Victron Energy Inverter/Chargers combined with Grid Tie Inverters

Notes on Off Grid System Configurations:

The right application of different solar system configurations is important to the life cycle of the components in the system.

When the Load or power demand is known to be high in the day time only, it is a very good idea to use a Grid Inverter system because the Grid Inverter produces 230VAC and then the power is consumed right away.

If the power demand is at night it can only supplied by a Battery bank and a Inverter/charger, thus to have the simplest method of charging and most cost effective is the answer.

If in a Grid Inverter/island system it often happens that no power is being used during the day and the battery bank is fully charged the Grid Inverter can shut down or sleep, if this happens very often then the system is over designed which is most of the time very possible but not ideal.

In load conditions it is also very important to understand what will happen when a large 230VAC load is switched off suddenly in an Island System. The Grid Inverter is at full power and the Inverter/charger monitors the power going to the load, once the load is shut down there is a high current condition on the 230VAC Bus, if the battery bank needs charging there is no problem, the charger goes into full Bulk charging mode.

If the battery bank is fully charged the high current condition causes an in rush of current into the Inverter/charger, this can cause several conditions to occur. The Inverter/charger can push the DC Voltage up very quickly to above Bulk Voltage most times the internal regulation can control the Grid Inverter power by changing the Inverter/charger frequency quick enough. Sometimes if this happens often the Inverter/charger can show a flashing over load LED, this should be avoided as much as possible.

How can this be prevented?

1. By not over-sizing the Grid Inverter system according to the load demand
2. Installing a battery bank that is not to small, rule of thumb it must be able to provide 6-8 hours back up

Here follows some of the important steps to make the settings for a Grid Inverter Solar System with our Assistants.

The Important point is that only Solar Systems with a Grid Inverters that can be controlled by Frequency can be used in Conjunction with a Victron Inverter/charger. This mode in the Grid Inverters is usually called an ‘Off Grid Mode’. The most common Grid Inverters are SMA, Kaco, Steca, SolarEdge and Fronius (new model) off course our own Grid Inverter as well. When it is required to have a battery back for such an installation we have a special software feature called assistants that is used

to make such an installation very easy and quick.

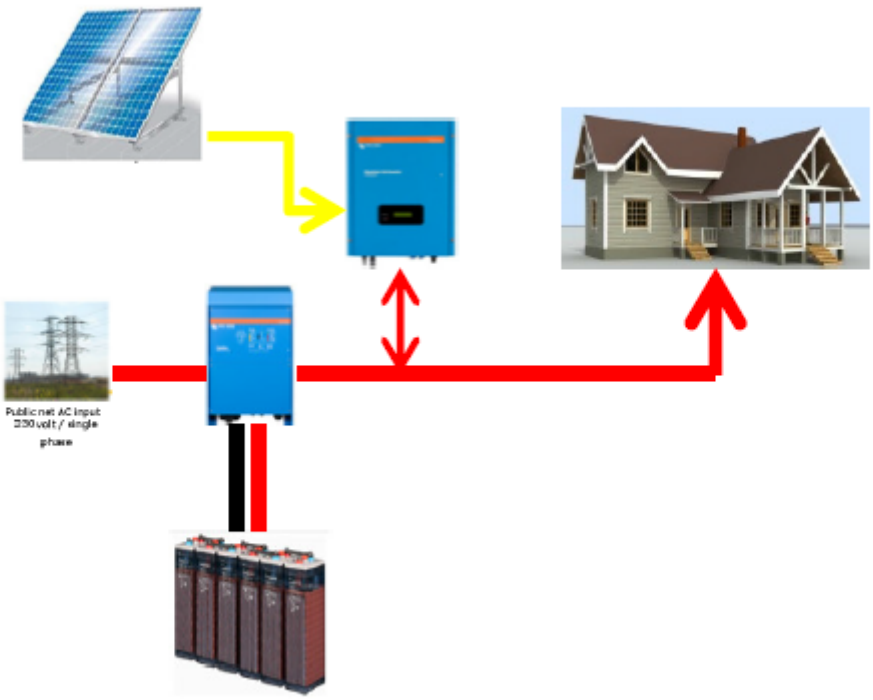
When is it best to use a Grid Inverter for a Solar System? Because of the very high efficiency in producing the AC Power it is best to use the power at the moment it is generated. So when there is more power used in the day time it is recommended to implement a Grid Inverter in the Solar System.

Important steps to take care of before you start.

1. Have a good understanding of how power is used in the application, make a load chart
2. Make a power curve over a 24Hour period to see when the most power is being used
3. Select the right size Inverter/charger to work with the Grid Inverter
4. Calculate and Verify the Solar Power that can be generated at this location
5. Size the battery bank
6. Calculate efficiency for each component in the system

Once the above steps are taken care of and a system is designed the list could be as follows:

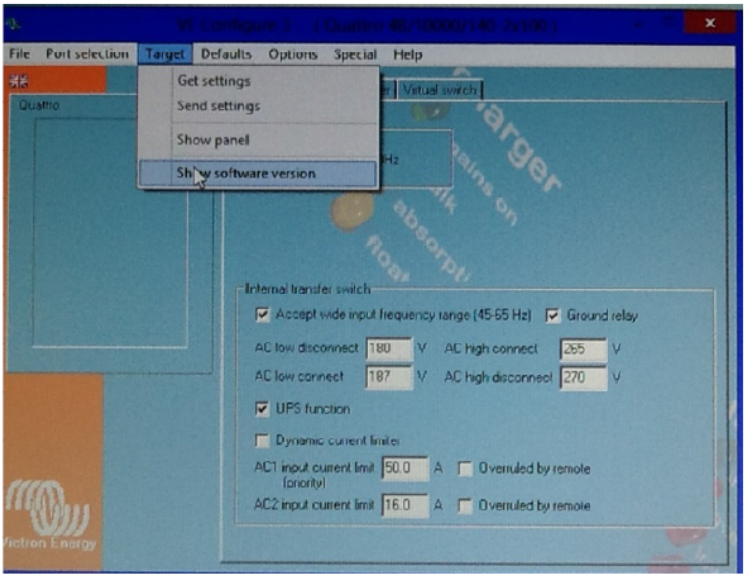
- 24 x 2V 800A/H OPzS Batteries
- 10 x 280Watt Victron Solar Panels
- 1 x 2800Watt Victron Grid Inverter
- 1 x 48/5000/70 Multiplus



The next step is to set up your system with VE Configure 3, because the assistants will be used the Inverter/charger will need to be upgraded to a special firmware version.

The Firmware number can be seen in the software and inside the Inverter/charger on the control card as shown below.

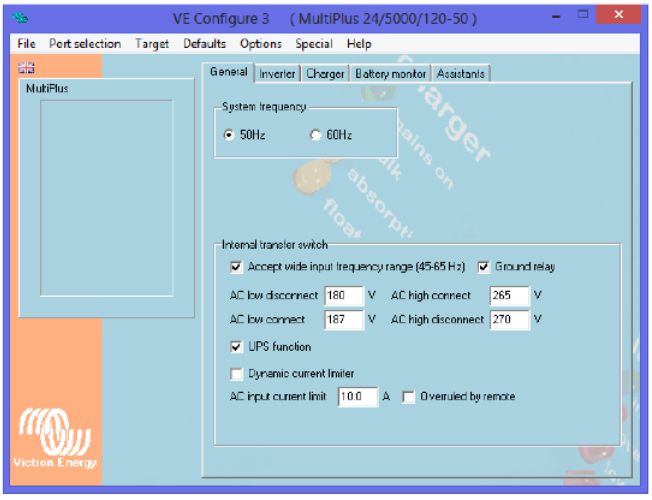


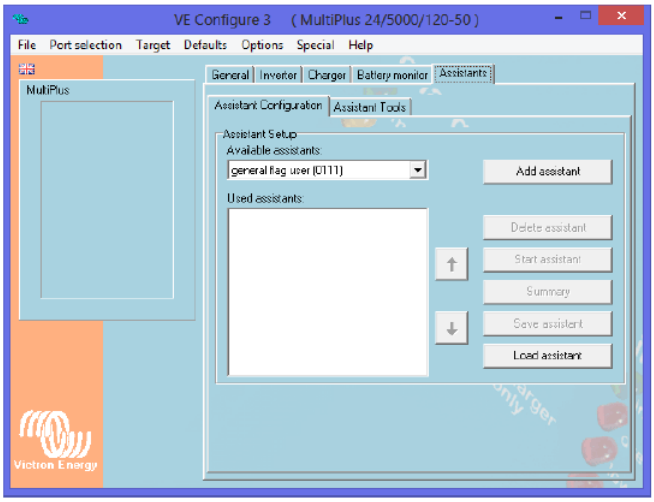


VE Configure 3 Settings:

The Normal settings can be made on the General, Inverter and Charger page. The Battery Monitor page can now be used (see explanation below *****). On the Charger page settings some settings can also be changed via the Assistant, ‘Grid Converter support’, this is optional.

The assistant page will become active when the firmware update has been completed.





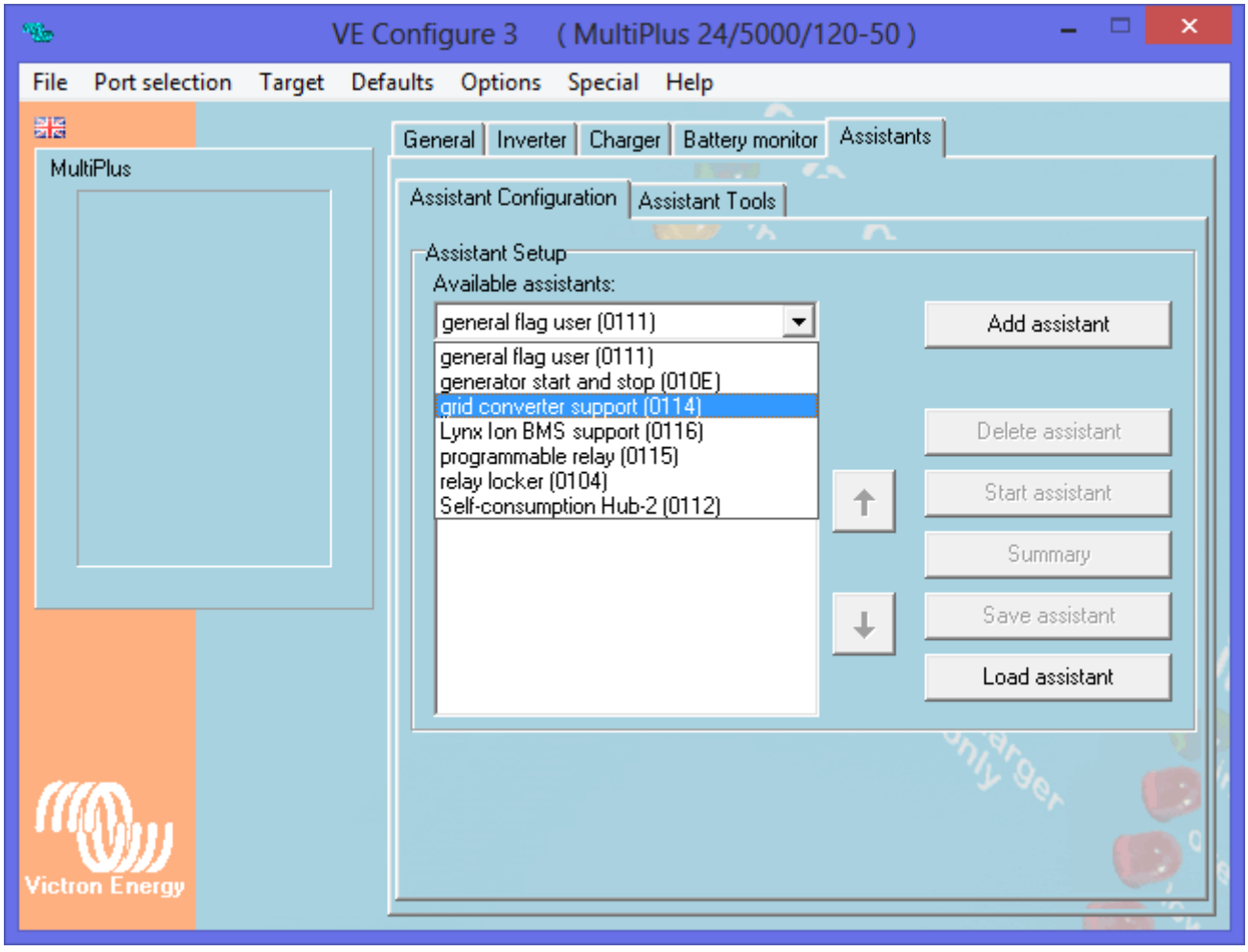
Before the setup using the Assistant can be done it is important to know at what frequency will the Grid Inverter go into sleep mode, the shutdown Hz level shut not be used to prevent any unnecessary on/off switching. The sleep mode keeps it on and when set into sleep it will provide power very quickly thereafter.

***** The Inverter/chargers internal shunt is used for counting the Amp Hours used and charged, when there are DC Loads in the system the Battery Monitor becomes in accurate.

Grid Converter Support

A list of assistants are available to choose from, the assistants listed are used and combined with each other for specific installations by different customers that are more technical knowledge and experience than our normal customers. In this document we will use the Grid Converter support assistant. While making settings on each specific window a brief explanation is given for reach screen at the top, it is very important to read this screen before carrying on to the next window.

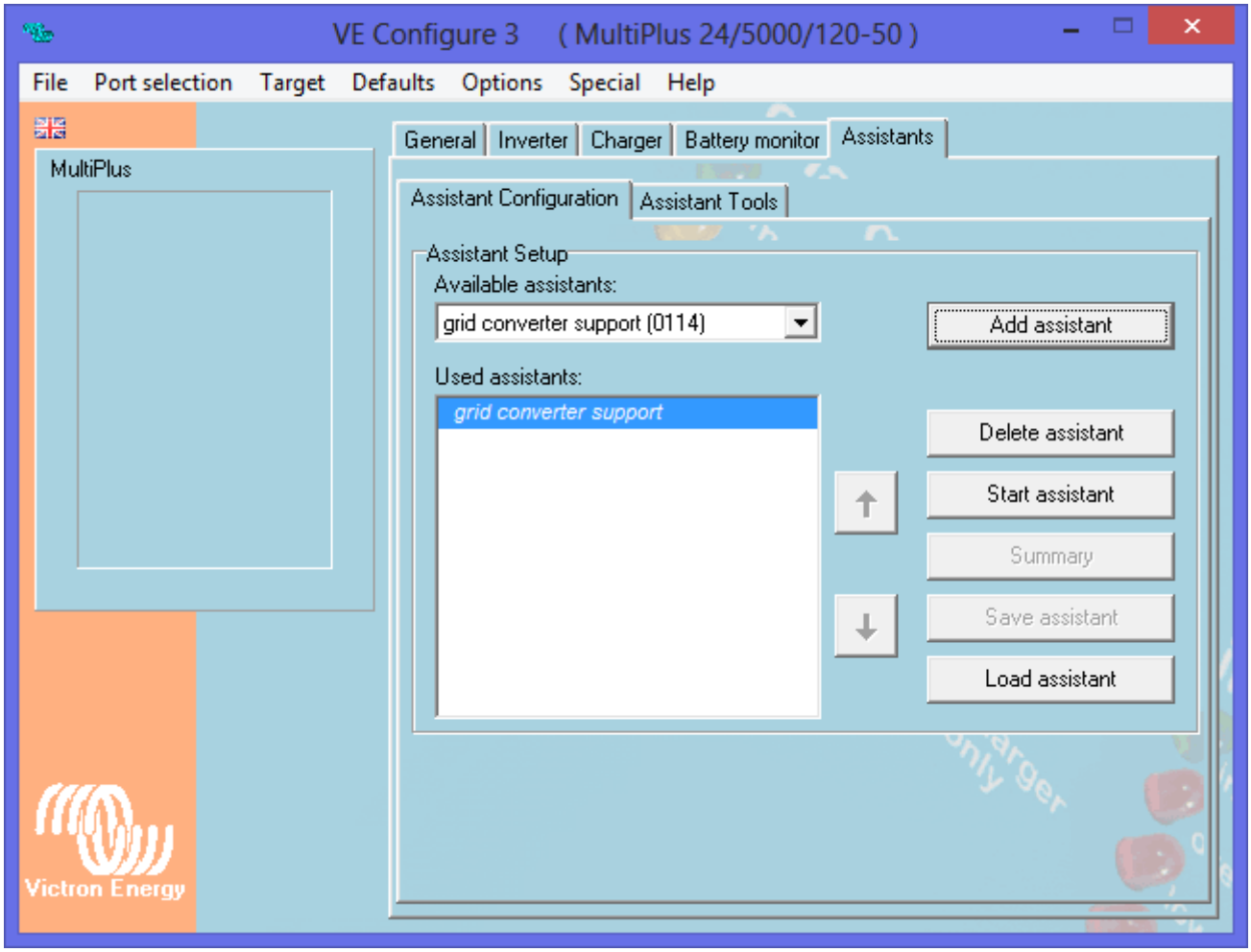
From the Drop down menu select the Grid converter support (0114) – shows the version of the assistant, this is the latest version.



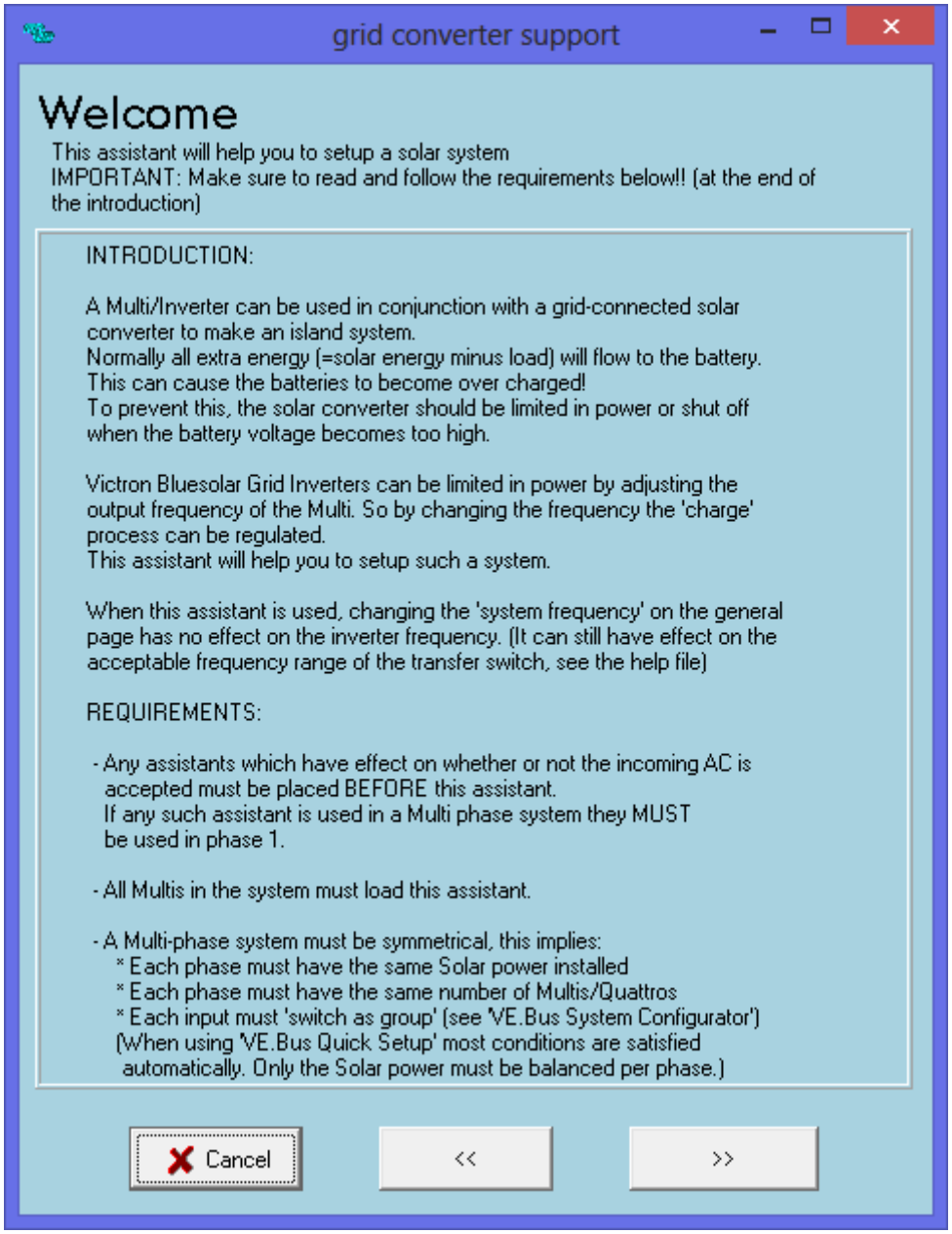
Once selected select ‘Add assistant’ it now appears in the main window under the drop down menu.

The Italic ‘grid converter support’ means it is not configured yet.

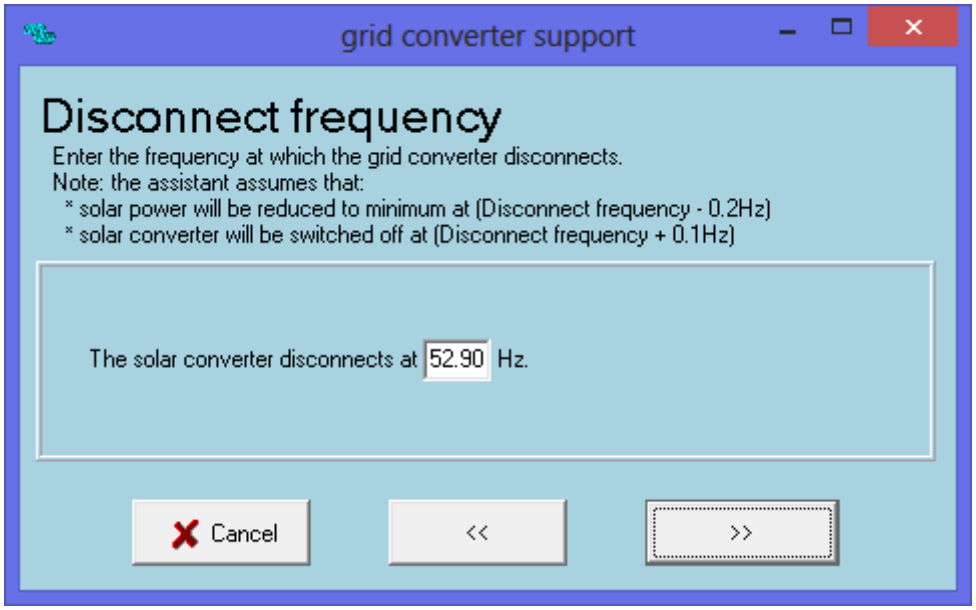
Now Start Assistant can be selected to begin making your settings.



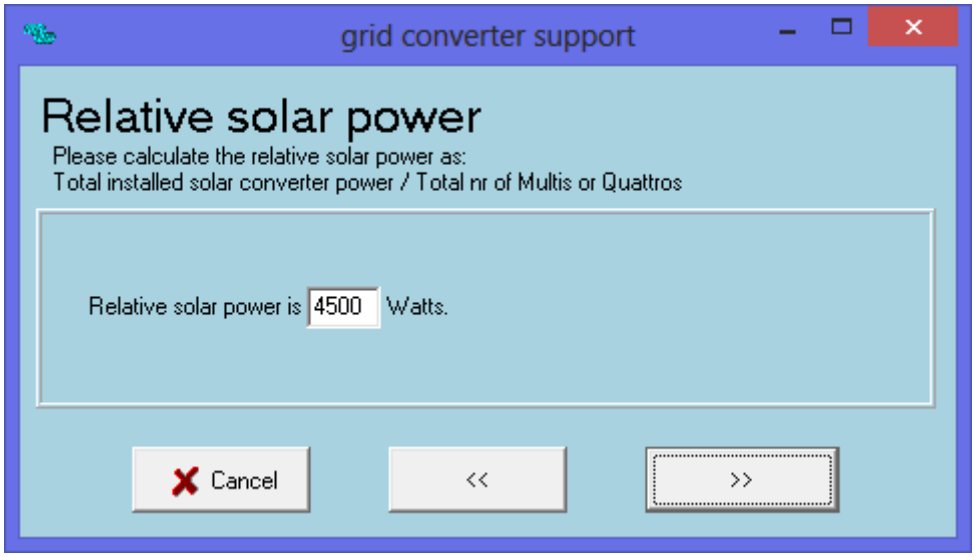
This Welcome screen is very important to read and understand, it explains certain important points to take note in Grid Inverter/Island systems.



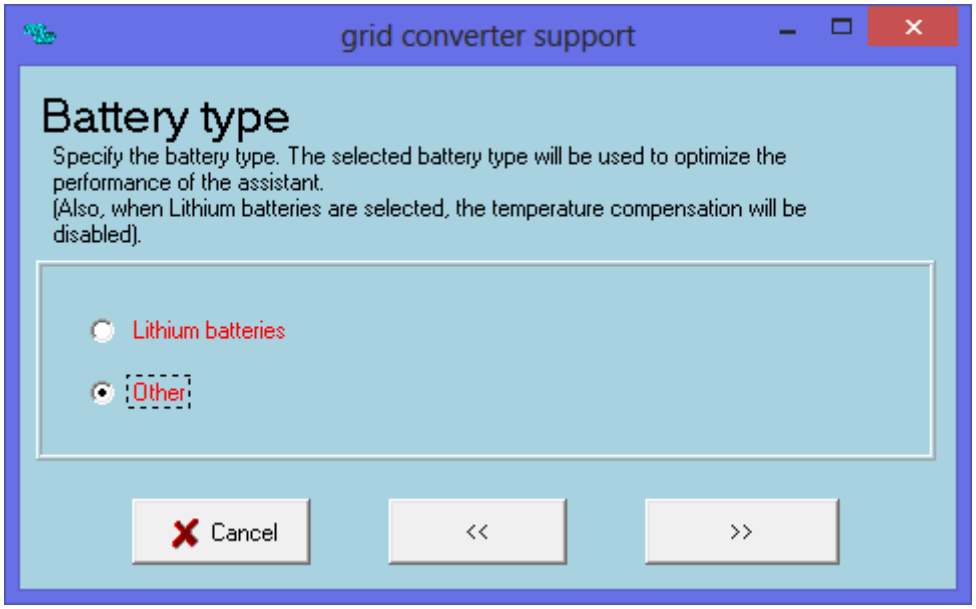
The Disconnect Frequency should be the Sleep level at which the Grid Inverter goes into sleep mode and stops producing power. If this level is not known the shutdown level can also be used, once the Hz is back to a normal level there should be a 30second delay for power is delivered again by the Grid inverter.



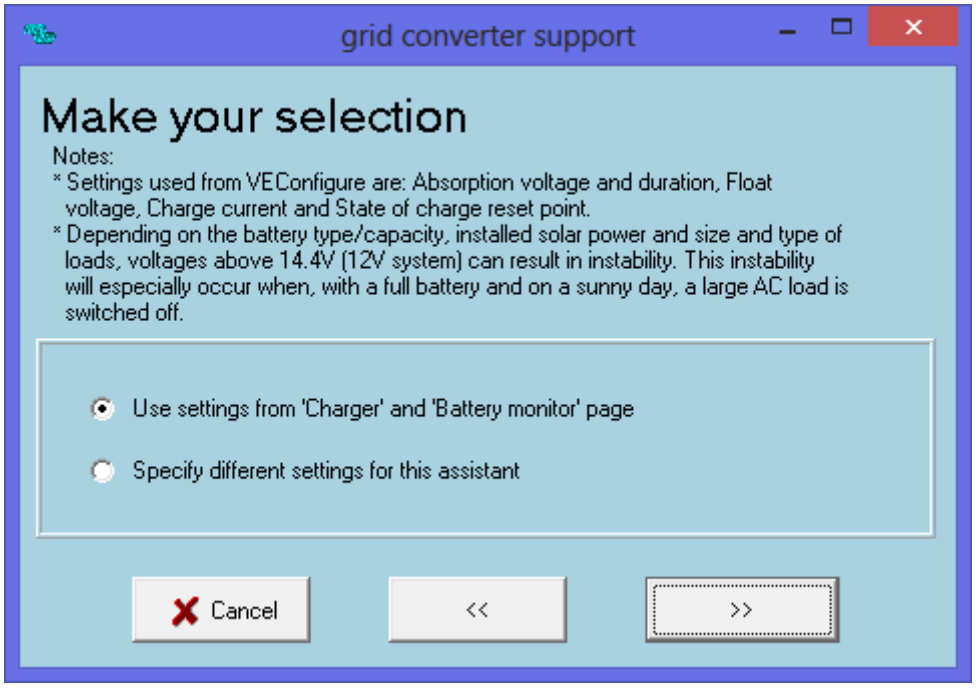
The value required here is the total installed PV Power, this value should reflect what the possible maximum power output from the PV Array could be.



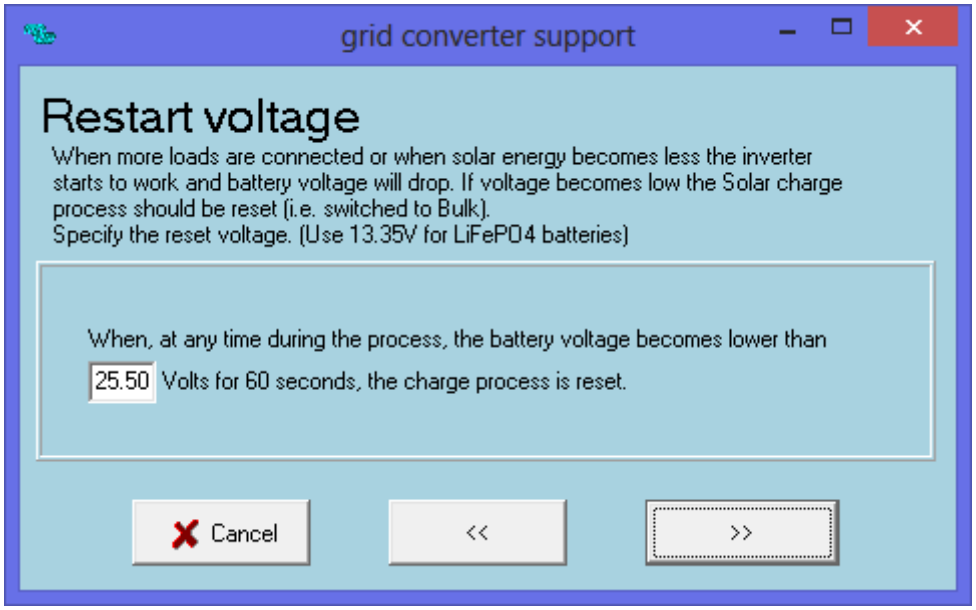
The Default setting is Lithium Batteries, in almost 99% of all cases it should be changed to other.



The Option to use the settings made on the Charger page is now available, alternatively it is possible to specify different settings for when charging from the Grid Inverter.



This setting is to reset the Grid Inverter once it has been switched off, reset into sleep mode. This happens when there is no load connected to the system and the battery bank if fully charged.



How much Solar power from a Grid Inverter can be combined with a Inverter/charger?

The rule is 3000VA Multi = 3000Wp installed solar power. So 8000VA Multi it is 8000Wp and so on. This rule is for grid connected systems and off-grid systems.

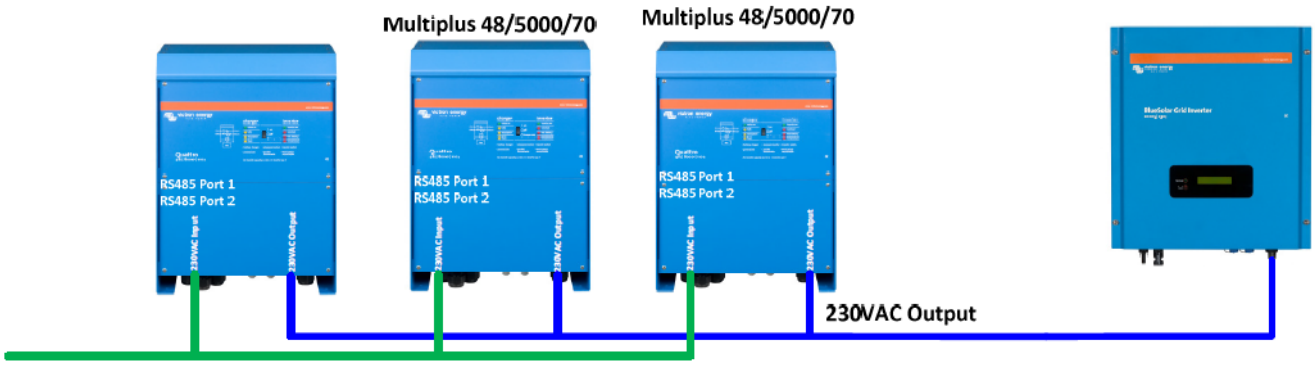
1. When a 3000VA Multi is connected to the grid, all 3000Wp can be fed back to the grid through the Multi.
2. In case the Multi is not connected to the grid, the 3000Wp is more than the charger in a Multi 3000VA can handle. The charger is around 1600Watt. Therefore the grid inverter assistant will automatically increase the frequency to reduce the output of the grid inverter, to match maximum charge current.

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

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.

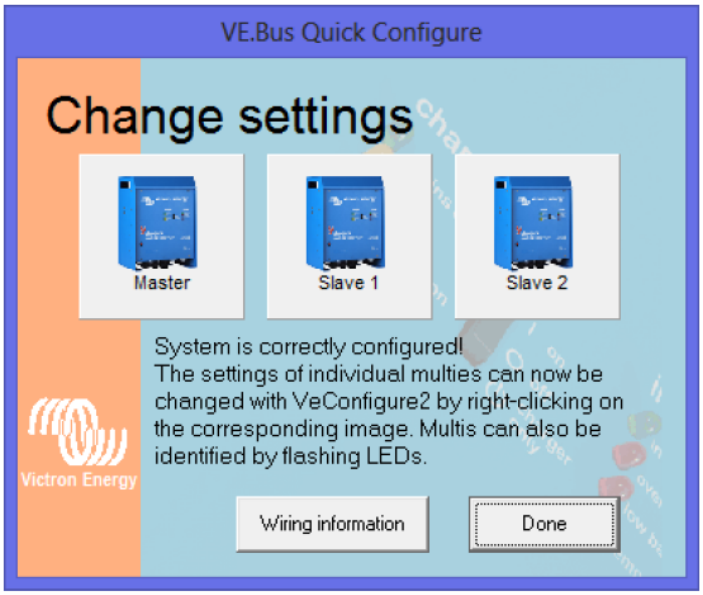
What Assistant settings are made when there is a Multiple Inverter/charger installation with a Grid Inverter?

In a Single Phase system only the Master unit will have the Grid Converter support assistant added.



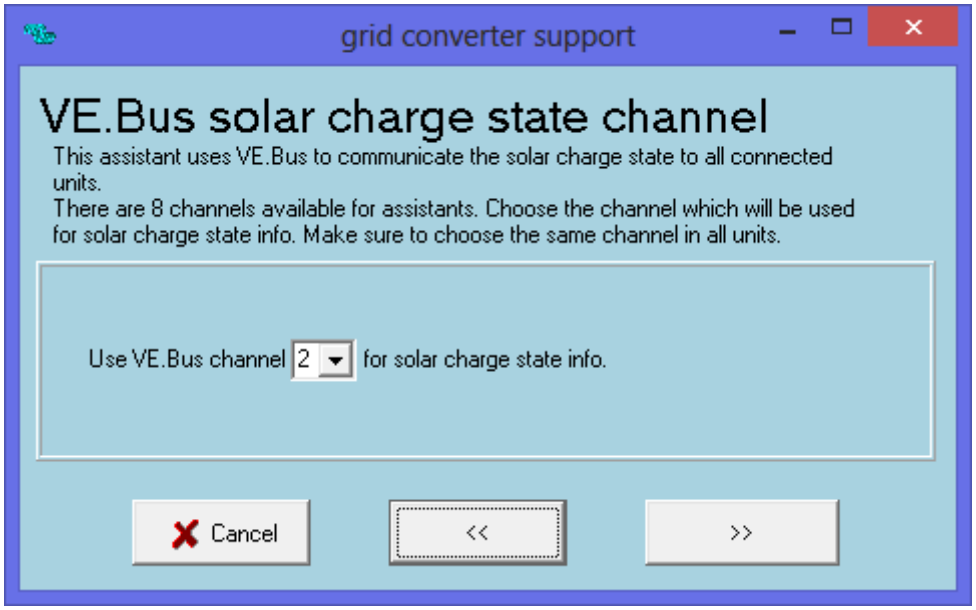
Careful attention must be paid to all Cabling DC and AC Cabling; the wire size must be rated correctly. The AC cabling must also be of the same length throughout from the Input into the Inverter/chargers and from the Output to the Grid Inverter/s and to the Distribution Board.

The software set up is the same as before.

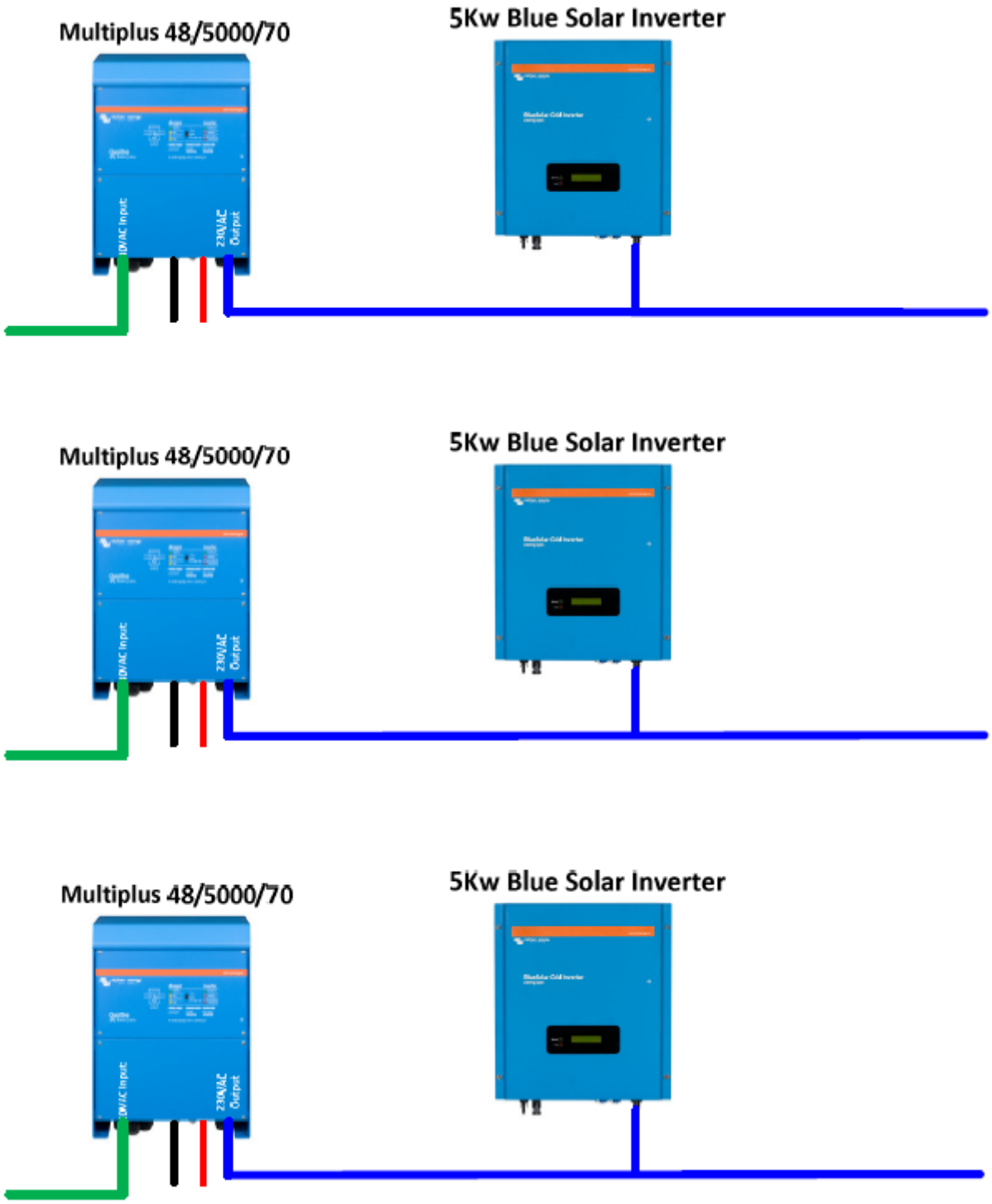




When making your VE Configure 3 settings in the master ensure all settings except the Assistant settings are sent to all units. Thereafter you make your assistant settings in the master and send it only to the Master. The image below is the only screen that is added from a single unit installation for the assistant. The default channel value is the correct setting.



In a 3 Phase system, each Phase Master unit must have the Grid Converter Support Assistant added.

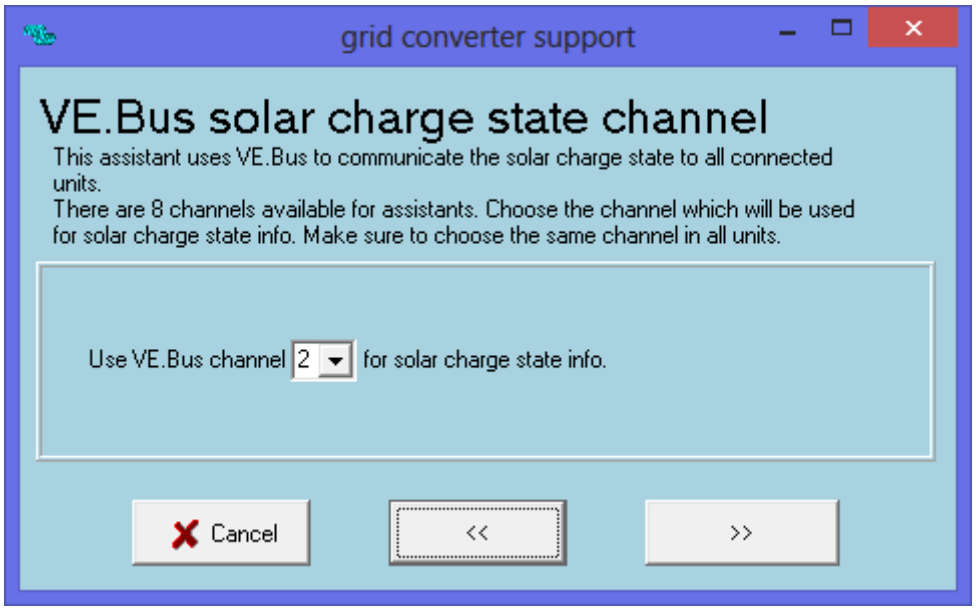


It is very important to ensure the loads are well balanced in a 3 phase system with Grid Inverters. Careful attention must be paid to all Cabling DC and AC Cabling; the wire size must be rated correctly. The AC cabling must also be of the same length throughout from the Input into the Inverter/chargers and from the Output to the Grid Inverter/s and to the Distribution Board.

There must be one central battery bank connected to each inverter/charger in the system. The same DC Voltage must be measurable in each Inverter/charger.

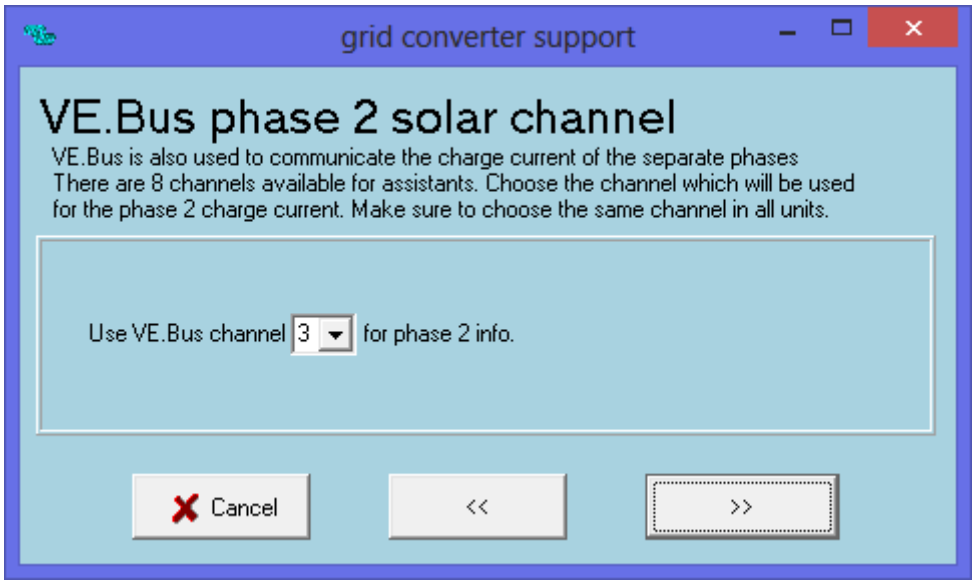
The assistant settings; we use channels inside the VE-Bus System, for Solar Charging control and State (via the Charger inside the Inverter/charger) the master can only control this, a Channel has to

be selected for this, see below.

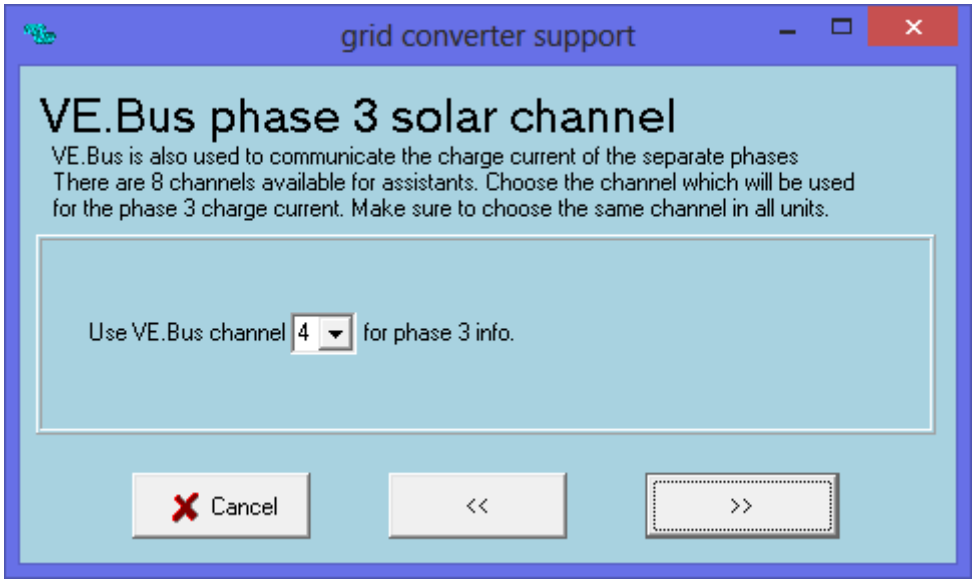


For Solar Charging Current, each Phase Inverter/charger must use its own Channel, see below the screen showing this setting.

Phase 2.



Phase 3.



After these screens are set the normal screens start as previously shown above.

NB: All system can be tested in Dem mode in the Software programs VE bus Quick Configure and VE Bus System Configurator. It is very Important to use these features when you are not sure of the set up procedures.

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