General info on AC Coupling and the Factor 1.0 rule

AC Coupling defined

[TODO: explain AC Coupling, mention DC coupling as an alternative, mention PV inverters and solar power, add system diagram]

What is frequency shifting?

[TODO: what is it? what is the purpose of it? how can a VE.Bus product configured to do it? From most advised to least advised:

1. With the Self-consumption Hub-2 v3 assistant
2. PV Inverter support Assistant
3. Use the Inverter period time settings on the Virtual switch tab.]

Factor 1.0 rule: Max PV power in combination with frequency shift

Rule definition

In both grid-connected and off-grid systems with PV inverters installed on the output of a Multi, Inverter or Quattro, there is a maximum of PV power that can be installed. This limit is called the factor 1.0 rule: 3.000 VA Multi = 3.000 Wp installed solar power. So for a 8.000 VA Quattro the maximum is 8.000 Wp, for two paralleled 8000 VA Quattros the maximum is 16.000 Wp, etcetera.

Example and background

To understand the background, consider the following situation: the PV inverter is at full power, supplying a big load. The Multi is in inverter mode. Then, suddenly and at once, this load is switched off. At that moment the PV inverter will continue operating at full power until the AC frequency has been increased. Increasing this frequency will take a very short time, but during that time all power will be directed into the batteries as there is no other place for it to go. This causes the following:

- When batteries are (nearly) full, the battery voltage will spike, possibly causing the Multi to switch off in DC over-voltage alarm.
- The same spike will cause the AC output voltage of the Multi to spike, as these two are directly related, and when the spike on the battery voltage is high and fast enough, the Multi can never regulate its PWMs down fast enough to prevent the spike on AC. This spike can damage the PV inverter, the Multi and also any connected loads and other equipment.

- Another problem is that the Multi starts charge current protection.
- In the best case it might switch the grid inverter off immediately by setting the AC frequency to the disconnect frequency as configured in the assistant.

It is no problem to overpower the grid inverter by installing more solar panels. Some people do this to increase the generated solar power in winter time or rainy weather. Refer to the PV Inverter datasheet to maximum allowed installed PV power. Two times the inverter nameplate rating or even more is not uncommon!

Charge current limit

Another question frequently asked is how can this factor be 1.0? Since the charger inside a 3000 VA Multi is not 3000 VA but closer to 2000 VA? The explanation lies in the fact that it will regulate . In other words: when there is too much power coming in, causing the charge current to exceed the limit, it will increase the output frequency again and will keep regulating the AC output frequency to charge with the limit.

An example, a 3000 VA Multi, with 3000 W of solar power coming out of a PV inverter:

1. When the Multi is connected to the grid, all 3000 W can be fed back to the grid through the Multi, no problem.
2. In case the Multi is not connected to the grid, the 3000 Wp is more than the charger in a Multi 3000 VA can handle. The charger is around 2000 W. Therefore the grid inverter assistant will automatically increase the frequency to reduce the output of the grid inverter, to match maximum charge current.

Should you look at the total PV array, or the PV inverter rating?

The mentioned 3000 Wp and 8000 Wp is the Watt-peak which can be expected from the solar system. So for and oversized PV array, where the total Watt-peak installed PV panels exceeds the power of the PV Inverter, you take the Wp from the inverter. For example 7000 Wp of solar panels installed, with an 6000 Watt PV grid inverter, the figure to be used in the calculations is 6000 Wp.

And for an undersized PV array, where the total Wp of installed PV panels is less than the installed PV grid inverter, you use the Wp from the PV panels in your calculation.

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