

# USER MANUAL

## **Phoenix Multi 120Vac**

12/1600/70  
12/2500/120  
24/1600/40  
24/3000/70

## **Phoenix MultiPlus 120Vac**

12/2500/120  
24/3000/70

## **Phoenix Inverter 120Vac**

12/1600  
12/2500  
24/1600  
24/3000

VICTRON ENERGY AT ANY TIME



victron energy

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# SAFETY RULES

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## General

Please familiarise yourself with the safety features and instructions by first reading the documentation supplied with this product before using the equipment. This product has been designed and tested in accordance with international standards. The equipment must be used exclusively for the purpose for which it was designed.

WARNING: ELECTRIC SHOCK HAZARD.

The product is used in conjunction with a permanent energy source (battery). Input and/ or output terminals may still be dangerously energised, even when the equipment is switched off. Always switch off the AC supply and the battery before carrying out maintenance or servicing the product.

The product has no internal user-serviceable components. Do not remove the front plate or operate the product if any panels have been removed. All servicing must be undertaken by qualified personnel.

Never use the product where there is a risk of gas or dust explosions. Consult the battery manufacturer's information to ascertain that the product is intended for use in conjunction with the battery. Always comply with the battery manufacturer's safety instructions.

WARNING: Do not lift heavy loads without assistance.

## Installation

Read the installation instructions in the installation manual before installing the equipment.

This is a Safety Class I product (supplied with a protective earthing terminal). Uninterruptible protective earthing must be provided at the AC input and/ or output terminals. An additional earth point is located externally on the product. Whenever it is likely that the earth protection has been damaged, the product must be turned off and secured against unintended operation; please contact qualified service staff.

Ensure that the DC and AC input cables are fused and fitted with circuit breakers. Never replace a safety component with a different type. Consult the manual to determine the correct component.

Before applying power, ensure that the available power source matches the configuration settings of the product as described in the manual.

Ensure that the equipment is used under the correct ambient conditions. Never operate the product in a wet or dusty environment. Ensure there is adequate free space for ventilation around the product and check that the ventilation vents are not blocked.

Ensure that the required system voltage does not exceed the product's capacity.

## Transport and Storage

Ensure that the mains power and battery leads have been disconnected before storing or transporting the product.

No liability can be accepted for any transport damage if the equipment is shipped in non-original packaging.

Store the product in a dry environment; the storage temperature must be between -20°C and 60°C.

Consult the battery manufacturer's manual in respect of transport, storage, charging, recharging and disposal of the battery.

# 1 DESCRIPTION

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## 1.1 General

### **Multi-functional (Multi/ MultiPlus only)**

The Multi gets its name from the multiple functions it can perform. It is a powerful true sine wave inverter, a sophisticated battery charger that features adaptive charge technology and a high-speed AC transfer switch in a single compact enclosure. Beside these primary functions, however, the Multi has several advanced features that provide a range of new applications as outlined below.

### **Uninterrupted AC power (Multi/ MultiPlus only)**

In the event of a grid failure, or shore or generator power being disconnected, the inverter within the Multi is automatically activated and takes over supply to the connected loads. This happens so fast (less than 20 milliseconds) that computers and other electronic equipment will continue to operate without disruption.

### **Virtually unlimited power thanks to parallel operation**

Up to 5 units can operate in parallel to achieve higher power output. Five 24/3000/70 units, for example, provide 12,5 kW output power with 350 Amps of charging capacity.

### **Three phase capability**

In addition to parallel connection, three units of the same model can be configured for three-phase output. But that's not all: up to five sets of three units can be parallel connected for a huge 37,5 kW inverter and 1050 A charger! (Multi/ MultiPlus only)

### **PowerControl – Dealing with limited generator or shore side power (Multi/MultiPlus only)**

The Multi is a very powerful battery charger. It will therefore draw a lot of current from the generator or shore side supply (nearly 10 A per Multi at 230 VAC). With the Phoenix Multi Control Panel (PMC) a maximum generator or shore current can be set. The Multi will then take account of other AC loads and use whatever is extra for charging, thus preventing the generator or shore supply from being overloaded.

### **PowerAssist – Boosting the capacity of shore or generator power**

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, it is possible to reduce the size of generator needed or conversely enable more to be achieved from the typically limited shore connection. When the load reduces, the spare power is used to recharge the battery.

Note: minimum shore current 4 A or generator capacity 2,5 kW required per MultiPlus.

## 1.2 Battery Charger (Multi/ MultiPlus only)

### **Adaptive 4-stage charge characteristic: bulk – absorption – float – storage**

The Phoenix Multi/ MultiPlus features a microprocessor controlled 'adaptive' battery management system that can be preset to suit different types of batteries. The 'adaptive' feature will automatically optimise the process relative to the way the battery is being used.

### **The right amount of charge: variable absorption time**

When only shallow discharges occur (a yacht connected to shore power for example) the absorption time is kept short in order to prevent overcharging of the battery. After a deep discharge the absorption time is automatically increased to make sure that the battery is completely recharged.

### **Preventing damage due to excessive gassing: the BatterySafe mode**

If, in order to quickly charge a battery, a high charge current in combination with a high absorption voltage has been chosen, the Multi/ MultiPlus will prevent damage due to excessive gassing by automatically limiting the rate of voltage increase once the gassing voltage has been reached

### **Less maintenance and aging when the battery is not in use: the Storage mode**

The storage mode kicks in whenever the battery has not been subjected to discharge during 24 hours. In the storage mode float voltage is reduced to 2,2 V/cell (13,2 V for a 12 V battery) to minimise gassing and corrosion of the positive plates. Once a week the voltage is raised back to the absorption level to 'equalize' the battery. This feature prevents stratification of the electrolyte and sulphation, a major cause of early battery failure.

### **Two outputs to charge 2 battery banks**

The Multi/ MultiPlus features 2 outputs, of which 1 can carry the full output current. The second output, limited to approximately 4 A and with a slightly lower output voltage, is intended to top up a starter battery.

### **To increase battery life: temperature compensation**

Every Multi/ MultiPlus comes with a battery temperature sensor. When connected, charge voltage will automatically decrease with increasing battery temperature. This feature is especially recommended for sealed batteries and/ or when important fluctuations of battery temperature are expected.

### **Battery voltage sense**

In order to compensate for voltage loss due to cable resistance, the Multi/ MultiPlus is provided with a voltage sense facility so that the battery always receives the correct charge voltage.

### **Learn more about batteries and battery charging**

To learn more about batteries and charging batteries, please refer to our book 'Electricity on Board' (available free of charge from Victron Energy and downloadable from [www.victronenergy.com](http://www.victronenergy.com)). For more information about adaptive charging please look under Technical Briefs on our website.

### 1.3 List of Article Numbers for Accessories

Phoenix Multi control	REC020002010
Phoenix Inverter control	SDRPPIV
Temperature sensor TI	SDRPSENSTI
Conn. kit 3-phase operation <sup>MultiPlus</sup>	EQU000002000
Flat cable for 3-phase connect <sup>MultiPlus</sup>	ASS030003000
Flat cable for parallel connect	ASS030063000
UTP Patch lead 5 m	ASS030065000
UTP Patch lead 10 m	ASS030065010
UTP Patch lead 15 m	ASS030065020

## 2 OPERATION

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### 2.1 On/ Off Charger Only Switch

When switched to "on", the product is fully functional. The inverter will come into operation and the LED "inverter on" will light up.

#### **Multi/ MultiPlus only:**

An AC voltage connected to the "AC in" terminal will be switched through to the "AC out" terminal, if within specifications. The inverter will switch off, the "mains on" LED will light up and the charger commences charging. The "bulk", "absorption" or "float" LEDs will light up, depending on the charger mode.

If the voltage at the "AC-in" terminal is rejected, the inverter will switch on.

When the switch is switched to "charger only", only the battery charger of the Phoenix Multi will operate (if mains voltage is present). In this mode input voltage also is switched through to the "AC out" terminal.

**NOTE:** When only the charger function is required, ensure that the switch is switched to "charger only". This prevents the inverter from being switched on if the mains voltage is lost, thus preventing your batteries from running flat.

### 2.2 Remote Operation

The Phoenix Multi can be operated with a remote control panel. This control panel is called the Phoenix Multi control panel. The panel has an on-off switch and repeats all indicators of the Multi.

The charger of the Phoenix Multi can be turned off. This can be done by changing the set up configuration or by connecting the Phoenix Inverter remote panel.

The Multi remote control panel can also be used to set the AC input current limit for the PowerControl and PowerAssist functions (See paragraph 1.1)

**For remote control of the Phoenix Inverter the Phoenix Inverter panel should be used.**



### 2.3 Special Charger Modes Equalizing

Some batteries may need a regular equalizing charge. To perform an equalizing charge the Phoenix Multi can charge at a higher voltage (1V above the absorption voltage for a 12V battery, 2V for a 24V battery) for a period of one hour. The charger current is then limited to 1/4 of the specified value.

**The "bulk" and "absorption" LEDs will flash alternately during this cycle.**



The equalizing mode results in a charging voltage that may exceed the maximum voltage of DC consumers. These should be disconnected when performing an equalizing charge.

#### Forced Absorption

In some cases it may be necessary to charge the battery at the absorption voltage for a specific period of time. In the Forced Absorption mode, the Phoenix Multi will charge at the normal absorption voltage during the preset maximum absorption period.

**The "absorption" LED will light up.**

The Phoenix Multi can be switched to one of these modes from the remote panel as well as with the aid of the front switch. A prerequisite is that all switches (front, remote and panel) are switched to "on", and that none are switched to the "charger only" position.

Proceed as follows to switch the Phoenix Multi to either the equalizing mode or Forced Absorption mode:

**REMARK:** switch quickly from "on" to "charger only" and back. The switch must be switched in such a way that the intermediate position is, as it were, "skipped". If the relevant switch remains in the "off" position for any length of time, you may run the risk that the appliance will be switched off. In that case you will need to start again at step 1. Practice is required, particularly when using the front switch. This is less critical when using the remote panel.

1. Ensure that all switches (i.e., front switch, remote switch or remote panel switch if present) are switched to the "on" position.
2. Ensure that the Phoenix Multi is charging (an AC input voltage must be present; check that the "mains on" LED and one of either the "bulk", "absorption" or "float" LEDs is illuminated).
3. Switch the switch successively to "charger only", "on" and "charger only". NOTE: the switching itself should be done quickly but the interval between switching should be from 1/2 to two seconds.
4. The "bulk", "absorption" and "float" LEDs will flash five times. Subsequently, the "bulk", "absorption" and "float" LEDs will each light up for a period of two seconds.
  - If the switch is switched to "on" while the "bulk" LED illuminates, the charger switches to the equalizing mode.
  - If the switch is switched to "on" while the "absorption" LED illuminates, the charger switches to 'Forced Absorption'.

If the switch is not in the required position after these steps, it can be simply switched one more time. This will not change the charging status.

## 2.4 LED Indications and What They Mean

- LED off
- ☀ LED flashes
- LED illuminated

### Inverter

charger		inverter	
<input type="radio"/> mains on	on	<input checked="" type="radio"/> inverter on	
<input type="radio"/> bulk	off	<input type="radio"/> overload	
<input type="radio"/> absorption	charger only	<input type="radio"/> low battery	
<input type="radio"/> float		<input type="radio"/> temperature	

The inverter is switched on and supplies power to the load.

charger		inverter	
<input type="radio"/> mains on	on	<input checked="" type="radio"/> inverter on	
<input type="radio"/> bulk	off	☀ overload	
<input type="radio"/> absorption	charger only	<input type="radio"/> low battery	
<input type="radio"/> float		<input type="radio"/> temperature	

The nominal output of the inverter is being exceeded. "overload" LED is on.

charger		inverter	
<input type="radio"/> mains on	on	<input type="radio"/> inverter on	
<input type="radio"/> bulk	off	<input checked="" type="radio"/> overload	
<input type="radio"/> absorption	charger only	<input type="radio"/> low battery	
<input type="radio"/> float		<input type="radio"/> temperature	

The inverter is switched off due to overload or a short circuit.

charger		inverter	
<input type="radio"/> mains on	on	<input checked="" type="radio"/> inverter on	
<input type="radio"/> bulk	off	<input type="radio"/> overload	
<input type="radio"/> absorption	charger only	☀ low battery	
<input type="radio"/> float		<input type="radio"/> temperature	

The battery is almost fully exhausted.

charger		inverter	
<input type="radio"/> mains on	on	<input type="radio"/> inverter on	
<input type="radio"/> bulk	off	<input type="radio"/> overload	
<input type="radio"/> absorption	charger only	<input checked="" type="radio"/> low battery	
<input type="radio"/> float		<input type="radio"/> temperature	

The inverter has switched off due to the battery voltage being too low.

charger		inverter	
<input type="radio"/> mains on	on	<input checked="" type="radio"/> inverter on	
<input type="radio"/> bulk	off	<input type="radio"/> overload	
<input type="radio"/> absorption	charger only	<input type="radio"/> low battery	
<input type="radio"/> float		<input checked="" type="radio"/> temperature	

The electronics temperature is becoming critical.

charger		inverter	
<input type="radio"/> mains on	on	<input type="radio"/> inverter on	
<input type="radio"/> bulk	off	<input type="radio"/> overload	
<input type="radio"/> absorption	charger only	<input type="radio"/> low battery	
<input type="radio"/> float		<input checked="" type="radio"/> temperature	

The inverter has switched off due to the electronics temperature being too high.

charger		inverter	
<input type="radio"/> mains on	on	<input checked="" type="radio"/> inverter on	
<input type="radio"/> bulk	off	<input checked="" type="radio"/> overload	
<input type="radio"/> absorption	charger only	<input checked="" type="radio"/> low battery	
<input type="radio"/> float		<input type="radio"/> temperature	

-If the LEDs are flashing alternately, the battery is nearly exhausted and the nominal output is being exceeded.

-If "overload" and "low battery" flash simultaneously, the ripple voltage on the battery terminal is too high.

charger		inverter	
<input type="radio"/> mains on	on	<input type="radio"/> inverter on	
<input type="radio"/> bulk	off	<input checked="" type="radio"/> overload	
<input type="radio"/> absorption	charger only	<input checked="" type="radio"/> low battery	
<input type="radio"/> float		<input type="radio"/> temperature	

The inverter switched off due to excess ripple voltage on the battery terminal.

**Battery Charger**

charger		inverter	
<input checked="" type="radio"/> mains on	on	<input type="radio"/> inverter on	
<input checked="" type="radio"/> bulk	off	<input type="radio"/> overload	
<input type="radio"/> absorption	charger only	<input type="radio"/> low battery	
<input type="radio"/> float		<input type="radio"/> temperature	

The mains voltage is switched through and the charger operates in bulk mode.

charger		inverter	
<input checked="" type="radio"/> mains on	on	<input type="radio"/> inverter on	
<input checked="" type="radio"/> bulk	off	<input type="radio"/> overload	
<input checked="" type="radio"/> absorption	charger only	<input type="radio"/> low battery	
<input type="radio"/> float		<input type="radio"/> temperature	

The mains voltage is switched through and the charger is charging. The set absorption voltage, however, has not yet been reached (Battery Protection Mode).

charger		inverter	
<input checked="" type="radio"/> mains on	on	<input type="radio"/> inverter on	
<input type="radio"/> bulk	off	<input type="radio"/> overload	
<input checked="" type="radio"/> absorption	charger only	<input type="radio"/> low battery	
<input type="radio"/> float		<input type="radio"/> temperature	

The mains voltage is switched through and the charger operates in the absorption mode.

charger		inverter	
<input checked="" type="radio"/> mains on	on	<input type="radio"/> inverter on	
<input type="radio"/> bulk	off	<input type="radio"/> overload	
<input type="radio"/> absorption	charger only	<input type="radio"/> low battery	
<input checked="" type="radio"/> float		<input type="radio"/> temperature	

The mains voltage is switched through and the charger operates in the float mode.

charger		inverter	
<input checked="" type="radio"/> mains on	on	<input type="radio"/> inverter on	
<input checked="" type="radio"/> bulk	off	<input type="radio"/> overload	
<input checked="" type="radio"/> absorption	charger only	<input type="radio"/> low battery	
<input type="radio"/> float		<input type="radio"/> temperature	

The mains voltage is switched through and the charger operates in raised absorption.

**Special Indications**

PowerControl

charger		inverter	
<input checked="" type="radio"/> mains on	on	<input type="radio"/> inverter on	
<input type="radio"/> bulk	off	<input type="radio"/> overload	
<input type="radio"/> absorption	charger only	<input type="radio"/> low battery	
<input type="radio"/> float		<input type="radio"/> temperature	

The mains voltage is switched through. The AC output current is equal to the preset maximum input current. The charge current is reduced to 0.

Power Assist<sup>MultiPlus</sup>

charger		inverter	
<input checked="" type="radio"/> mains on	on	<input checked="" type="radio"/> inverter on	
<input type="radio"/> bulk	off	<input type="radio"/> overload	
<input type="radio"/> absorption	charger only	<input type="radio"/> low battery	
<input type="radio"/> float		<input type="radio"/> temperature	

The mains voltage is switched through but the load requires more current than the preset maximum input current. The inverter now switches on to supply the required additional current.





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