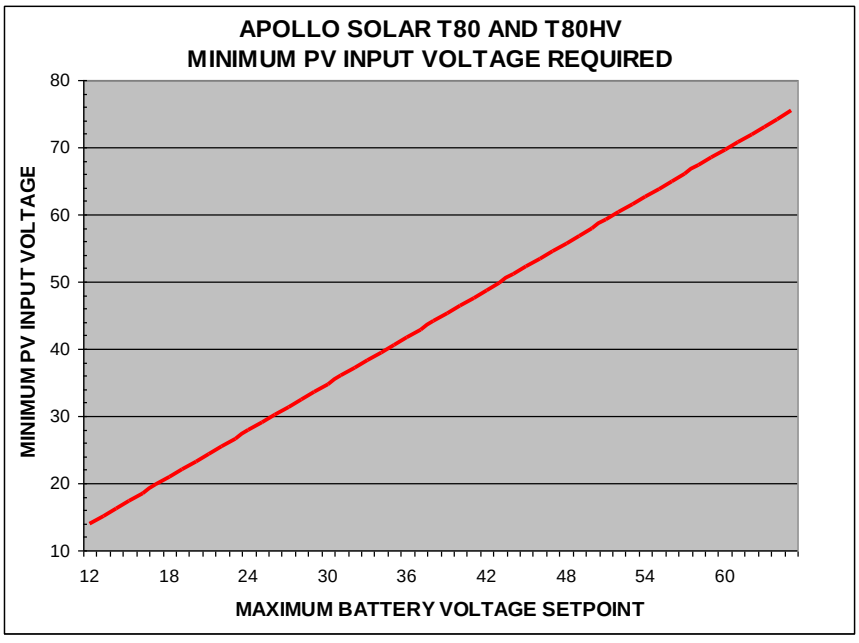
MEMORANDUM on PV Module String Sizing

SUBJECT: MPPT Charge Controller VOLTAGE REQUIREMENTS -- April 2012

The Apollo Solar Charge Controllers are based on DC to DC converters which convert the input voltage to a lower output voltage. The input current is boosted by the same percentage as the voltage is reduced. The most significant advantage this provides is the ability to adjust the voltage and current on the input to match the Maximum Power Point of any PV module or array of modules. The Apollo Solar (Maximum Power Point Tracking) Charge Controllers increase the energy harvest into a battery by up to 30% or more over the less capable PWM (Pulse Width Modulation) charge controllers which must throw away all voltage from the PV modules that is greater than the battery voltage.

In order for MPPT charge controllers to find and track the maximum power point of the PV array, they need some voltage headroom above the maximum charge voltage set for the battery. The advanced MPPT algorithm in the Apollo Solar charge controllers require **the minimum voltage from the PV array to be at least 16% greater than the highest battery charge voltage.**

A second advantage of MPPT charge controllers is that the higher PV input voltage means lower current and less loss in the wiring from the PV array. Since the power loss is proportional to the square of the current, by wiring the PV modules for the highest voltage and lowest current allowed is significant in terms of reduced loss and/or reduced cost of wiring. System designers and installers trained to use PWM controllers will see much greater output using our MPPT charge controllers, but the PV modules must be wired for higher voltage than with PWM systems. The actual Vmp at the input of the MPPT charge controller must be confirmed, rather than counting the number of PV modules in series.



The graph to the left shows how to determine the minimum PV input voltage. Simple identify the maximum battery charge voltage on the horizontal axis. Look up to the red line representing the 16% voltage headroom, then over to the left to find the minimum PV input voltage.

Remember that this is the Vmp (maximum power voltage) and it is at the maximum temperature that the PV module will see.

Remember to subtract the voltage loss in the wiring.

The principle is that MPPT charge controllers like higher voltage, as long as maximum Voc of the modules does not exceed the maximum input voltage of the charge controller.

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