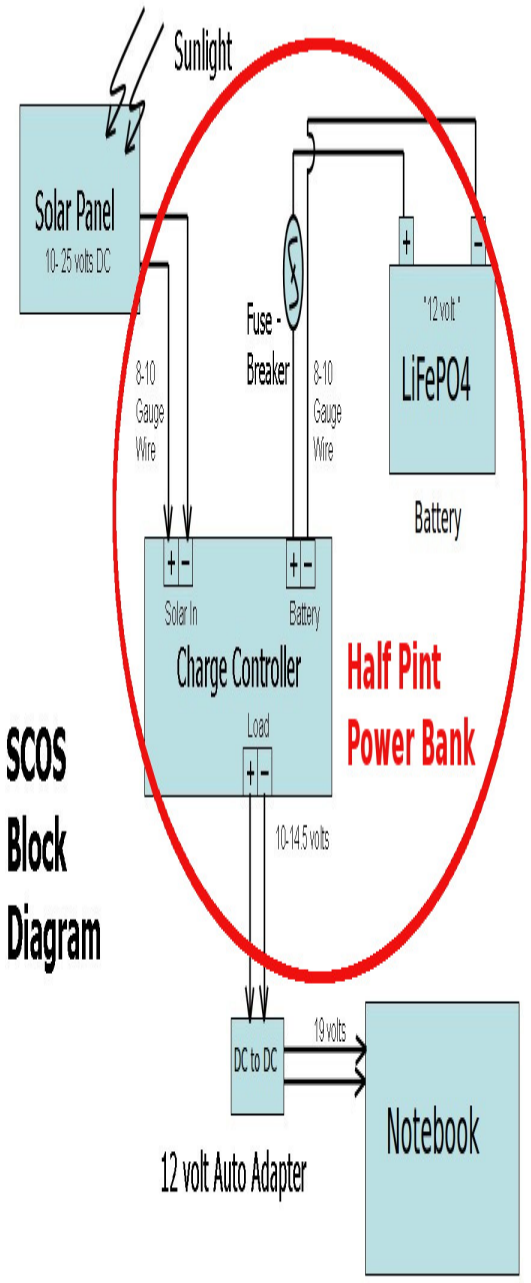
Controller / Battery Combined Units

June 2016

These are the kind of units/ systems that people really want, combining the function of the latest LFP technology and a solar controller in one small, self-contained box with simple connectors. Perfect for more tamper proof operations in village settings. Internal thermal fuses that reset themselves are also inside such boxes, and another level of complexity or point of failure is hidden from the end user.

Overview:

If we look at the original solar system block diagram, we can see the part that is combined in the special units under discussion here. Note the simplified wiring setup now required into and out of the "red" marked zone here. There is a solar panel module that is simply plugged into the "Combo" box here, and there is the 11-14 volt conditioned voltage output, that heads to the Auto-adapter unit which is next in line to the notebook itself. These boxes typically have a standard female car-adapter port, similar to what's found in any automobile and people are very familiar with plugging tools that require electricity in such a recepticle. It's quite commonly understood what to do. So, you plug in your auto-adapter charger for the computer, and your done.



Note too, that safety devices like fuses and breakers are inside the box. Some use a time-out thermal fuse that the user doesn't have to really think about. When a short or overload occurs by mistake, the system protects itself and shuts down. The user has to wait a while for things to reset, but doesn't have to do anything except disconnect whatever it was that created the fault in the

first place. It's not normal to shut down, so the user has to figure that part out.... but the box made it's own decision to protect itself and that makes training the user, that much easier.

Purchase Summary:

Someone says: "*Just tell me what to purchase*"

First, you must know the power consumption of the computer you hope to power, in watts, in it's normal "steady state" mode of operation. This would mean activities such as Word Processing and Email as a guide, and if you need it Wifi services turned "on". If you do not know this figure in wattage, then you cannot proceed.

Notebook Power Required	Solar Box to Purchase with Panel Size
4-6 watts	GTIS Half-Pint system with 20-30 watt solar panel
7-9 watts	GTIS Villager-III (Dual Pack option) with 35-50 watt solar panel
10-12 watts	GTIS Villager-III Standard Issue with 50-60 watt solar panel
15 watts	GTIS Villager-III with 75 watt solar panel
20 watts	Consider another laptop system; expensive to carry on with solar

Remember that the user working spec is 8 working hours a day, including 4 hours of night-time work, under typical rainy weather or overcast conditions for week long intervals. The idea is that the language worker never has to really think about power at all and can just concentrate on their work. If you are working in sub-Sahara Africa, then obviously you can go with less hardware. These recommendations work for rainy, tropical Papua New Guinea.

The GTIS (JAARS Inc.) store is: GTIS PowerMon Store[1]

There is an on-line "cart" to fill up, and SIL members get a 20% discount on parts.

All parts including the LFP batteries can be air-freighted by DHL to anywhere in the world via Purchasing and Shipping department.

The "Half-Pint" System

If you are in a hurry to set up, and if you are using a modern "Bay Trail" notebook as commonly sold in 2016, THEN proceed immediately to purchase the GTIS "Half-Pint" system. ($188; SIL Discount) See: GTIS PowerMon Store[2]

(Click to Zoom; Click again for Ultra-Zoom)

We have no idea why GTIS came up with this name, but they did, and one name is as good as the next. This is an amazingly light weight box, and easily held in one hand. It's about as light as a rugby-ball, and can be hefted about as far (don't try this!). It comes with a cute carrying pouch with strap, and with space enough for the universal Vanson auto-adapter with multiple connectors for many popular makes and models of notebooks/ laptops. This box is a "**4 amp**" box, limiting it's use to charging small, truly low-power consuming netbooks in the 4-7 watt range. 4 amps is a limitation of both the load, or the netbook as well as the solar panel. Thus the suggest maximum solar panel wattage is capped at 45 watts. (3x Solartec 15 watt panels, or equivalent)

This box listed at 72 Wh of energy storage, and combined with a mere 30 watts solar panel, will sustain a modern 2016 notebook running Paratext (SIL/UBS software) for 8 working hours a day, including 4 working hours at night, even during a week of rainy, overcast weather. Every day will be a "work day" with this setup.

The digital display is energized by the black momentary push-button as seen in the picture. This is handy to quickly see the state of charge (voltage at battery terminals; 11.0 to 13.9 volts) and would be advantageous for diagnostic purposes, say over the radio or via mobile phone (or email) to technicians if there are any problems in deployment in remote settings.

There is a **prototype unit**, under development that foregoes this display unit and has a LED Bar-Graph indicator, for users who are confused by the digital nomenclature indicating "state of charge". For some of our language workers, this is indeed the case. But "bar-graphs" commonly found on mobile phones are easily understood already. If this is your need, then presently one must special order this type of unit from GTIS. This prototype will also have some sort of LVD function, or low-voltage alarm.

Note: a normal "Half-Pint" system does not have an LVD function and the user therefore must be trained to avoid abuse of this system. We are working to change this situation as of this writing. On a positive note, field testing of low-voltage or severe discharge abuse has shown the normal "Half-Pint" to recover brilliantly from severe discharge states..... so that is a very positive outcome of using LFP technologies. But true "damage" is hard to determine in terms of overall cycle time (longevity) performance when we are talking about a system that normally runs beyond 10 years of service.

Possible Extra Items:

For Lenovo models you need an addtional "square" adapter purchased. This gets added to the Vanson Adapter set that normally comes from GTIS with their systems. See: Amazon Store[3]

We anticipate that such a simple and inexpensive part ($5) will already be listed in the GTIS catalog on-line in the future. Again, ask for this from GTIS. They may have them in stock. One disadvantage to the popular universal Vanson auto-adapters is their manual voltage control slide switch. These must be glued in place to prevent casual users and friends in the village from "playing" with the switch and then potentially damaging your notebook computer later. It might be preferred to never allow this situation to happen. See below.

Instead, you might want to forego the popular Vanson Unit and simply purchase an Auto-adapter specific for your machine. For Lenovo see: Amazon Store[4]

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Note: This DC-DC auto-adapter is preferred over using an AC inverter, which wastes precious joules of energy in the conversion from DC to AC electricity and then back to DC once more. See the Auto DC-to-DC Adapter[5] section for more details on this topic.

The Villager-III

(Click to Zoom; Click again for Ultra-Zoom)

SIL
Villager III PV Power Bank
SIL GTIS Power Systems
power_systems@sil.org

bove, but larger. It is the box you want to purchase if you have a larger, power consuming box, such as an anceint (2014) Dell Latitude E6420 model running perhaps at 12 watts. The very good news is that this box can handle up to 12 amps of current, so it can handle very old computers if necessary and with relatively large solar arrays, up to 144 watts of solar panel. (Yes, "large" is a relative term here)

See: GTIS PowerMon Store[6]

Picture: A complete "kit" with flexible Sunpower 100 w panel. Note too the 10 meters of UV resistant power cable for a roof installation of the panel.

Note the aluminum metal box chasis and the dual, covered, 12 v automotive output ports and digital display. The total capacity in the LFP battery packs, installed is 216 Wh, which is slightly less than the old Villager-N units that are no longer in production, but with the superior amperage of the Villager-III (12 amps) versus the max of 5 amps before... the Villager-III is clearly a better built box and no exposed battery terminals to "hang onto" with an alien apparatus. And, best of all, unlike the older Villager-N box, there are no air-freight transport restrictions. **The Villager-III can be flown anywhere in the world, without restrictions**, so long as it is sent as cargo in the hold. This is a major deal. The extreme light weight over a Lead-Acid solution, also lends itself well to air transport.

The Villager-III does have an adjustable LVD (Low-Voltage-Disconnect) feature, therefore preventing an undesirable deep discharge of the battery. There's even an indicator light if the depth has been exceeded by the user. It is recommended to leave this at the GTIS factory settings, internal to the box. Normally the user does not set this. The solar controller inside the box is the popular Xantrex C-12 PC Board. See the Solar Controllers[7] section.

Inside the Villager-III the LFP battery packs sport Anderson Power Pole connectors. This is great for easily swapping out units for maintenance, but more importantly, they discourage unwarranted connection of other loads should the user open the box for power modifications in the village. There are no "terminals" to easily hang onto with extraneous other devices to power. This is important for unsupervised language projects.

The Villager-III (Dual Packs)

In some situations, the user might want to special order a slightly modified Villager-III box. Inside is normally 3x of a 72 Wh LFP battery pack, and for a large, older notebook where the goal is 4 hours of run time at night, then one would want the standard Villager-III.

However, some machines sold in 2015, such as the popular Lenovo x131e and the Lenovo xx140e models would be served well by only 2x LFP battery packs installed in the Villager-III box. GTIS says this would save approx. $80 in the purchase price. How do you calculate your need? When should you ask for the dual pack option?

For four hours of night-time use, let's say you are using a laptop running at about 9-10 watts. You are planning to work for 4 hours each night, but realistically there's about 2 extra night-time hours at dawn or dusk where the solar panels have not really turned on to deliver any usable power. So really 6 hours of "night-time" here. Energy consumed: 6 x 10 watts or 60 Wh (watt hours).

Inside the Half-Pint and Villager-III solar units are either 1, 2 or 3 72 Wh battery packs. These are completely sealed units with Anderson style power-pole connectors.

The Villager III with 2 battery packs would have 2x 72 Wh of energy, but remember that you can only really use 80% of the capacity here, so practically speaking you have, 2 x 72 Wh x 0.80 = 115 Wh of energy. Wow! That's a lot of extra energy storage. But remember that for the LFP batteries (see the Battery Technology[8] section) to achieve 5000 or so cycles (well beyond 10 years of lifetime), one must discharge to around 50% or so of the full capacity of the battery. Well, consuming 60 Wh or energy each day, from 115 Wh of usable storage, is close enough for a 50% depth of discharge, each and every day. Congratuations! You have saved $80 and yet have a system that could last you, over 15 years of service! Wonderful! This would be for older netbooks like the Lenovo x131e models.

However, for older Dells and Lenovos and Toshiba laptops of the past, say those purchased back in 2012-2014, they could be running 15-20 watts while in use. You MUST specify the standard Villager-III unit, in that scenario.

Don't even think to try to get this kind of lifetime performance with a Lead-Acid battery, even the "deep discharge" more expensive variety. They will be replaced in 2 years.

Important Point:

If it is not clear from this paper already. The choice of computer you are planning to use has a **severe impact** on the size and cost of your solar system for stand-alone, rural use. It's quite possible that in a truly remote solar site, that it is **worth the cost to ditch the old laptop** you have in hand today, and start over with a more modern low-power computer, and then save a bundle of money with a tiny solar system that would be required. It's one of those situations where one can be a "penny-wise but pound foolish" by insisting on using the older computer at thand, and trying to go forward with your project. The modern netbooks we are talking about today weigh in at $300 cost or so, but the savings in solar equipment costs could exceed $1000 or more! It all depends, of course, on "how old" your present laptop might be that you are trying to re-purpose here.

But do not think that all computers are the same, power wise. They are very different. It pays to do your homework.

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[1] http://www.powermon.org/store/

[2] http://www.powermon.org/store/product/half-pint-power-bank

[3] https://www.amazon.com/Conversion-Converter-Thinkpad-UltraBook-convertor/dp/B00PC51ATS/ref=pd_bxgy_147_img_3?ie=UTF8&refRID=8FHGE9ARSYDEA0884WS1

[4] https://www.amazon.com/Laptop-Charger-Ideapad-Thinkpad-Chromebook/dp/B00HCM6H9W/ref=sr_1_2?s=pc&ie=UTF8&qid=1466633075&sr=1-2&keywords=lenovo+dc+auto+adapter+charger

[5] https://lingtran.net/DC-DC+(Auto)+Adapters

[6] http://www.powermon.org/store/product/villager-iii-solar-power-bank

[7] https://lingtran.net/Solar+Controllers

[8] https://lingtran.net/Battery+Technologies