12 October 2006

DC solar system with MultiPlus inverter/charger

In a DC solar system batteries are used to store energy.
An inverter can be installed if alternating current (AC) is needed.

If AC is also available from the grid / mains, the system becomes more complicated.
The DC solar system can then be used as a back up in case the mains supply fails.
During a mains failure the AC consumers will be supplied through the inverter.
Once the mains is restored, the inverter shuts down and the batteries are recharged with the solar panels.
But what to do with the electricity from the solar panels after the batteries have been fully charged?
Answer: interface DC and AC with a Phoenix MultiPlus inverter/charger

Description of the DC solar system with MultiPlus inverter/charger (see fig. 1)

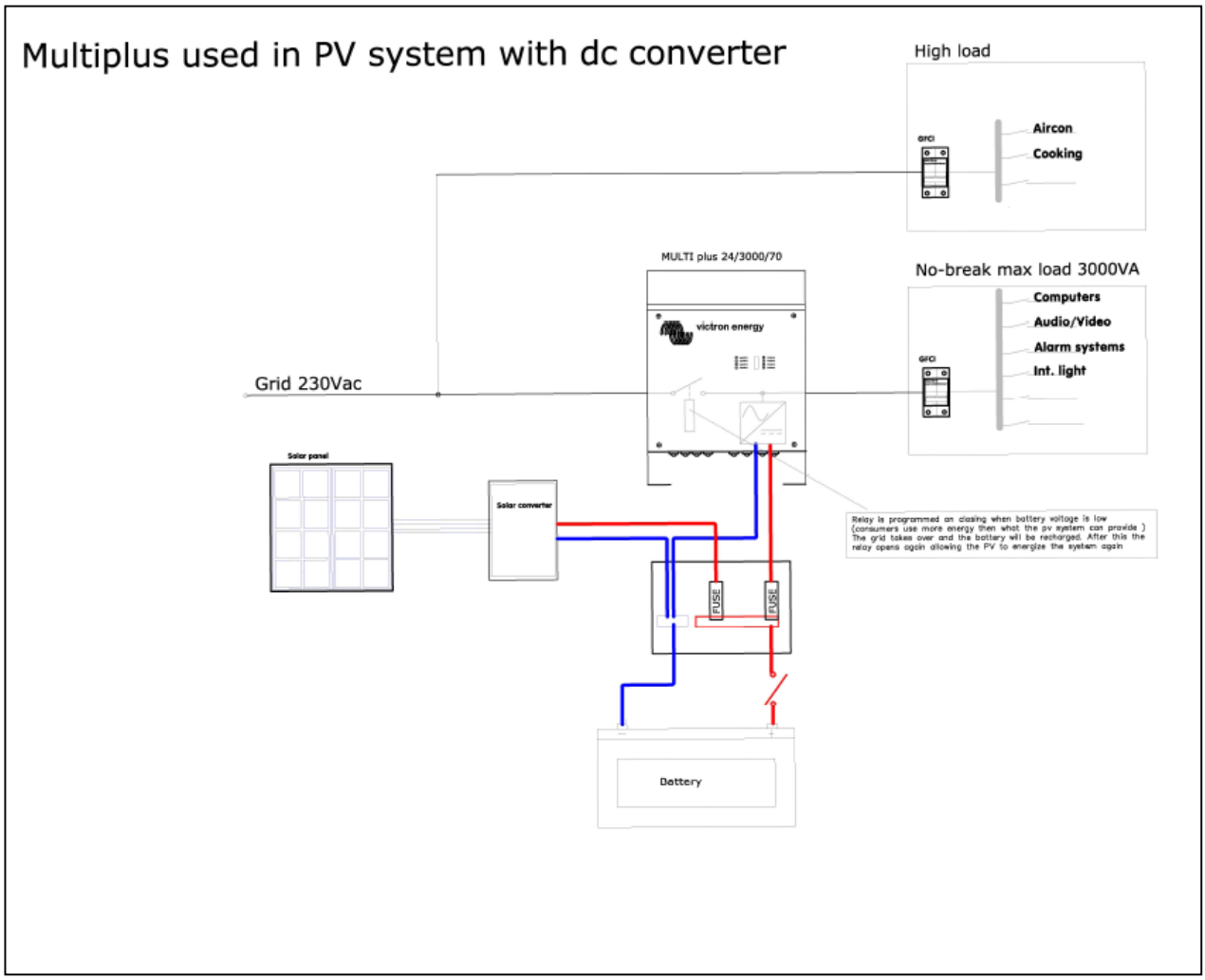


Fig. 1: DC solar energy system with MultiPlus inverter/charger

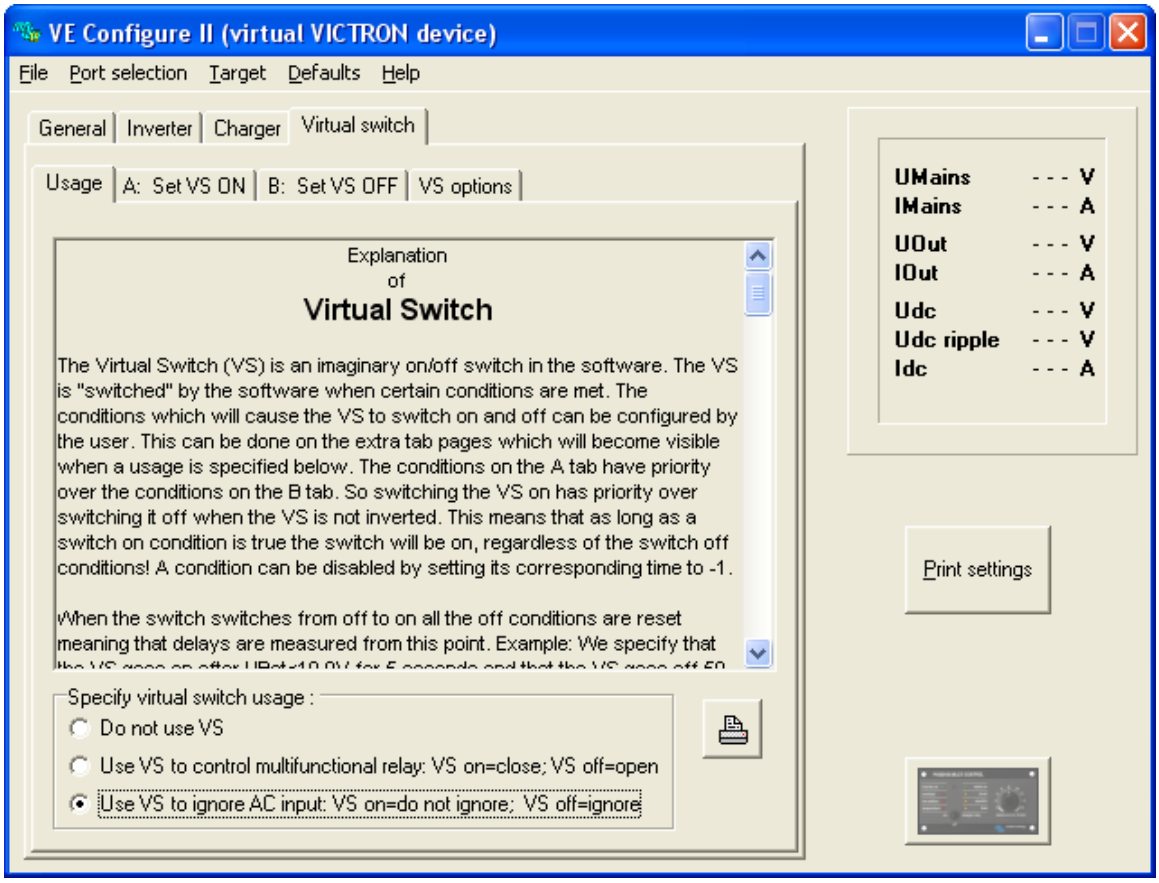
Loads that cannot be handled by the Multi are connected directly connected to the mains supply.
(If needed, several Multi's can be paralleled to handle higher loads)
The other loads are connected to the Multi. The Multi, together with the batteries and solar panels, functions as a no break power supply for the connected loads.

The trick to make optimum use of the solar panels is to program the 'virtual switch' in the Multi in such a way that the inverter function of the Multi is switched on when the battery voltage has increased to a certain value (indicating the batteries are charged). Simultaneously the back feed protection relay in the Multi is opened, this to prevent power to be fed back into the mains.
The Multi can be programmed to switch back to mains supply when the battery voltage has decreased to a preset voltage. The Multi remains off until the solar panels have recharged the batteries (unless the mains fails in the mean time of course), and the cycle starts again.

Programming the Virtual Switch
Needed to program the Virtual Switch:

- VEConfigure II software (can be downloaded free of charge from our website)
- White paper 'A guide to VEConfigure' (can be downloaded free of charge from our website)
- Laptop or PC
- Victron Interface MK2 (RS485 to RS 232 interface, Victron Energy part number ASS030120200)

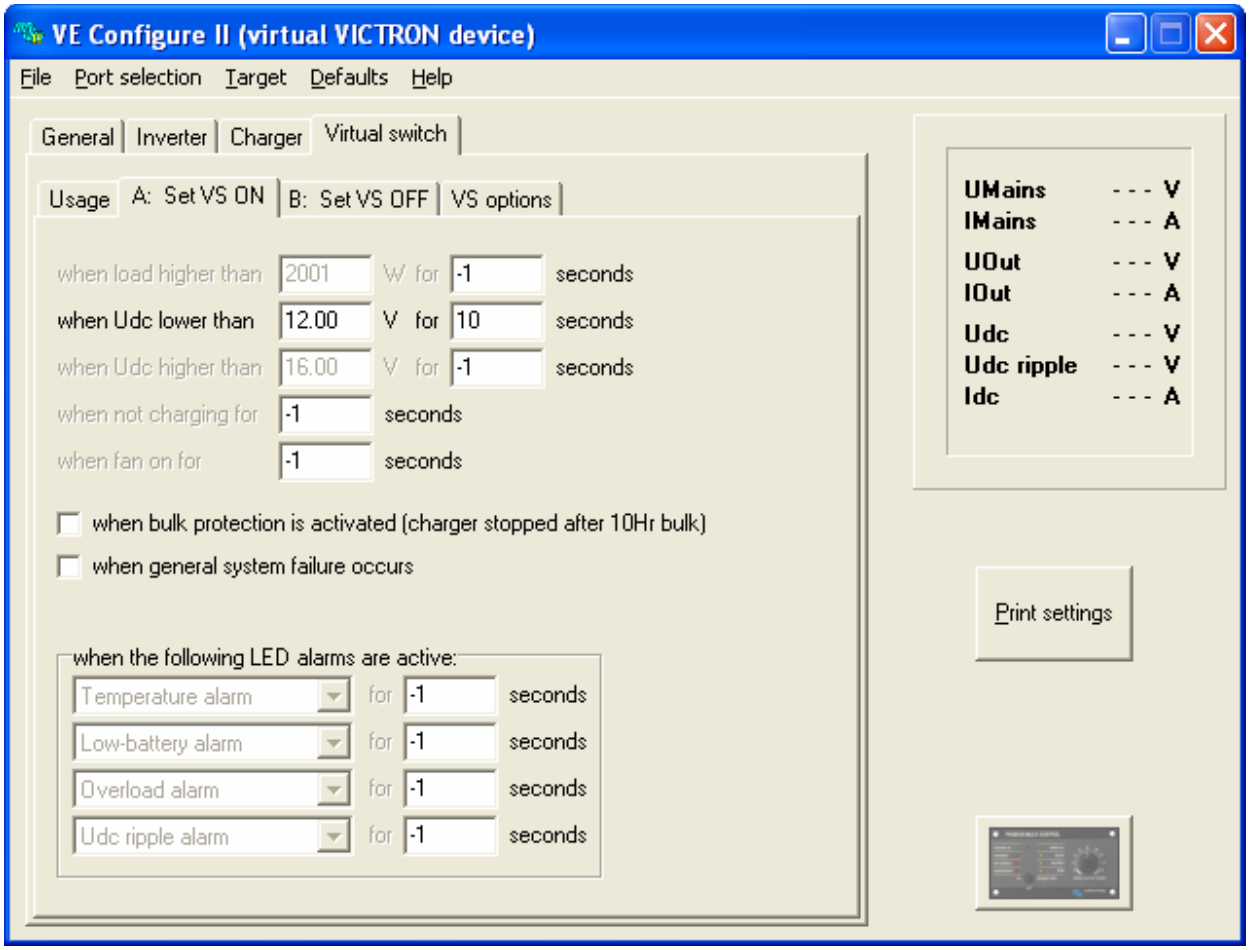
Once VEConfigure is up and running, go to the window 'Virtual Switch'



Select the window ‘Usage’

Select the option ‘Use VS to ignore AC input’
Now the AC input will be ignored when the VS is off, so the next step is to switch off the VS when the DC voltage has decreased a certain level.

Select window ‘A: Set VS ON’

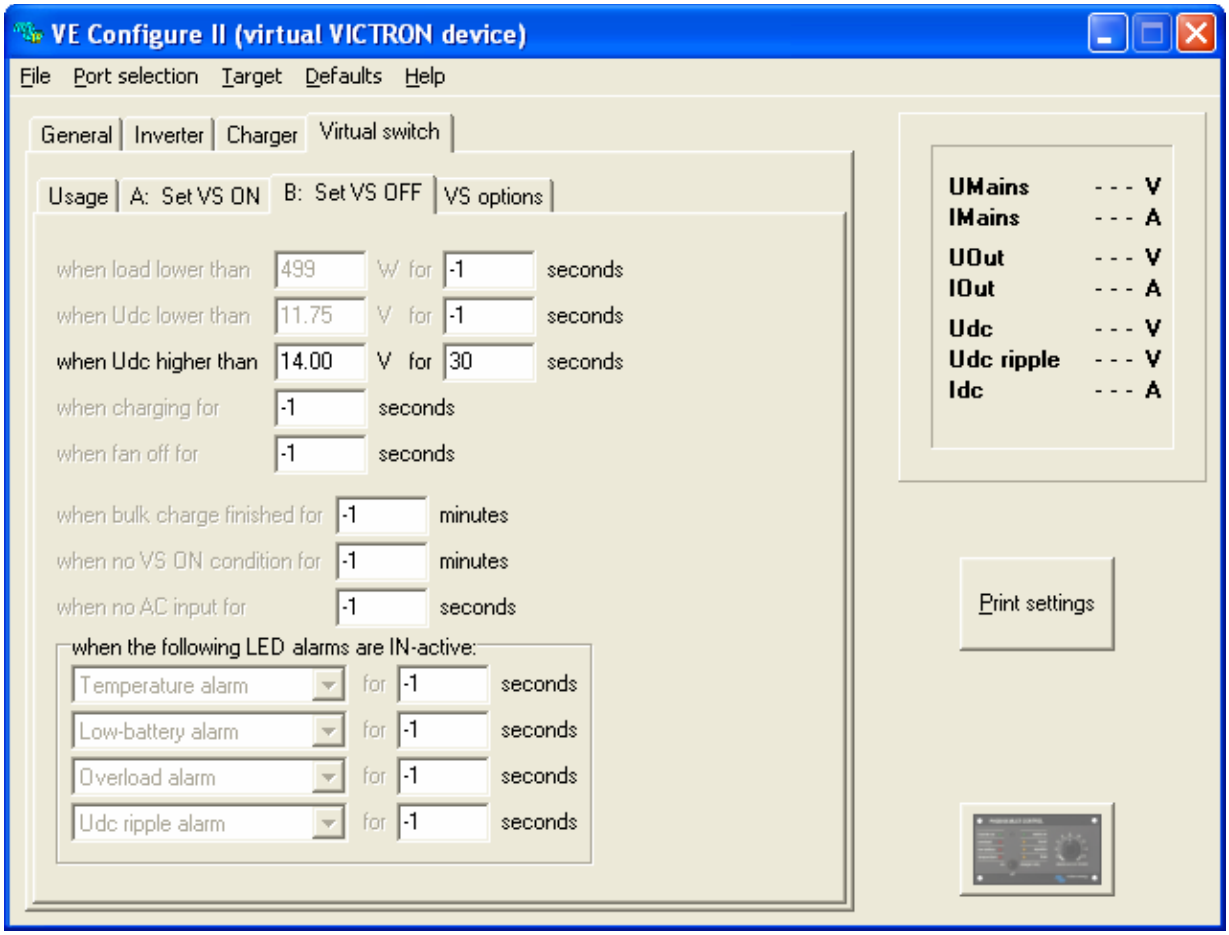


Select ‘when Udc lower than’
Type the required voltage and delay time.
The inverter will switch off at this voltage. Depending on how deep the batteries should be discharged, the voltage should typically be between 11V and 12V for a 12V system. To avoid spurious switching , the delay should at least 10 seconds.

If direct mains supply is also required at high load (to prevent fast discharge of the battery or overload of the inverter), a load limit and delay (minimum 1 second) can be added at ‘when load higher than’

Note: a Battery Monitor can also be used to switch the Multi on and off. The advantage of using a Battery Monitor is that the Multi can be switched based on the state of charge of the battery, measured in Ah. This method is more accurate than switching based on DC voltage, and is recommended for large systems.

Now select window ‘B: Set VS OFF’



Select ‘when Udc higher than’
Type the required voltage and delay time.
The inverter will switch on at this voltage. The switch voltage should always be lower than the (absorption-) charge voltage level of the solar panel regulator. Otherwise the inverter will never switch on.
The voltage should typically be set between 14V and 15V for a 12V system.
The delay should be at least 10 seconds.

To avoid low DC to AC conversion efficiency at low load, a minimum load could be set at ‘when load lower than’.

The configuration of the VS is now complete: send the settings to the Multi.