



**Manual**

EN

**Handleiding**

NL

**Manuel**

FR

**Anleitung**

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**Manual**

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SE

Appendix

## Quattro

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24 | 8000 | 200 – 100 | 100 – 230V

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48 | 10000 | 140 – 100 | 100 – 230V



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# 1. SAFETY INSTRUCTIONS

## In general

Please read the documentation supplied with this product first, so that you are familiar with the safety signs and directions before using the product.

This product is designed and tested in accordance with international standards. The equipment should be used for the designated application only.

### **WARNING: DANGER OF ELECTRICAL SHOCK**

The product is used in combination with a permanent energy source (battery). Even if the equipment is switched off, a dangerous electrical voltage can occur at the input and/or output terminals. Always switch the AC power off and disconnect the battery before performing maintenance.

The product contains no internal user-serviceable parts. Do not remove the front panel and do not put the product into operation unless all panels are fitted. All maintenance should be performed by qualified personnel.

Never use the product at sites where gas or dust explosions could occur. Refer to the specifications provided by the manufacturer of the battery to ensure that the battery is suitable for use with this product. The battery manufacturer's safety instructions should always be observed.

**WARNING: do not lift heavy objects unassisted.**

## Installation

Read the installation instructions before commencing installation activities.

This product is a safety class I device (supplied with a ground terminal for safety purposes). **Its AC input and/or output terminals must be provided with uninterruptable grounding for safety purposes. An additional grounding point is located on the outside of the product.** If it can be assumed that the grounding protection is damaged, the product should be taken out of operation and prevented from accidentally being put into operation again; contact qualified maintenance personnel.

Ensure that the connection cables are provided with fuses and circuit breakers. Never replace a protective device by a component of a different type. Refer to the manual for the correct part.

Check before switching the device on whether the available voltage source conforms to the configuration settings of the product as described in the manual.

Ensure that the equipment is used under the correct operating conditions. Never operate it in a wet or dusty environment. Ensure that there is always sufficient free space around the product for ventilation, and that ventilation openings are not blocked.

Install the product in a heatproof environment. Ensure therefore that there are no chemicals, plastic parts, curtains or other textiles, etc. in the immediate vicinity of the equipment.

## Transport and storage

On storage or transport of the product, ensure that the mains supply and battery leads are disconnected.

No liability can be accepted for damage in transit if the equipment is not transported in its original packaging.

Store the product in a dry environment; the storage temperature should range from  $-20^{\circ}\text{C}$  to  $60^{\circ}\text{C}$ .

Refer to the battery manufacturer's manual for information on transport, storage, charging, recharging and disposal of the battery.

## 2. DESCRIPTION

### 2.1 In general

The basis of the Quattro is an extremely powerful sine inverter, battery charger and automatic switch in a compact casing. The Quattro features the following additional, often unique characteristics:

#### **Two AC inputs; integrated switch-over system between shore voltage and generating set**

The Quattro features two AC inputs (AC-in-1 and AC-in-2) for connecting two independent voltage sources. For example, two generator sets, or a mains supply and a generator set. The Quattro automatically selects the input where voltage is present. If voltage is present on both inputs, the Quattro selects the AC-in-1 input, to which normally the generating set is connected.

#### **Two AC outputs**

Besides the usual uninterruptible output, an auxiliary output is available that disconnects its load in the event of battery operation. Example: an electric boiler that is allowed to operate only if the genset is running or shore power is available.

#### **Automatic and uninterruptible switching**

In the event of a supply failure or when the genset is switched off, the Quattro will switch over to inverter operation and take over the supply of the connected devices. This is done so quickly that operation of computers and other electronic devices is not disturbed (Uninterruptible Power Supply or UPS functionality). This makes the Quattro highly suitable as an emergency power system in industrial and telecommunication applications.

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

Up to 10 Quattro's can operate in parallel. Ten units 48/10000/140, for example, will provide 90kW / 100kVA output power and 1400 Amps charging capacity.

#### **Three phase capability**

Three units can be configured for three-phase output. But that's not all: up to 10 sets of three units can be parallel connected to provide 270kW / 300kVA inverter power and more than 4000A charging capacity.

#### **PowerControl – maximum use of limited shore current**

The Quattro can supply a huge charging current. This implies heavy loading of the shore connection or generating set. For both AC inputs, therefore, a maximum current can be set. The Quattro then takes other power users into account, and only uses 'surplus' current for charging purposes.

- Input AC-in-1, to which usually a generating set is connected, can be set to a fixed maximum with DIP switches, with VE.Net or with a PC, so that the generating set is never overloaded.
- Input AC-in-2 can also be set to a fixed maximum. In mobile applications (ships, vehicles), however, a variable setting by means of a Multi Control Panel will usually be selected. In this way the maximum current can be adapted to the available shore current in an extremely simple manner.

#### **PowerAssist – Extended use of your generating set and shore current: the Quattro “co-supply” feature**

The Quattro operates in parallel with the generating set or the shore connection. A current shortfall is automatically compensated: the Quattro draws extra power from the battery and helps along. A current surplus is used to recharge the battery.

#### **Three programmable relays**

The Quattro is equipped with 3 programmable relays. The relays can be programmed for all kinds of other applications however, for example as a starter relay for a generating set.

#### **Two programmable analog/digital input/output ports**

The Quattro is equipped with 2 analog/digital input/output ports. These ports can be used for several purposes. One application is communication with the BMS of a lithium-ion battery.

#### **Frequency shift**

When solar inverters are connected to the output of a Multi or Quattro, the excess solar energy is used to recharge the batteries. Once the absorption voltage is reached, the Multi or Quattro will shut down the solar inverter by shifting the output frequency 1Hz (from 50Hz to 51Hz for example). Once battery voltage has dropped slightly, the frequency returns to normal and the solar inverters will restart.

#### **Built-in Battery Monitor (optional)**

The ideal solution when Multi's or Quattro's are part of a hybrid system (diesel generator, inverter/chargers, storage battery, and alternative energy). The built-in battery monitor can be set to start and stop the generator:

- Start at a preset % discharge level, and/or
- start (with a preset delay) at a preset battery voltage, and/or
- start (with a preset delay) at a preset load level.
- Stop at a preset battery voltage, or
- stop (with a preset delay) after the bulk charge phase has been completed, and/or
- stop (with a preset delay) at a preset load level.

### Solar energy

The Quattro is extremely suitable for solar energy applications. It can be used for building autonomous systems as well as mains-coupled systems.

### Emergency power or autonomous operation on mains failure

Houses or buildings provided with solar panels or a combined micro-scale heating and power plant (a power-generating central heating boiler) or other sustainable energy sources have a potential autonomous energy supply which can be used for powering essential equipment (central heating pumps, refrigerators, deep freeze units, Internet connections, etc.) during a power failure. A problem in this regard, however, is that mains-coupled solar panels and/or micro-scale heating and power plants drop out as soon as the mains supply fails. With a Quattro and batteries, this problem can be solved in a simple manner: the Quattro can replace the mains supply during a power failure. When the sustainable energy sources produce more power than necessary, the Quattro will use the surplus to charge the batteries; in the event of a shortfall, the Quattro will supply additional power from its battery energy resources.

### Programmable with DIP switches, VE.Net panel or personal computer

The Quattro is supplied ready for use. Three features are available for changing certain settings if desired:

- The most important settings (including parallel operation of up to three devices and 3-phase operation) can be changed in a very simple manner, using Quattro DIP switches.
- All settings, with exception of the multi-functional relay, can be changed with a VE.Net panel.
- All settings can be changed with a PC and free of charge software, downloadable from our website [www.victronenergy.com](http://www.victronenergy.com)

## 2.2 Battery charger

### Adaptive 4-stage charging characteristics: bulk – absorption – float – storage

The microprocessor-driven adaptive battery management system can be adjusted for various types of batteries. The adaptive function automatically adapts the charging process to battery use.

### Correct charging quantity: adapted absorption time

In the event of slight battery discharge, absorption is kept short to prevent overcharging and excessive gas formation. After deep discharging, the absorption time is automatically extended in order to charge the battery fully.

### Limiting aging by excessive gas formation: limited voltage rise

If a high charging current as well as an increased charging voltage is used to shorten charging time, the Quattro will limit the voltage slew rate after the gas pressure has been reached. In this way, excessive gas formation in the final stage of the charging cycle is prevented.

### Less maintenance and ageing when the battery is not used: the storage feature

The Quattro switches over to 'storage' if no discharge has occurred after more than 24 hours. The voltage is then lowered to 2.2V/cell (13.2V for a 12V battery). Gas formation in the battery will then be drastically reduced, and corrosion of the positive plates is limited as much as possible. Once a week, the voltage is increased to absorption level to recharge the battery; this prevents stratification of the electrolyte and sulphate formation.

### Two DC outputs for charging two batteries

The Quattro has two DC outputs, one of which can supply the full output current. The second output, intended for charging a starter battery, is limited to 4A and has a slightly lower output voltage.

### Increasing the lifecycle of the accumulator battery: temperature compensation

The Quattro is supplied with a temperature sensor. The temperature sensor serves to reduce charging voltage when battery temperature rises. This is particularly important for maintenance-free batteries, which could otherwise dry out by overcharging.

### Battery voltage sense

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

### More on batteries and charging

Our book 'Energy Unlimited' offers further information on batteries and battery charging, and is available free of charge at Victron Energy (see [www.victronenergy.com](http://www.victronenergy.com)). For more information on adaptive charging characteristics, please refer to the 'Tech Info' page on our website.



## 3. OPERATION

### 3.1 “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.

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" LED's will light up, depending on the charger state.

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 Quattro 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.

### 3.2 Remote control

Remote control is possible with a 3-way switch or with a Multi Control panel.

The Multi Control panel has a simple rotary knob with which the maximum current of the AC input can be set: see PowerControl and PowerAssist in Section 2.

### 3.3 Equalisation and forced absorption

#### 3.3.1 Equalisation

Traction batteries require regular additional charging. In the equalisation mode, the Quattro will charge with increased voltage for one hour (1V above the absorption voltage for a 12V battery, 2V for a 24V battery), and with charging current limited to 1/4 of the set value. **The “bulk” and “absorption” LED's flash intermittently.**



Equalisation mode supplies a higher charging voltage than most DC consuming devices can cope with. These devices must be disconnected before additional charging takes place.

#### 3.3.2 Forced absorption

Under certain circumstances, it can be desirable to charge the battery for a fixed time at absorption voltage level. In Forced Absorption mode, the Quattro will charge at the normal absorption voltage level during the set maximum absorption time. **The “absorption” LED lights.**

#### 3.3.3 Activating equalisation or forced absorption

The Quattro can be put into both these states from the remote panel as well as with the front panel switch, provided that all switches (front, remote and panel) are set to “on” and no switches are set to “charger only”.

In order to put the Quattro in this state, the procedure below should be followed.

If the switch is not in the required position after following this procedure, it can be switched over quickly once. This will not change the charging state.

**NOTE:** Switching from “on” to “charger only” and back, as described below, must be done quickly. The switch must be toggled such that the intermediate position is 'skipped', as it were. If the switch remains in the “off” position even for a short time, the device may be turned off. In that case, the procedure must be restarted at step 1. A certain degree of familiarisation is required when using the front switch on the Compact in particular. When using the remote panel, this is less critical.

#### Procedure:


- Check whether all switches (i.e. front switch, remote switch or remote panel switch if present) are in the “on” position.
- Activating equalisation or forced absorption is only meaningful if the normal charging cycle is completed (charger is in 'Float').
- To activate:
  - a. Switch rapidly from “on” to “charger only” and leave the switch in this position for ½ to 2 seconds.
  - b. Switch rapidly back from “charger only” to “on” and leave the switch in this position for ½ to 2 seconds.
  - c. Switch once more rapidly from “on” to “charger only” and leave the switch in this position.
- On the Quattro (and, if connected, on the MultiControl panel) the three LED's "Bulk", "Absorption" and "Float" will now flash 5 times.
- Subsequently, the LED's "Bulk", "Absorption" and "Float" will each light during 2 seconds.
  - a. If the switch is set to “on” while the “Bulk” LED lights, the charger will switch to equalisation.
  - b. If the switch is set to “on” while the “Absorption” LED lights, the charger will switch to forced absorption.
  - c. If the switch is set to “on” after the three LED sequence has finished, the charger will switch to “Float”.
  - d. If the switch has not been moved, the Quattro's will remain in 'charger only' mode and switch to “Float”.




### 3.4 LED indications and their meaning

- LED off
- ⦿ LED flashes
- LED lights


#### Inverter

charger		inverter	
○ mains on	on	● inverter on	
○ bulk	 off	○ overload	
○ absorption		○ low battery	
○ float	charger only	○ temperature	


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

charger		inverter	
○ mains on	on	● inverter on	
○ bulk	 off	⦿ overload	
○ absorption		○ low battery	
○ float	charger only	○ temperature	


The nominal power of the inverter is exceeded. The "overload" LED flashes.

charger		inverter	
○ mains on	on	○ inverter on	
○ bulk	 off	● overload	
○ absorption		○ low battery	
○ float	charger only	○ temperature	


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

charger		inverter	
○ mains on	on	● inverter on	
○ bulk	 off	○ overload	
○ absorption		⦿ low battery	
○ float	charger only	○ temperature	


The battery is almost empty.

charger		inverter	
○ mains on	on	○ inverter on	
○ bulk	 off	○ overload	
○ absorption		● low battery	
○ float	charger only	○ temperature	


The inverter is switched off due to low battery voltage.

charger		inverter	
○ mains on	on	● inverter on	
○ bulk	 off	○ overload	
○ absorption		○ low battery	
○ float	charger only	⦿ temperature	


The internal temperature is reaching a critical level.

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		<input type="radio"/> low battery
<input type="radio"/> float	charger only	<input checked="" type="radio"/> temperature

The inverter is switched off due to excessively high internal temperature.

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		<input checked="" type="radio"/> low battery
<input type="radio"/> float	charger only	<input type="radio"/> temperature

– If the LEDs flash alternately, the battery almost empty and nominal power is exceeded.  
 – If “overload” and “low battery” flash simultaneously, there is an excessively high ripple voltage at the battery connection.

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		<input checked="" type="radio"/> low battery
<input type="radio"/> float	charger only	<input type="radio"/> temperature

The inverter is switched off due to an excessively high ripple voltage on the battery connection.

## 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		<input type="radio"/> low battery	
<input type="radio"/> float	charger only	<input type="radio"/> temperature	

The AC voltage on AC-in-1 or AC-in-2 is switched through, and the charger operates in bulk phase.

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		<input type="radio"/> low battery	
<input type="radio"/> float	charger only	<input type="radio"/> temperature	

The AC voltage on AC-in-1 or AC-in-2 is switched through and the charger operates, but the set absorption voltage 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		<input type="radio"/> low battery	
<input type="radio"/> float	charger only	<input type="radio"/> temperature	

The AC voltage on AC-in-1 or AC-in-2 is switched through, and the charger operates in absorption phase.

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		<input type="radio"/> low battery	
<input checked="" type="radio"/> float	charger only	<input type="radio"/> temperature	



The AC voltage on AC-in-1 or AC-in-2 is switched through, and the charger operates in float or storage phase.

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		<input type="radio"/> low battery	
<input type="radio"/> float	charger only	<input type="radio"/> temperature	

The AC voltage on AC-in-1 or AC-in-2 is switched through, and the charger operates in equalisation mode.



Special indications

Set with limited input current

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

Occurs only if PowerAssist is disabled.  
The AC voltage on AC1-in-1 or AC-in-2 is switched through. The AC-input current is equal to the load current. The charger is down-controlled to 0A.

Set to supply additional current

charger		inverter	
<input checked="" type="radio"/> mains on	on	 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 AC voltage on AC-in-1 or AC-in-2 is switched through, but the load demands more current than the mains can supply. The inverter is now switched on to supply additional current.