victron energy
BLUE POWER

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Phoenix Multi Inverter/Chargers

The most versatile and modular power conversion equipment available today

Ease of installation and configuration, unlimited parallel operation, suitability for multiple applications, and several other features make the Phoenix Multi inverter/chargers the most versatile power conversion equipment available today.
A step by step overview of possibilities and applications is outlined below. More detailed specifications and application examples can be found in the following documents, available on our website:

- Datsheet Phoenix Multi(Plus)
- Phoenix MultiPlus brochure and Systems brochure
- Phoenix Multi/MultiPlus installation and users manual
- The book “Energy Unlimited”
- White paper “Achieving the impossible”
- White paper “Using the Phoenix MultiPlus to reduce operating cost of a generator”
- White paper “DC solar system with a MultiPlus inverter-charger”
- Examples of installation diagrams
- VE.Net white paper and VE.Net specifications

1. A straightforward inverter/charger

There is no product that is easier to install and to operate. Wire it, switch it on. That is all. And if needed, Voltage, Current, Frequency, Alarms and several other settings can be adapted to your needs. Dipswitches, a hard wire computer interface or infrared communication[1] (an industry first!) are available for this purpose.
The software for your computer, laptop or PDA can be downloaded from http://www.victronenergy.com. A range of analogue and digital panels is available to control the Multi as well as auxiliary equipment, such as one or more battery monitor modules.

2. A long autonomy UPS

A Phoenix Multi will seamlessly transfer your load from AC grid or generator supply whenever the AC fails, sags or surges. Its very powerful battery recharge function makes the product ideal for UPS applications where frequent and long power failures require:

- a high capacity battery
- fast recharge capability

A programmable alarm relay and a communications port are available for automatic network or computer shutdown when batteries are nearly discharged.

3. The core element in an alternative energy system
The Phoenix Multi has a lot to offer in grid connected as well as off-grid alternative energy systems.

3.1. Feeding low voltage energy (solar, wind, water or other, up to 60 VDC) back into the grid
The Phoenix Multi is a bidirectional converter. It can take energy from the AC grid and use that energy to charge batteries. It can also take energy from a battery and feed that energy back into the grid. Where DC supply is available from alternative energy sources (solar and so forth), the Phoenix Multi can be used to convert that energy into pure sine wave AC power. Any excess DC energy available can be fed back into the grid.

3.2. The central node in an off-grid system
In an off-grid system the Phoenix MultiPlus will be the central node linking energy suppliers and consumers on the AC level. One or more MultiPlus modules connected to the AC grid will:

- power the grid with energy from the batteries
- be the voltage and frequency reference for grid connected solar and other converters
- absorb energy from these same converters to recharge batteries when supply of energy exceeds demand
- supply additional power to the grid when demand exceeds supply
- start an AC generator to provide additional power when needed
- synchronise the grid to the AC generator for seamless parallel connection

4. Modularity: any power you need.
Modules are available for 12, 24, and 48 VDC, for 50 and 60 Hz and all related AC Voltages. AC output ranges from 800 VA to 3000 VA per module. DC Charging capacity ranges from 12 Amps to 120 Amps per module.

The amazing and unique feature of the Phoenix Multi is that an **unlimited** number of modules can be parallel connected to suit your power requirements. Be it in a single phase, split phase or a three phase configuration.

5. Is it complicated to setup a multi module system?
No, it is very easy to do. All that is needed is a self explaining software package that can be downloaded from our website.

6. Enter the world of cogeneration (*PowerAssist*)

Whether in a boat, a coach, a remote home or an industrial application, cogeneration will simplify your electric system and reduce costs and weight as well.

- Ever experienced nuisance tripping of shore power or AC generator main circuit breakers?
- Not enough shore power available to run your air-conditioning, washing machine, dishwasher, electric oven?
- No space available for a big enough generator?
- Do you want to save money and weight by using a smaller generator?

The solution is cogeneration, with help of the unique *PowerControl* and *PowerAssist* features of the Phoenix Multi. And there is more: your system will be simpler, easier to install and substantially more cost-effective.

Cogeneration means that the Phoenix Multi modules will operate in parallel with the AC generator and/or shore-side supply. The generator or shore-side supply current can be monitored either internally in the Multi (up to 30 A per module), or with external AC monitoring modules (up to 100 A per phase). Limits can be set for shore and generator currents.

When AC is available the Multi modules will synchronise and connect to the AC-supply.
As long as sufficient power is available, the Phoenix Multi modules will tap current from the AC supply to recharge the batteries and supply the DC consumers as needed.

When the preset AC current limit is reached *PowerControl* comes into action. The *PowerControl* function will automatically reduce battery charging, and therefore reduce AC-current draw, when otherwise the system would be overloaded.

The feature that distinguishes the Phoenix MultiPlus from the standard Multi is *PowerAssist*. This feature takes the principle of *PowerControl* to a further dimension, allowing the MultiPlus to supplement the capacity of the alternative source. Where peak power is so often required only for a limited period, the Phoenix MultiPlus will make sure that insufficient shore or generator power is immediately compensated for by power from the battery.

7. Cogeneration with low power “inverter-type” generators

So called “inverter generators” like the Honda “I” series and the Yamaha “I” series as well as several other low power AC generators have a very convenient ‘economy feature’ whereby rpm is reduced when operated at low load.
A software setting in the Phoenix Multi is will make sure that if a high load is suddenly applied, the Phoenix Multi will carry most of that load, until the generator has revved up.

8. Cogeneration when the waveform of the alternative supply is very distorted

In contrast to “inverter generators”, the output of low power conventional generators is often very distorted, especially at low load. The result can be that a Multi will reject this input and will not connect to it. The harmonic distortion acceptance can be increased with a software setting (‘Waveform check’ in VEConfigure) in the Phoenix Multi.
The transfer time will increase, but experience has shown that in general computers, clocks and other equipment will ride through the transfer break without any problems.
Remark: once connected to a generator, the Multi will tend to reduce distortion of the system.

9. Using Phoenix Multi’s to reduce operating cost of a generator

Apart from the obvious advantage of “silent AC power” when the generator is switched off, there are other major considerations that make cogeneration with one or more Multi inverter/chargers very attractive:

- Fuel savings
- Cost and time savings due to reduced maintenance
- Longer generator life
- Prevention of early generator engine failure due to glazing

Generators very often operate most of the time at a fraction of their nominal rating. Boats, remote homes and remote telecommunications sites are examples where generators rated at 4 to 20 kVA generally are loaded to 15% or less of their nominal capacity.

By adding a deep cycle battery and one or more Multi modules to the system:

- The generator can be downsized because the Multi’s will “help” the generator to ride through peak power periods (peak shaving functionality of the Multi’s when operating in cogeneration mode).
- Generator running hours and maintenance can be reduced by a factor 3 or better, which also results in very substantial fuel savings (more than 50%).
- The much higher average load will in turn increase service hours before engine wear out. The service life of the generator will therefore increase by more than a factor 3.

Glazing is phenomenon that can severely damage new diesel engines within the first few 100 hours of operation.
When new and operating at full rpm and nearly no load, an oil film can build up on the not yet perfectly smooth cylinder walls in the engine. Exposed to combustion, the oil film will burn and oxidize, leaving a hard, enamel like residue on the cylinder wall. Local build up of glaze will result in leakage between piston ring and cylinder. At best it will increase oil consumption and reduce efficiency. At its worst overhaul of the engine will be needed.
Cogeneration increases generator load and therefore solves this problem.

10. A range of intelligent control panels, interfaces and software options
To support the operation options as outlined above a range of control panels, computer and network interfaces and software options has been developed.

10.1. The Multi Control Panel: simple and easy to use
The Multi Control Panel will monitor and control any number of paralleled Multi's. A very convenient rotary knob is available to set the shore or generator current limit.

10.2. Generator Control Panel
For a fixed generator current limit, next to the variable shore current limit.

10.3. VE.Net Panel
A 20 character digital panel that will control a number of Victron Energy products, for example on or more Phoenix Multi's and one or more Battery Monitors.

10.4. VE.Net Blue Power Panel
This is the next level with a dot-matrix display to provide a more flexible and intuitive user interface.

11. Programmable relays for generator control and alarms
The larger Phoenix Multi's are fitted with a programmable relay that can be used to start a generator or for any combination of alarms[2]. Additional programmable relays are available on the Battery Monitor and all our digital panels. Please note that several generator brands can also be controlled directly by VE.Net, see below.

12. The amazing features of VE.Net
VE.Net is an open network that will integrate all major VE products as well as digital communication enabled third party products into one control and monitoring system. Victron Energy has also developed a series of VE.Net enabled AC and DC switches, for remote control and monitoring of other DC and AC equipment.

VE.Net is a very convenient way to control and monitor one or more Multi modules.
But there is more: VE.Net allows VE products to talk to each-other. A VE.Net battery monitor for example will inform the Phoenix Multi about the state of charge and temperature of the battery. With that information de charge cycle will be optimised and batteries will last longer.

A VE.Net Connectivity Module has been developed for two purposes:

1. Remain "in contact": give the owner remote access to his yacht, mobile home or other application.
2. Remote monitoring and fault finding by a qualified technician
   Enable the service departments from Victron Energy and other third

party suppliers to check equipment and make sure the customer is getting the best out of its products.

13. Other important features of the Phoenix Multi range

13.1. Four stage adaptive charging: bulk – absorption – float – storage
The charger features a microprocessor controlled 'adaptive' battery management system that can be programmed to suit different types of batteries. The 'adaptive' feature will automatically optimise the charging process relative to the way the battery is being used[3].
A further improvement is obtained by adding a VE.Net enabled battery monitor to the system. The battery monitor will inform the Multi about the state of charge of the battery and the true battery charge current. The battery charge current can be much lower than the Multi output current due to DC loads connected to the system.

13.2. More than short circuit proof
A Multi will even survive if short-circuited for a short period to another (not synchronised) AC source. This important feature is a protection against installation and operation faults in a cogeneration system.

13.3. Automotive Directive

The Phoenix Multi range is ideal for use in mobile homes, coaches, service vans, ambulances, and other vehicles. The product has therefore been tested and approved according to the European Automotive Directive 95/54/EC and 2004/104/EC. Certificates are available on request.