# Tools

# Useful Tools:

**June 2017**

## Non-Invasive, Clamp-Style DC Ammeters

Ammeters are instructments that measure amperage or the rate of current flow in a circuit.  There are AC type and DC type ammeters, and you want those that can measure DC current in solar setups.  AC (Alternating Current) power is the kind you would find in a residence or a business office in the mains power supplied by a utility company.  DC (Direct Current) flows continuously in one direction and so, when purchasing a measuring device, be sure to look for a DC capability (which is harder to find, often).

Portable Clamp Style Ammeters are usually multi-funciton devices and add standard DVM multi-meter capabilities as well.  They are easily spotted with their rather large "C-Clamp" looking sensor at the top of the device.  One pushes a small lever, and opens the clamp sensor, which is placed around a single wire in the circuit to be measured.  Depending upon the current flow in relation to clamp orientation you chose, the current will be indicated in either a positive (+) direction or the opposite, a negative (-) direction.  There will be indication for this on the digital display.  Units are typically in Amps.  The picture here is measuring 8.7 amps through the brown wire.

The advantage of the clamp style ammeter is that you don't have to modify your solar setup in any drastic way, other than to reach a single wire to wrap around with current flowing in one direction.  You cannot wrap around two wires, for example both wires coming and going from a battery because the two currents in the two wires will cancel each other out, if they are flowing in opposite directions.  You need to isolate one wire in your measurement.  Also, a DC ammeter cannot be used on an AC circuit since the current is alternating back and forth up to 50 or 60 times a second.

If one were to permanantly wire an ammeter into their solar setup then one can subsitute a much less expensive analog or digital meter, which are also readily found on amazon.com to purchase.  These meters must break the DC circuit at some point and be placed in a series configuration to re-connect the working circuit. They can monitor in real time, but are a more permanent installation.  Nice, but for a temporary monitor, the clamp meter is more useful for random measurements and used to diagnostically determine what might be wrong or right about an aging solar system in the field.  This is a great investment for the solar technician, helping others.

The Uni-T model UT-203 is highly recommended at US$ 30

amazon.com: UT-203[1]

## The YKS, USB Power Monitor

With the advent of more and more useful applications coming to Android mobile phones and tablets, including the new "Paratext

Lite" application (coming soon for Android OS), we have been doing a lot more research with inexpensive fold-out solar panels and a "direct connect" charging scheme, via a typical USB cable. These are 5 volt systems instead of the typical 19 volt DC systems we see with a more conventional notebook class computer. For more details on these new developments see the Asus Transformer Book class of notebook computer in the computer section.

**Click to Enlarge**

But various solar panels, and various tablets/ mobile phones do not all behave alike, and so there needs to be careful testing. It's important to be able to see the charge levels and rates of charging from the solar panel. Therefore there are any number of in-line monitoring devices that can be found on amazon.com. One simply connects the USB meter in-line with the charging cable and then takes some readings in real-time. However, most of these devices on the market are inadequate because they have standard color OLED or electro-luminescent displays, that are **totally unreadable in direct sunlight**, outdoors. And most of the time you are indeed outdoors with a portable solar panel in hand, and a relatively short USB charging cable.

Enter the brilliant **YKS USB Power Monitor**, pictured here. it uses the "old style" mono-chrome LCD technology which has high contrast in normal ambient light outdoors. Sort of like the e-Ink displays on certain Kindle tablet readers. These are totally readable in bright sunlight and not an expensive device.

**Click to Enlarge**

The "smarts" of the device are also quite superior. It will monitor voltage, current, power, time since you started charging, energy consumed in mAh (multiply by voltage for mWh), and finally total energy, if you managed to re-charge more than one

device.  These modes are easily switched by a single push-button mode switch at any time in your measurements.  Finally, you can set up your experiment and walk away for a few hours, since the unit will also sense when the device is fully charged and then self-disconnect the circuit, ending all charging.  That not only protects the device from overcharging (which is a good standard practice anyway) but all the stats are there recorded for you to read later.  This means you can go do other work while you wait....  like write reports on the SCOS wiki page, or do emails.

This part now appears to be sold out, so substitute:

amazon: Centech Power Meter[2]

Note: Centech has not been evaluated, but is LCD type display

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[1] https://www.amazon.com/Digital-Clamp-Meter-Uni-Trend-UT203/dp/B005HOPRRK/ref=sr_1_10?ie=UTF8&qid=1497397038&sr=8-10&keywords=uni-t+clamp+meter

[2] https://www.amazon.com/Centech-USB-Power-Meter/dp/B00DAR4ITE/ref=sr_1_3?s=industrial&ie=UTF8&qid=1497576220&sr=1-3&keywords=Centech+Meter