

Quattro (firmware xxxx1xx)

48 | 3000 | 35 – 50|50 – 120V

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 S 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°C to 60°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 (AC-out-1), an auxiliary output (AC-out-2) 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. The maximum alternating current that can be switched is 30A.

Virtually unlimited power thanks to parallel operation

Up to 6 Quattros can operate in parallel. Six units 24/3000/70, for example, will provide 15kW / 18kVA output power and 420 Amps charging capacity.

Three phase capability

Three units can be configured for three-phase output. But that's not all: up to 6 sets of three units can be parallel connected to provide 45kW / 54kVA inverter power and more than 1200A 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.

This unique feature offers a definitive solution for the ‘shore current problem’: electric tools, dish washers, washing machines, electric cooking etc. can all run on 16A shore current, or even less. In addition, a smaller generating set can be installed.

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 relay

The Quattro is equipped with a programmable relay that by default is set as an alarm relay. The relay can be programmed for all kinds of other applications however, for example as a starter relay for a generating set.

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

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.

The right amount of charge: variable 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 fully charge the battery.

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, damage due to excessive gassing will be prevented 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 2,2V/cell (13,2V for 12V 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 DC outputs for charging two batteries

The main DC terminal 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 service life of the battery: temperature compensation

The temperature sensor (supplied with the product) 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: the correct charge voltage

Voltage loss due to cable resistance can be compensated by using the voltage sense facility to measure voltage directly on the DC bus or on the battery terminals.

More on batteries and charging

Our book 'Energy Unlimited' offers further information on batteries and battery charging, and is available free of charge on our website (see www.victronenergy.com -> Support & Downloads -> General Technical Information). For more information on adaptive charging, please also refer to the General Technical Information our website.

2.3 Self consumption – solar energy storage systems

When the Multi/Quattro is used in a configuration in which it will feed back energy to the grid it is required to enable grid code compliance by selecting the grid code country setting with the VEConfigure tool.

This way the Multi/Quattro can comply to the local rules.

Once set, a password will be required to disable grid code compliance or change grid code related parameters.

If the local grid code is not supported by the Multi/Quattro an external certified interface device should be used to connect the Multi/Quattro to the grid.

Special note for Australian customers: IEC62109.1 certification and CEC approval for off-grid use does NOT imply approval for grid-interactive installations. Additional certification to IEC 62109.2 and AS 4777.2.2015 are required before grid-interactive systems can be implemented. Please check Clean Energy Council website for current approvals.

3. OPERATION

3.1 “On / stand by / 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” 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 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). The charging current is then 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 is has not been moved, the Quattros 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	
☐ mains on	on	☐ inverter on	
☐ bulk	 off	☐ overload	
☐ absorption		☐ low battery	
☐ float	charger only	☒ temperature	

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

charger		inverter	
☐ mains on	on	☒ inverter on	
☐ bulk	 off	 overload	
☐ absorption		 low battery	
☐ float	charger only	☐ 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	
☐ mains on	on	☐ inverter on	
☐ bulk	 off	☒ overload	
☐ absorption		☒ low battery	
☐ float	charger only	☐ temperature	

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

Battery charger

charger		inverter
☒ mains on	on	☐ inverter on
☒ bulk	off	☐ overload
☐ absorption	charger only	☐ low battery
☐ float		☐ temperature

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

charger		inverter
☒ mains on	on	☐ inverter on
☒ bulk	off	☐ overload
☒ absorption	charger only	☐ low battery
☐ float		☐ 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
☒ mains on	on	☐ inverter on
☐ bulk	off	☐ overload
☒ absorption	charger only	☐ low battery
☐ float		☐ temperature

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

charger		inverter
☒ mains on	on	☐ inverter on
☐ bulk	off	☐ overload
☐ absorption	charger only	☐ low battery
☒ float		☐ 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
☒ mains on	on	☐ inverter on
☒ bulk	off	☐ overload
☒ absorption	charger only	☐ low battery
☐ float		☐ 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	☐ inverter on	
☐ bulk	 off	☐ overload	
☐ absorption		☐ low battery	
☐ float	charger only	☐ temperature	

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	
☒ mains on	on	☒ inverter on	
☐ bulk	 off	☐ overload	
☐ absorption		☐ low battery	
☐ float	charger only	☐ 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.

4. INSTALLATION



This product may only be installed by a qualified electrical engineer.

4.1 Location

The Quattro should be installed in a dry, well-ventilated location, as close as possible to the batteries. The device should be surrounded by a free space of at least 10 cm for cooling purposes.



An excessively high environmental temperature has the following consequences:

- shorter lifespan
- lower charging current
- lower peak power or inverter shut-down.

Never place the device directly above the batteries.

The Quattro is suitable for wall mounting. For mounting purposes, a hook and two holes are provided at the back of the casing (see appendix G). The device can be fitted either horizontally or vertically. For optimal cooling, vertical fitting is preferred.



The inner part of the device should remain accessible after installation.

The distance between the Quattro and the battery should be as short as possible to reduce voltage loss across the battery cables to a minimum.



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



The Quattro has no internal DC fuse. The DC fuse should be installed outside the Quattro.

4.2 Connecting the battery cables

In order to use the full potential of the Quattro, batteries of sufficient capacity and battery cables with the correct cross-section should be used.

See table:

	12/3000/120	24/3000/70	48/3000/35
Recommended battery capacity (Ah)	400–1200	200–700	100–400
Recommended DC fuse	400A	300A	125A
Recommended cross-section (mm ²) per + and - connection terminal			
0 – 5 m*	2x 50 mm ²	50 mm ²	35 mm ²
5 -10 m*	2x 70 mm ²	2x 50 mm ²	2x 35 mm ²

* '2x' means two positive and two negative cables.

Procedure

To connect the battery cables, follow the procedure below:



To prevent short circuiting of the battery, an isolated box wrench should be used.

- Remove the DC fuse.
- Loosen the four lower front panel screws at the front of the unit, and remove the lower front panel.
- Connect the battery leads: + (red) to the right-hand terminal and - (black) to the left-hand terminal (see appendix A).
- Tighten the connections after mounting the fastening parts.
- Tighten the nuts well for minimal contact resistance.
- Replace the DC fuse only after completing the whole installation procedure.

4.3 Connecting AC cables

The Quattro is a safety class I product (supplied with an ground terminal for safety purposes). **Its AC input and/or output terminals and/or grounding point on the outside of the product must be provided with an uninterruptable grounding point for safety purposes. See the following instructions in this regard.**



The Quattro is provided with a ground relay (see appendix) that **automatically connects the N output to the casing if no external AC supply is available**. If an external AC supply is provided, the ground relay will open before the input safety relay closes (relay H in appendix B). This ensures the correct operation of an earth leakage circuit breaker that is connected to the output.

In a fixed installation, an uninterruptable grounding can be secured by means of the grounding wire of the AC input. Otherwise the casing must be grounded.

In a mobile installation (for example, with a shore current plug), interrupting the shore connection will simultaneously disconnect the grounding connection. In that case, the casing must be connected to the chassis (of the vehicle) or to the hull or grounding plate (of the boat).

In general, the connection described above to shore connection grounding is not recommended for boats because of galvanic corrosion. The solution to this is using an isolating transformer.

AC-in-1 (see appendix A)

If AC voltage is present on these terminals, the Quattro will use this connection. Generally a generator will be connected to AC-in-1.

The AC-in-1 input must be protected by a fuse or magnetic circuit breaker rated at 50A or less, and cable cross-section must be sized accordingly. If the input AC supply is rated at a lower value, the fuse or magnetic circuit breaker should be down sized accordingly.

AC-in-2 (see appendix A)

If AC voltage is present on these terminals, the Quattro will use this connection, **unless voltage is also present on AC-in-1. The Quattro will then automatically select AC-in-1.** Generally the mains supply or shore voltage will be connected to AC-in-2.

The AC-in-2 input must be protected by a fuse or magnetic circuit breaker rated at 50A or less, and cable cross-section must be sized accordingly. If the input AC supply is rated at a lower value, the fuse or magnetic circuit breaker should be down sized accordingly.

Note: The Quattro may not start when AC is present only on AC-in-2, and DC battery voltage is 10% or more below nominal (less than 11 Volt in case of a 12 Volt battery).

Solution: connect AC power to AC-in-1, or recharge the battery.

AC-out-1 (see appendix A)

The AC output cable can be connected directly to the terminal block "AC-out".

With its PowerAssist feature the Quattro can add up to 3kVA (that is $3000 / 120 = 25A$) to the output during periods of peak power requirement. Together with a maximum input current of 50A this means that the output can supply up to $50 + 13 = 63A$.

An earth leakage circuit breaker and a fuse or circuit breaker rated to support the expected load must be included in series with the output, and cable cross-section must be sized accordingly. The maximum rating of the fuse or circuit breaker is 63A.

AC-out-2 (see appendix A)

A second output is available that disconnects its load in the event of battery operation. On these terminals, equipment is connected **that may only operate if AC voltage is available on AC-in-1 or AC-in-2**, e.g. an electric boiler or an air conditioner. The load on AC-out-2 is disconnected immediately when the Quattro switches to battery operation. After AC power becomes available on AC-in-1 or AC-in-2, the load on AC-out-2 will be reconnected with a delay of approximately 2 minutes. This to allow a genset to stabilise.

AC-out-2 can support loads of up to 25A. An earth leakage circuit breaker and fuse rated at max. 25A must be connected in series with AC-out-2.

Procedure

Use three-core cable. The connection terminals are clearly encoded:

PE: earth

N: neutral conductor

L: phase/live conductor

4.4 Connection options

4.4.1 Starter battery (connection terminal G, see appendix A)

The Quattro has a connection for charging a starter battery. Output current is limited to 4A.

4.4.2 Voltage sense (connection terminal E, see appendix A)

For compensating possible cable losses during charging, two sense wires can be connected with which the voltage directly on the battery or on the positive and negative distribution points can be measured. Use wire with a cross-section of 0,75mm². During battery charging, the Quattro will compensate the voltage drop over the DC cables up to a maximum of 1 Volt (i.e. 1V over the positive connection and 1V over the negative connection). If the voltage drop threatens to become larger than 1V, the charging current is limited in such a way that the voltage drop remains limited to 1V.

4.4.3 Temperature sensor (connection terminal H, see appendix A)

For temperature-compensated charging, the temperature sensor (supplied with the Quattro) can be connected. The sensor is isolated and must be fitted to the negative terminal of the battery.

4.4.4 Remote control

The Quattro can be remotely controlled in two ways:

With an external switch (connection terminal L, see appendix A). Operates only if the switch on the Quattro is set to "on".

With a Multi control panel (connected to one of the two RJ48 sockets B, see appendix A). Operates only if the switch on the Quattro is set to "on".

Using the Multi control panel, only the current limit for AC-in-2 can be set (in regard to PowerControl and PowerAssist).

The current limit for AC-in-1 can be set with DIP switches or by means of software.

Only one remote control can be connected, i.e. either a switch or a Multi control panel.

4.4.5. Programmable relay

The Quattro is equipped with a multi-functional relay that by default is programmed as an alarm relay. The relay can be programmed for all kinds of other applications however, for example to start a generator (VEConfigure software needed).

4.4.6 Auxiliary AC output (AC-out-2)

Besides the usual uninterruptable output (AC-out-1), a second output (AC-out-2) is available that disconnects its load in the event of battery operation. Example: an electric boiler or air conditioner that is allowed to operate only if the genset is running or shore power is available.

In case of battery operation, AC-out-2 is switched off immediately. After the AC supply has become available, AC-out-2 is reconnected with a delay of 2 minutes, this allow a genset to stabilize prior to connecting a heavy load.

4.4.7 Connecting Quattros in parallel (see appendix C)

The Quattro can be connected in parallel with several identical devices. To this end, a connection is established between the devices by means of standard RJ45 UTP cables. The system (one or more Quattros plus optional control panel) will require subsequent configuration (see Section 5).

In the event of connecting Quattro units in parallel, the following requirements must be met:

- A maximum of six units connected in parallel.
- Only identical devices with the same power ratings may be connected in parallel.
- Battery capacity should be sufficient.
- The DC connection cables to the devices must be of equal length and cross-section.
- If a positive and a negative DC distribution point is used, the cross-section of the connection between the batteries and the DC distribution point must at least equal the sum of the required cross-sections of the connections between the distribution point and the Quattro units.
- Place the Quattro units close to each other, but allow at least 10 cm for ventilation purposes under, above and beside the units.
- UTP cables must be connected directly from one unit to the other (and to the remote panel). Connection/splitter boxes are not permitted.
- A battery-temperature sensor need only be connected to one unit in the system. If the temperature of several batteries is to be measured, you can also connect the sensors of other Quattro units in the system (with a maximum of one sensor per Quattro). Temperature compensation during battery charging responds to the sensor indicating the highest temperature.
- Voltage sensing must be connected to the master (see Section 5.5.1.4).
- Only one remote control means (panel or switch) can be connected to the system.

4.4.8 Three-phase configuration (see appendix C)

Quattros can also be used in 3-phase wye (Y) configuration. To this end, a connection between the devices is made by means of standard RJ45 UTP cables (the same as for parallel operation). The system (Quattros plus an optional control panel) will require subsequent configuration (see Section 5).

Pre-requisites: see Section 4.4.7.

Note: the Quattro is not suitable for 3-phase delta (Δ) configuration.

5. CONFIGURATION



- Settings may only be changed by a qualified electrical engineer.
- Read the instructions thoroughly before implementing changes.
- During setting of the charger, the DC fuse in the battery connections must be removed.

5.1 Standard settings: ready for use

On delivery, the Quattro is set to standard factory values. In general, these settings are selected for single-unit operation. Settings, therefore, do not require changing in the event of stand-alone use.

Warning: Possibly, the standard battery charging voltage is not suitable for your batteries! Refer to the manufacturer's documentation, or to your battery supplier!

Standard Quattro factory settings

Inverter frequency	60 Hz
Input frequency range	45 - 65 Hz
Input voltage range	95 -130VAC
Inverter voltage	120 VAC
Stand-alone / parallel / 3-phase	stand-alone
AES (Automatic Economy Switch)	off
Ground relay	on
Charger on/ off	on
Charging characteristics	four-stage adaptive with BatterySafe mode
Charging current	75% of the maximum charging current
Battery type	Victron Gel Deep Discharge (also suitable for Victron AGM Deep Discharge)
Automatic equalisation charging	off
Absorption voltage	14.4 / 28.8 / 57.6 V
Absorption time	up to 8 hours (depending on bulk time)
Float voltage	13.8 / 27.6 / 55.2 V
Storage voltage	13.2V (not adjustable)
Repeated absorption time	1 hour
Absorption repeat interval	7 days
Bulk protection	on
Generator (AC-in-1) / shore current (AC-in-2)	50A/16A (= adjustable current limit for PowerControl and PowerAssist functions)
UPS feature	on
Dynamic current limiter	off
WeakAC	off
BoostFactor	2
Programmable relay	alarm function
PowerAssist	on

5.2 Explanation of settings

Settings that are not self-explanatory are described briefly below. For further information, please refer to the help files in the software configuration programs (see Section 5.3).

Inverter frequency

Output frequency if no AC is present at the input.
Adjustability: 50Hz; 60Hz

Input frequency range

Input frequency range accepted by the Quattro. The Quattro synchronises within this range with the voltage present on AC-in-1 (priority input) or AC-in-2. Once synchronised, the output frequency will be equal to the input frequency.
Adjustability: 45 – 65 Hz; 45 – 55 Hz; 55 – 65 Hz

Input voltage range

Voltage range accepted by the Quattro. The Quattro synchronises within this range with the voltage present on AC-in-1 (priority input) or on AC-in-2. After the back feed relay has closed, output voltage will be equal to input voltage.

Adjustability:

Lower limit: 90 - 120V

Upper limit: 120 - 130V

Note: the standard lower limit setting of 90V is intended for connection to a weak mains supply, or to a generator with unstable AC output. This setting may result in a system shut down when connected to a 'brushless, self excited, externally voltage regulated, synchronous AC generator' (synchronous AVR generator). Most generators rated at 10kVA or more are synchronous AVR generators. The shut down is initiated when the generator is stopped and revs down while the AVR simultaneously 'tries' to keep the output voltage of the generator at 120V.

The solution is to increase the lower limit setting to 110VAC (the output of AVR generators is generally very stable), or to disconnect the Multi(s) from the generator when a generator stop signal is given (with help of an AC contactor installed in series with the generator).

Inverter voltage

Output voltage of the Quattro in battery operation.
Adjustability: 110 – 130V

Stand-alone / parallel operation / 2-3 phase setting

Using several devices, it is possible to:

- increase total inverter power (several devices in parallel)
- create a split-phase system (only for Quattro units with 120V output voltage)
- create a 3-phase system.

To this end, the devices must be mutually connected with RJ45 UTP cables. Standard device settings, however, are such that each device operates in stand-alone operation. Reconfiguration of the devices is therefore required.

AES (Automatic Economy Switch)

If this setting is turned 'on', the power consumption in no-load operation and with low loads is decreased by approx. 20%, by slightly 'narrowing' the sinusoidal voltage. Not adjustable with DIP switches. Applicable in stand-alone configuration only.

Search Mode

Instead of the AES mode, the search mode can also be chosen (with help of VEConfigure only).

If search mode is 'on', the power consumption in no-load operation is decreased by approx. 70%. In this mode the Quattro, when operating in inverter mode, is switched off in case of no load or very low load, and switches on every two seconds for a short period. If the output current exceeds a set level, the inverter will continue to operate. If not, the inverter will shut down again.

The Search Mode "shut down" and "remain on" load levels can be set with VEConfigure.

The standard settings are:

Shut down: 40 Watt (linear load)

Turn on: 100 Watt (linear load)

Not adjustable with DIP switches. Applicable in stand-alone configuration only.

Ground relay (see appendix B)

With this relay (H), the neutral conductor of the AC output is grounded to the casing when the back feed safety relays in the AC-in-1 and the AC-in-2 inputs are open. This ensures the correct operation of earth leakage circuit breakers in the outputs. If a non-grounded output is required during inverter operation, this function must be turned off. (See also Section 4.5)

Not adjustable with DIP switches.

If required an external ground relay can be connected (for a split-phase system with a separate autotransformer).

See appendix A.

Battery charge curve

The standard setting is 'Four-stage adaptive with BatterySafe mode'. See Section 2 for a description.

This is the best charging characteristic. See the help files in the software configuration programs for other features.

'Fixed' mode can be selected with DIP switches.

Battery type

The standard setting is the most suitable for Victron Gel Deep Discharge, Gel Exide A200, and tubular plate stationary batteries (OPzS). This setting can also be used for many other batteries: e.g. Victron AGM Deep Discharge and other AGM batteries, and many types of flat-plate open batteries. Four charging voltages can be set with DIP switches.

With VEConfigure the charge curve can be adjusted to charge any battery type (Nickel Cadmium batteries, Lithium-ion batteries)

Automatic equalisation charging

This setting is intended for tubular plate traction batteries. During absorption the voltage limit increases to 2,83V/cell (34V for a 24V battery) once the charge current has tapered down to less than 10% of the set maximum current.

Not adjustable with DIP switches.

See 'tubular plate traction battery charge curve' in VEConfigure.

Absorption time

This depends on the bulk time (adaptive charging characteristic), so that the battery is optimally charged. If the 'fixed' charging characteristic is selected, the absorption time is fixed. For most batteries, a maximum absorption time of eight hours is suitable. If an extra high absorption voltage is selected for rapid charging (only possible for open, flooded batteries!), four hours is preferable. With DIP switches, a time of eight or four hours can be set. For the adaptive charging characteristic, this determines the maximum absorption time.

Storage voltage, Repeated Absorption Time, Absorption Repeat Interval

See Section 2. Not adjustable with DIP switches.

Bulk Protection

When this setting is 'on', the bulk charging time is limited to 10 hours. A longer charging time could indicate a system error (e.g. a battery cell short-circuit). Not adjustable with DIP switches.

AC input current limit AC-in-1 (generator) / AC-in-2 (shore/grid supply)

These are the current limit settings at which PowerControl and PowerAssist come into operation.

PowerAssist setting range:

- From 5,3A to 50A for input AC-in-1

- From 5,3A to 50A for input AC-in-2

Factory setting: the maximum value (50A and 16A).

In case of parallel units the range the minimum and maximum values have to be multiplied by the number of parallel units.

See Section 2, the book 'Energy Unlimited', or the many descriptions of this unique feature on our website

www.victronenergy.com .

UPS feature

If this setting is 'on' and AC on the input fails, the Quattro switches to inverter operation practically without interruption. The Quattro can then be used as an Uninterruptible Power Supply (UPS) for sensitive equipment such as computers or communication systems.

The output voltage of some small generating sets is too unstable and distorted for using this setting – the Quattro would continually switch to inverter operation. For this reason, the setting can be turned off. The Quattro will then respond less quickly to voltage deviations on AC-in-1 or AC-in-2. The switchover time to inverter operation is consequently slightly longer, but most equipment (computers, clocks or household equipment) is not adversely impacted.

Recommendation: Turn the UPS feature off if the Quattro fails to synchronise, or continually switches back to inverter operation.

Dynamic current limiter

Intended for generators, the AC voltage being generated by means of a static inverter (so-called 'inverter' generators). In these generators, rotational speed is down-controlled if the load is low: this reduces noise, fuel consumption and pollution. A disadvantage is that the output voltage will drop severely or even completely fail in the event of a sudden load increase. More load can only be supplied after the engine is up to speed.

If this setting is 'on', the Quattro will start supplying extra power at a low generator output level and gradually allow the generator to supply more, until the set current limit is reached. This allows the generator engine to get up to speed.

This setting is also often used for 'classical' generators that respond slowly to sudden load variation.

WeakAC

Strong distortion of the input voltage can result in the charger hardly operating or not operating at all. If WeakAC is set, the charger will also accept a strongly distorted voltage, at the cost of greater distortion of the input current.

Recommendation: Turn WeakAC on if the charger is hardly charging or not charging at all (which is quite rare!). Also turn on the dynamic current limiter simultaneously, and reduce the maximum charging current to prevent overloading the generator if necessary.

Note: when WeakAC is on, the maximum charge current is reduced by approximately 20%.

Not adjustable with DIP switches.

BoostFactor

Change this setting only after consulting with Victron Energy or with an engineer trained by Victron Energy!

Not adjustable with DIP switches.

Programmable relay

By default, the programmable relay is set as an alarm relay, i.e. the relay will de-energise in the event of an alarm or a pre-alarm (inverter almost too hot, ripple on the input almost too high, battery voltage almost too low). Not adjustable with DIP switches.

Auxiliary AC output (AC-out-2)

Besides the uninterruptable output (AC-out-1), a second output (AC-out-2) is available that disconnects its load in the event of battery operation. Example: an electric boiler or air conditioner that is allowed to operate only if the genset is running or shore power is available.

In case of battery operation, AC-out-2 is switched off immediately. After the AC supply has become available, AC-out-2 is reconnected with a delay of 2 minutes, this to allow a genset to stabilise prior to connecting a heavy load.

5.3 Configuration by computer

All settings can be changed by means of a computer or with a VE.Net panel (except for the multi-functional relay and the VirtualSwitch when using VE.Net).

The most common settings (including parallel and 3-phase operation) can be changed by means of DIP switches (see Section 5.5).

For changing settings with the computer, the following is required:

- VEConfigure3 software: can be downloaded free of charge at www.victronenergy.com.
 - A MK3-USB (VE.Bus to USB) interface, and a RJ45 UTP cable.
- Alternatively, the Interface MK2.2b (VE.Bus to RS232) and a RJ45 UTP cable can be used.

5.3.1 VE.Bus Quick Configure Setup

VE.Bus Quick Configure Setup is a software program with which systems with a maximum of three Quattro units (parallel or three phase operation) can be configured in a simple manner. VEConfigure3 forms part of this program.

The software can be downloaded free of charge at www.victronenergy.com.

5.3.2 VE.Bus System Configurator

For configuring advanced applications and/or systems with four or more Quattro units, **VE.Bus System Configurator** software must be used. The software can be downloaded free of charge at www.victronenergy.com. VEConfigure3 forms part of this program.

5.4 Configuration with a VE.Net panel

To this end, a VE.Net panel and the VE.Net to VE.Bus converter is required.

With VE.Net all parameters are accessible, with the exception of the multi-functional relay and the VirtualSwitch.

5.5 Configuration with DIP switches

Introduction

A number of settings can be changed using DIP switches (see appendix A, position M).

This is done as follows:

Turn the Quattro on, preferably unloaded and without AC voltage on the inputs. The Quattro will then operate in inverter mode.

Step 1: Setting the DIP switches for:

- The required current limitation of the AC inputs.
- Limitation of the charging current.
- Selection of stand-alone, parallel or 3-phase operation.

To store the settings after the required values have been set: press the 'Up' button for 2 seconds (upper button to the right of the DIP switches, see appendix A, position K). You can now re-use the DIP switches to apply the remaining settings (step 2).

Step 2: other settings

To store the settings after the required values have been set: press the 'Down' button for 2 seconds (lower button to the right of the DIP switches). You can now leave the DIP switches in the selected positions, so that the 'other settings' can always be recovered.

Remarks:

- The DIP switch functions are described in 'top to bottom' order. Since the uppermost DIP switch has the highest number (8), descriptions start with the switch numbered 8.
 - In parallel mode or 3-phase mode, not all devices require all settings to be made (see section 5.5.1.4).
- For parallel or 3-phase mode, read the whole setting procedure and make a note of the required DIP switch settings before actually implementing them.

5.5.1 Step 1

5.5.1.2 Current limitation AC inputs (default: AC-in-1: 50A, AC-in-2: 16A)

If the current demand (Quattro load + battery charger) threatens to exceed the set current, the Quattro will first reduce its charging current (PowerControl), and subsequently supply additional power from the battery (PowerAssist), if needed.

The AC-in-1 current limit (the generator) can be set to eight different values by means of DIP switches.

The AC-in-2 current limit can be set to two different values by means of DIP switches.

With a Multi Control Panel, a variable current limit can be set for the AC-in-2 input.

Procedure

AC-in-1 can be set using DIP switches ds8, ds7 and ds6 (default setting: 50A).

Procedure: set the DIP switches to the required value:

ds8 ds7 ds6

off	off	off = 6A (0,72kVA at 120V)
off	off	on = 10A (1.2kVA at 120V)
off	on	off = 12A (1.4kVA at 120V)
off	on	on = 16A (2kVA at 120V)
on	off	off = 20A (2.4kVA at 120V)
on	off	on = 25A (3kVA at 120V)
on	on	off = 30A (3.6kVA at 120V)
on	on	on = 50A (6kVA at 120V)

Remark: Manufacturer-specified continuous power ratings for small generators are sometimes inclined to be rather optimistic. In that case, the current limit should be set to a much lower value than would otherwise be required on the basis of manufacturer-specified data.

AC-in-2 can be set in two steps using DIP switch ds5 (default setting: 16A).

Procedure: set ds5 to the required value:

ds5

off = 16A
on = 30A

5.5.1.3 Charge current limitation (default setting 75%)

For maximum battery life, a charge current of 10% to 20% of the capacity in Ah should be applied.

Example: optimal charge current of a 24V/500Ah battery bank: 50A to 100A.

The temperature sensor supplied automatically adjusts the charging voltage to the battery temperature.

If faster charging – and a subsequent higher current – is required:

- the temperature sensor supplied should be fitted to the battery, since fast charging can lead to a considerable temperature rise of the battery bank. The charging voltage is adapted to the higher temperature (i.e. lowered) by means of the temperature sensor.
- the bulk charging time will sometimes be so short that a fixed absorption time would be more satisfactory ('fixed' absorption time, see ds5, step 2).

Procedure

The battery charging current can be set in four steps, using DIP switches ds4 and ds3 (default setting: 75%).

ds4 ds3

off off = 25%

off on = 50%

on off = 75%

on on = 100%

Note: when WeakAC is on, the maximum charge current is reduced from 100% to approximately 80%.

5.5.1.4 Stand-alone, parallel and 3-phase operation

Using DIP switches ds2 and ds1, three system configurations can be selected.

NOTES:

- All units in a parallel or three phase system must be connected to the same battery. The DC and the AC cabling of all units must be of the same length and cross section.

- When configuring a parallel or 3-phase system, all related devices should be interconnected using RJ45 UTP cables (see appendix C, D). All devices must be turned on. They will subsequently return an error code (see Section 7), since they have been integrated into a system and still are configured as 'stand-alone'. This error message can safely be ignored.

- Storing settings (by pressing the 'Up' button (step 1) – and later on the 'Down' button (step 2) – for 2 seconds) should be done on one device only. This device is the 'master' in a parallel system or the 'leader' (L1) in a 3-phase system.

In a parallel system, the step-1 setting of DIP switches ds8 to ds3 need to be done on the master only. The slaves will follow the master with regard to these settings (hence the master/slave relationship).

In a 3-phase system, a number of settings are required for the other devices, i.e. the followers (for phases L2 and L3).

(The followers, therefore, do not follow the leader for all settings, hence the leader/follower terminology).

- A change in the setting 'stand-alone / parallel / 3-phase' is only activated after the setting has been stored (by pressing the 'UP' button for 2 seconds) and after all devices have been turned off and then on again. In order to start up a VE.Bus system correctly, all devices should therefore be turned off after the settings have been stored. They can then be turned on in any order. The system will not start until all devices have been turned on.

- Note that only identical devices can be integrated in one system. Any attempt to use different models in one system will fail. Such devices may possibly function correctly again only after individual reconfiguration for 'stand-alone' operation.

- The combination ds2=on and ds1=on is not used.

DIP switches ds2 and ds1 are reserved for the selection of stand-alone, parallel or 3-phase operation

Stand-alone operation (see figure 1)

Step 1: Setting ds2 and ds1 for stand-alone operation

DS-8 AC-in-1	Set as desired	
DS-7 AC-in-1	Set as desired	
DS-6 AC-in-1	Set as desired	
DS-5 AC-in-2	Set as desired	
DS-4 Charging current	Set as desired	
DS-3 Charging current	Set as desired	
DS-2 Stand-alone operation		off
DS-1 Stand-alone operation		off

Examples of DIP switch settings for stand-alone mode are given below.

Example 1 shows the factory setting (since factory settings are entered by computer, all DIP switches of a new product are set to 'off' and do not reflect the actual settings in the microprocessor).

Important: When a panel is connected, the AC-in-2 current limit is determined by the panel and not by the value stored in the Quattro.

Four examples of stand-alone settings:

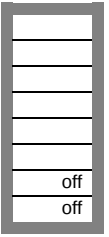
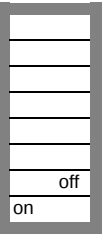
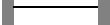
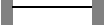
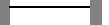
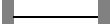
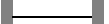
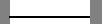
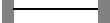
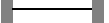
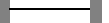
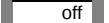
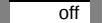
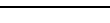
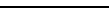
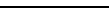
DS-8 AC-in-1 DS-7 AC-in-1 DS-6 AC-in-1 DS-5 AC-in-2 DS-4 Charging current DS-3 Charging current DS-2 Stand-alone mode DS-1 Stand-alone mode on on on on on off off off	DS-8 DS-7 DS-6 DS-5 DS-4 DS-3 DS-2 DS-1 on on on off on on off off	DS-8 DS-7 DS-6 DS-5 DS-4 DS-3 DS-2 DS-1 off on on off on on off off	DS-8 DS-7 DS-6 DS-5 DS-4 DS-3 DS-2 DS-1 on on off on off on off off
Step1, stand-alone Example 1 (factory setting): 8, 7, 6 AC-in-1: 50A 5 AC-in-2: 30A 4, 3 Charge current: 75% 2, 1 Stand-alone mode	Step1, stand-alone Example 2: 8, 7, 6 AC-in-1: 50A 5 AC-in-2: 16A 4, 3 Charge: 100% 2, 1 Stand-alone	Step1, stand-alone Example 3: 8, 7, 6 AC-in-1: 16A 5 AC-in-2: 16A 4, 3 Charge: 100% 2, 1 Stand-alone	Step1, stand-alone Example 4: 8, 7, 6 AC-in-1: 30A 5 AC-in-2: 30A 4, 3 Charge: 50% 2, 1 Stand-alone

the DIP switches, see appendix A, position K). **The overload and low-battery LED's will flash to indicate acceptance of the settings.**

We recommend making a note of the settings, and filing this information in a safe place.

The DIP switches can now be used to apply the remaining settings (step 2).

Parallel operation (see appendix C)**Step 1: Setting ds2 and ds1 for parallel operation of two or three units**

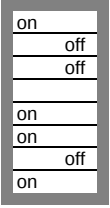
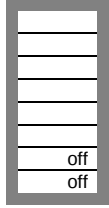
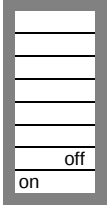
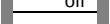
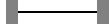
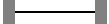
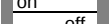
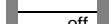
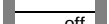
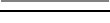
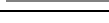
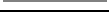
Master	Slave 1	Slave 2 (optional)
DS-8 AC-in-1 Set 	DS-8 na 	DS-8 na 
DS-7 AC-in-1 Set 	DS-7 na 	DS-7 na 
DS-6 AC-in-1 Set 	DS-6 na 	DS-6 na 
DS-5 AC-in-2 Set 	DS-5 na 	DS-5 na 
DS-4 Ch. current Set 	DS-4 na 	DS-4 na 
DS-3 Ch. current Set 	DS-3 na 	DS-3 na 
DS-2 Master  off	DS-2 Slave 1  off	DS-2 Slave 2  off
DS-1 Master  on	DS-1 Slave 1  off	DS-1 Slave 2  on

The current settings (AC current limitation and charging current) are multiplied by the number of devices. However, the AC current limitation setting when using a remote panel will always correspond to the value indicated on the panel and should **not** be multiplied by the number of devices.

Example: 7kVA parallel system

- If an AC-in-1 current limitation of 20A is set on the master and the system consists of three devices, then the effective system current limitation for AC-in-1 is equal to $3 \times 20 = 60A$ (maximum input power $3 \times 20 \times 120 = 7,2kVA$).
- If a 30A panel is connected to the master, the system current limitation for AC-in-2 is adjustable to a maximum of 30A, regardless of the number of devices.
- If the charging current on the master is set to 100% (70A for a Quattro 24/3000/70) and the system consists of three devices, then the effective system charging current is equal to $3 \times 70 = 210A$.

The settings according to this example (7.2kVA parallel system) are as follows:

Master	Slave 1	Slave 2
DS-8 AC-in-1 ($3 \times 20 = 60A$)  on	DS-8 na 	DS-8 na 
DS-7 AC-in-1 ($3 \times 20 = 60A$)  off	DS-7 na 	DS-7 na 
DS-6 AC-in-1 ($3 \times 20 = 60A$)  off	DS-6 na 	DS-6 na 
DS-5 AC-in-2 na (30A panel) 	DS-5 na 	DS-5 na 
DS-4 Charging current $3 \times 70A$  on	DS-4 na 	DS-4 na 
DS-3 Charging current $3 \times 70A$  on	DS-3 na 	DS-3 na 
DS-2 Master  off	DS-2 Slave 1  off	DS-2 Slave 2  off
DS-1 Master  on	DS-1 Slave 1  off	DS-1 Slave 2  on

To store the settings after the required values have been set: press the 'Up' button of the **master** for 2 seconds (**upper** button to the right of the DIP switches, see appendix A, position K). **The overload and low-battery LEDs will flash to indicate acceptance of the settings.**

We recommend making a note of the settings, and filing this information in a safe place.

The DIP switches can now be used to apply the remaining settings (step 2).

Three phase operation (see appendix D)

Step 1: Setting ds2 and ds1 for 3-phase operation

Leader (L1)	Follower (L2)	Follower (L3)
DS-8 AC-in-1 Set ☐ DS-7 AC-in-1 Set ☐ DS-6 AC-in-1 Set ☐ DS-5 AC-in-2 Set ☐ DS-4 Ch. current Set ☐ DS-3 Ch. current Set ☐ DS-2 Leader ☐ on DS-1 Leader ☐ off	DS-8 Set ☐ DS-7 Set ☐ DS-6 Set ☐ DS-5 Set ☐ DS-4 na ☐ DS-3 na ☐ DS-2 Follower 1 ☐ off DS-1 Follower 1 ☐ off	DS-8 Set ☐ DS-7 Set ☐ DS-6 Set ☐ DS-5 Set ☐ DS-4 na ☐ DS-3 na ☐ DS-2 Follower 2 ☐ off DS-1 Follower 2 ☐ on

As the table above shows, the current limits for each phase should be set separately (ds8 thru ds5). Thus, for AC-in1 as well as AC-in-2, different current limits per phase can be selected.

If a Multi control panel is connected, the AC-in-2 current limit will equal the value set on the panel for all phases.

The maximum charging current is the same for all devices, and should be set on the leader (ds4 and ds3).

Example: 4.3kVA 3-phase system

AC-in-1 current limitation on the leader and the followers: 12A (maximum input power $12 \times 120 \times 3 = 4,3\text{kVA}$).

AC-in-2 current limitation with 16A Multi control panel.

If the charging current on the leader is set to 100% (70A for a Quattro 24/3000/70) and the system consists of three devices, then the effective system charging current is equal to $3 \times 70 = 210\text{A}$.

The settings according to this example (4.3kVA 3-phase system) are as follows:

Leader (L1)	Follower (L2)	Follower (L3)
DS-8 AC-in-1 12A ☐ off DS-7 AC-in-1 12A ☐ on DS-6 AC-in-1 12A ☐ off DS-5 AC-in-2 na (16A panel) ☐ DS-4 Ch. current 3x70A ☐ on DS-3 Ch. current 3x70A ☐ on DS-2 Leader ☐ on DS-1 Leader ☐ off	DS-8 AC-in-1 12A ☐ off DS-7 AC-in-1 12A ☐ on DS-6 AC-in-1 12A ☐ off DS-5 na ☐ DS-4 na ☐ DS-3 na ☐ DS-2 Follower 1 ☐ off DS-1 Follower 1 ☐ off	DS-8 AC-in-1 12A ☐ off DS-7 AC-in-1 12A ☐ on DS-6 AC-in-1 12A ☐ off DS-5 na ☐ DS-4 na ☐ DS-3 na ☐ DS-2 Follower 2 ☐ off DS-1 Follower 2 ☐ on

To store the settings after the required values have been set: press the 'Up' button of the **leader** for 2 seconds (**upper** button to the right of the DIP switches, see appendix A, position K). **The overload and low-battery LEDs will flash to indicate acceptance of the settings.**

We recommend making a note of the settings, and filing this information in a safe place.

The DIP switches can now be used to apply the remaining settings (step 2).

5.5.2 Step 2: Other settings

The remaining settings are not relevant for slaves.

Some of the remaining settings are not relevant for followers (**L2, L3**). These settings are imposed on the whole system by the leader **L1**. If a setting is irrelevant for L2, L3 devices, this is mentioned explicitly.

ds8-ds7: Setting charging voltages (**not relevant for L2, L3**)

ds8-ds7	Absorption voltage	Float voltage	Storage voltage	Suitable for
off off	14.1 28.2 56.4	13.8 27.6 55.2	13.2 26.4 52.8	Gel Victron Long Life (OPzV) Gel Exide A600 (OPzV) Gel MK battery
off on	14.4 28.8 57.6	13.8 27.6 55.2	13.2 26.4 52.8	Gel Victron Deep Discharge Gel Exide A200 AGM Victron Deep Discharge Stationary tubular plate (OPzS)
on off	14.7 29.4 58.8	13.8 27.6 55.2	13.2 26.4 52.8	AGM Victron Deep Discharge Tubular plate (OPzS) batteries in semi-float mode AGM spiral cell
on on	15.0 30.0 60.0	13.8 27.6 55.2	13.2 26.4 52.8	Tubular plate (OPzS) batteries in cyclic mode

ds6: absorption time 8 or 4 hours (**not relevant for L2, L3**) on = 8 hours off = 4 hours

ds5: adaptive charging characteristic (**not relevant for L2, L3**) on = active off = inactive (fixed absorption time)

ds4: dynamic current limiter on = active off = inactive

ds3: UPS function on = active off = inactive

ds2: converter voltage on = 120V off = 115V

ds1: converter frequency (**not relevant for L2, L3**) on = 50Hz off = 60Hz
(the wide input frequency range (45-55Hz) is 'on' by default)

Step 2: Exemplary settings for stand-alone mode

Example 1 is the factory setting (since factory settings are entered by computer, all DIP switches of a new product are set to 'off' and do not reflect the actual settings in the microprocessor).

DS-8 Ch. voltage DS-7 Ch. voltage DS-6 Absorpt. time DS-5 Adaptive ch. DS-4 Dyn. Curr. limit DS-3 UPS function: DS-2 Voltage DS-1 Frequency	off on on on off on on on	DS-8 DS-7 DS-6 DS-5 DS-4 DS-3 DS-2 DS-1	off off on on off off on on	DS-8 DS-7 DS-6 DS-5 DS-4 DS-3 DS-2 DS-1	on off on on on off off on	DS-8 DS-7 DS-6 DS-5 DS-4 DS-3 DS-2 DS-1	on on off off off on off off
Step 2 Example 1 (factory setting): 8, 7 GEL 14,4V 6 Absorption time: 8 hours 5 Adaptive charging: on 4 Dynamic current limit: off 3 UPS function: on 2 Voltage: 120V 1 Frequency: 50Hz	Step 2 Example 2: 8, 7 OPzV 14,1V 6 Absorption time: 8 h 5 Adaptive charging: on 4 Dyn. current limit: off 3 UPS function: off 2 Voltage: 120V 1 Frequency: 50Hz	Step 2 Example 3: 8, 7 AGM 14,7V 6 Absorption time: 8 h 5 Adaptive charging: on 4 Dyn. current limit: on 3 UPS function: off 2 Voltage: 120V 1 Frequency: 50Hz	Step 2 Example 4: 8, 7 Tubular-plate 15V 6 Absorption time: 4 h 5 Fixed absorption time 4 Dyn. current limit: off 3 UPS function: on 2 Voltage: 120V 1 Frequency: 60Hz				

To store the settings after the required values have been set: press the 'Down' button for 2 seconds (lower button to the right of the DIP switches). **The temperature and low-battery LEDs will flash to indicate acceptance of the settings.**

The DIP switches can be left in the selected positions, so that the 'other settings' can always be recovered.

Step 2: Exemplary setting for parallel mode

In this example, the master is configured according to factory settings.
The slaves do not require setting!

Master		Slave 1		Slave 2	
DS-8 Ch. voltage(GEL 14,4V)	☐ off	DS-8 na	☐	DS-8 na	☐
DS-7 Ch. voltage(GEL 14,4V)	☐ on	DS-7 na	☐	DS-7 na	☐
DS-6 Absorption time (8 h)	☐ on	DS-6 na	☐	DS-6 na	☐
DS-5 Adaptive charging (on)	☐ on	DS-5 na	☐	DS-5 na	☐
DS-4 Dyn. current limit (off)	☐ off	DS-4 na	☐	DS-4 na	☐
DS-3 UPS function (on)	☐ on	DS-3 na	☐	DS-3 na	☐
DS-2 Voltage (120V)	☐ on	DS-2 na	☐	DS-2 na	☐
DS-1 Frequency (50Hz)	☐ on	DS-1 na	☐	DS-1 na	☐

To store the settings after the required values have been set: press the 'Down' button of the master for 2 seconds (**lower** button to the right of the DIP switches). **The temperature and low-battery LEDs will flash to indicate acceptance of the settings.**

You can then leave the DIP switches in the selected positions, so that the 'other settings' can always be recovered.

To start the system: first, turn all devices off. The system will start up as soon as all devices have been turned on.

Step 2: Exemplary setting for 3-phase mode

In this example the leader is configured according to factory settings.

Leader (L1)		Follower (L2)		Follower (L3)	
DS-8 Ch. Volt. GEL 14,4V	☐ off	DS-8 na	☐	DS-8 na	☐
DS-7 Ch. Volt. GEL 14,4V	☐ on	DS-7 na	☐	DS-7 na	☐
DS-6 Absorption time (8 h)	☐ on	DS-6 na	☐	DS-6 na	☐
DS-5 Adaptive ch. (on)	☐ on	DS-5 na	☐	DS-5 na	☐
DS-4 Dyn. current limit (off)	☐ off	DS-4 D. c. l. (off)	☐ off	DS-4 D. c. l. (off)	☐ off
DS-3 UPS function (on)	☐ on	DS-3 UPS f. (on)	☐ on	DS-3 UPS f. (on)	☐ on
DS-2 Voltage (120V)	☐ on	DS-2 V (120V)	☐ on	DS-2 V (120V)	☐ on
DS-1 Frequency (50Hz)	☐ on	DS-1 na	☐	DS-1 na	☐

To store the settings after the required values have been set: press the 'Down' button of the **leader** for 2 seconds (**lower** button to the right of the DIP switches). **The temperature and low-battery LEDs will flash to indicate acceptance of the settings.**

The DIP switches can be left in the selected positions, so that the 'other settings' can always be recovered.

To start the system: first, turn all devices off. The system will start up as soon as all devices have been turned on.

6. MAINTENANCE

The Quattro does not require specific maintenance. It will suffice to check all connections once a year. Avoid moisture and oil/soot/vapours, and keep the device clean.

7. ERROR INDICATIONS

Important note:

When the battery is completely discharged (battery voltage less than 10V / 20V or 40V), the Quattro will start charging only when AC power is connected to AC-in-1.

For the Quattro to start charging when AC power is connected to AC-in-2, battery voltage must exceed 10V / 20V or 40V.

7.1 General error indications

With the procedures below, most errors can be quickly identified. If an error cannot be resolved, please refer to your Victron Energy supplier.

Problem	Cause	Solution
Quattro will not switch over to generator or mains operation.	Circuit breaker or fuse in the AC-in input is open as a result of overload.	Remove overload or short circuit on AC-out-1 or AC-out-2, and reset fuse/breaker.
Inverter operation not initiated when switched on.	The battery voltage is excessively high or too low. No voltage on DC connection.	Ensure that the battery voltage is within the correct range.
"Low battery" LED flashes.	The battery voltage is low.	Charge the battery or check the battery connections.
"Low battery" LED lights.	The converter switches off because the battery voltage is too low.	Charge the battery or check the battery connections.
"Overload" LED flashes.	The converter load is higher than the nominal load.	Reduce the load.
"Overload" LED lights.	The converter is switched off due to excessively high load.	Reduce the load.
"Temperature" LED flashes or lights.	The environmental temperature is high, or the load is too high.	Install the converter in cool and well-ventilated environment, or reduce the load.
"Low battery" and "overload" LEDs flash intermittently.	Low battery voltage and excessively high load.	Charge the batteries, disconnect or reduce the load, or install higher capacity batteries. Fit shorter and/or thicker battery cables.
"Low battery" and "overload" LEDs flash simultaneously.	Ripple voltage on the DC connection exceeds 1,5Vrms.	Check the battery cables and battery connections. Check whether battery capacity is sufficiently high, and increase this if necessary.
"Low battery" and "overload" LEDs light.	The inverter is switched off due to an excessively high ripple voltage on the input.	Install batteries with a larger capacity. Fit shorter and/or thicker battery cables, and reset the inverter (switch off, and then on again).
One alarm LED lights and the second flashes.	The inverter is switched off due to alarm activation by the lighted LED. The flashing LED indicates that the inverter was about to switch off due to the related alarm.	Check this table for appropriate measures in regard to this alarm state.
The charger does not operate.	The AC input voltage or frequency is not within the range set.	Ensure that the AC input is between 185 VAC and 265 VAC, and that the frequency is within the range set (default setting 45-65Hz).
	Circuit breaker or fuse in the AC-in input is open as a result of overload.	Remove overload or short circuit on AC-out-1 or AC-out-2, and reset fuse/breaker.
	The battery fuse has blown.	Replace the battery fuse.
	The distortion or the AC input voltage is too large (generally generator supply).	Turn the settings WeakAC and dynamic current limiter on.
The charger does not operate. "Bulk" LED flashes and "Mains on" LED illuminates.	MultiPlus is in "Bulk protection" mode thus, the maximum bulk charging time of 10 hours is exceeded. Such a long charging time could indicate a system error (e.g. a battery cell short-circuit).	Check your batteries. NOTE: You can reset the error mode by switching off and back on the MultiPlus. The standard MultiPlus factory setting of the "Bulk protection" mode is switched on. The "Bulk protection" mode can be switched off with help of VEConfigure only.
The battery is not completely charged.	Charging current excessively high, causing premature absorption phase.	Set the charging current to a level between 0.1 and 0.2 times the battery capacity.
	Poor battery connection.	Check the battery connections.
	The absorption voltage has been set to an incorrect level (too low).	Set the absorption voltage to the correct level.
	The float voltage has been set to an incorrect level (too low).	Set the float voltage to the correct level.
	The available charging time is too short to fully charge the battery.	Select a longer charging time or higher charging current.
	The absorption time is too short. For adaptive charging this can be caused by an extremely high charging current with respect to battery capacity, so that bulk time is insufficient.	Reduce the charging current or select the 'fixed' charging characteristics.
The battery is overcharged.	The absorption voltage is set to an incorrect level (too high).	Set the absorption voltage to the correct level.
	The float voltage is set to an incorrect level (too high).	Set the float voltage to the correct level.
	Poor battery condition.	Replace the battery.

	The battery temperature is too high (due to poor ventilation, excessively high environmental temperature, or excessively high charging current).	Improve ventilation, install batteries in a cooler environment, reduce the charging current, and connect the temperature sensor .
The charging current drops to 0 as soon as the absorption phase initiates.	The battery is over-heated (>50°C)	Install the battery in a cooler environment Reduce the charging current Check whether one of the battery cells has an internal short circuit
	Defective battery temperature sensor	Disconnect the temperature sensor plug in the Quattro. If charging functions correctly after approximately 1 minute, the temperature sensor should be replaced.

7.2 Special LED indications

(for the normal LED indications, see section 3.4)

Bulk and absorption LEDs flash synchronously (simultaneously).	Voltage sense error. The voltage measured at the voltage sense connection deviates too much (more than 7V) from the voltage on the positive and negative connection of the device. There is probably a connection error. The device will remain in normal operation. NOTE: If the "inverter on" LED flashes in phase opposition, this is a VE.Bus error code (see further on).
Absorption and float LEDs flash synchronously (simultaneously).	The battery temperature as measured has an extremely unlikely value. The sensor is probably defective or has been incorrectly connected. The device will remain in normal operation. NOTE: If the "inverter on" LED flashes in phase opposition, this is a VE.Bus error code (see further on).
"Mains on" flashes and there is no output voltage.	The device is in "charger only" operation and mains supply is present. The device rejects the mains supply or is still synchronising.

7.3 VE.Bus LED indications

Equipment included in a VE.Bus system (a parallel or 3-phase arrangement) can provide so-called VE.Bus LED indications. These LED indications can be subdivided into two groups: OK codes and error codes.

7.3.1 VE.Bus OK codes

If the internal status of a device is in order but the device cannot yet be started because one or more other devices in the system indicate an error status, the devices that are in order will indicate an OK code. This facilitates error tracing in a VE.Bus system, since devices not requiring attention are easily identified as such.

Important: OK codes will only be displayed if a device is not in inverter or charging operation!

- A flashing "bulk" LED indicates that the device can perform inverter operation.
- A flashing "float" LED indicates that the device can perform charging operation.

NOTE: In principle, all other LEDs must be off. If this is not the case, the code is not an OK code. However, the following exceptions apply:

- The special LED indications above can occur together with the OK codes.
- The "low battery" LED can function together with the OK code that indicates that the device can charge.

7.3.2 VE.Bus error codes

A VE.Bus system can display various error codes. These codes are displayed with the "inverter on", "bulk", "absorption" and "float" LEDs.

To interpret a VE.Bus error code correctly, the following procedure should be followed:

1. The device should be in error (no AC output).
2. Is the "inverter on" LED flashing? If not, then there is **no** VE.Bus error code.
3. If one or more of the LEDs "bulk", "absorption" or "float" flashes, then this flash must be in phase opposition to the "inverter on" LED, i.e. the flashing LEDs are off if the "inverter on" LED is on, and vice versa. If this is not the case, then there is **no** VE.Bus error code.
4. Check the "bulk" LED, and determine which of the three tables below should be used.
5. Select the correct column and row (depending on the "absorption" and "float" LEDs), and determine the error code.
6. Determine the meaning of the code in the tables below.

All of the conditions below must be met!:

1. The device is in error! (No AC output)
2. Inverter LED flashes (in opposition to any flashing of the Bulk, Absorption or Float LED)
3. At least one of the LEDs Bulk, Absorption and Float is on or flashing

Bulk LED off				Bulk LED flashes				Bulk LED on			
Float LED		Absorption LED			Float LED		Absorption LED			Float LED	
		off	flashing	On			off	flashing	on		
	off	0	3	6		off	9	12	15		off
	flashing	1	4	7		flashing	10	13	16		flashing
	on	2	5	8		on	11	14	17		on
	on	20	23	26		on	20	23	26		on

Bulk LED Absorption LED Float LED	Code	Meaning:	Cause/solution:
○ ○ ★	1	Device is switched off because one of the other phases in the system has switched off.	Check the failing phase.
○ ★ ○	3	Not all, or more than, the expected devices were found in the system.	The system is not properly configured. Reconfigure the system. Communication cable error. Check the cables and switch all equipment off, and then on again.
○ ★ ★	4	No other device whatsoever detected.	Check the communication cables.
○ ★ ★	5	Overvoltage on AC-out.	Check the AC cables.
★ ○ ★	10	System time synchronisation problem occurred.	Should not occur in correctly installed equipment. Check the communication cables.
★ ★ ★	14	Device cannot transmit data.	Check the communication cables (there may be a short circuit).
★ ★ ★	17	One of the devices has assumed 'master' status because the original master failed.	Check the failing unit. Check the communication cables.
★ ○ ○	18	Overvoltage has occurred.	Check AC cables.
★ ★ ★	22	This device cannot function as 'slave'.	This device is an obsolete and unsuitable model. It should be replaced.
★ ★ ○	24	Switch-over system protection initiated.	Should not occur in correctly installed equipment. Switch all equipment off, and then on again. If the problem recurs, check the installation. Possible solution: increase lower limit of AC input voltage to 210VAC (factory setting is 180VAC)
★ ★ ★	25	Firmware incompatibility. The firmware of one the connected devices is not sufficiently up to date to operate in conjunction with this device.	1) Switch all equipment off. 2) Switch the device returning this error message on. 3) Switch on all other devices one by one until the error message reoccurs. 4) Update the firmware in the last device that was switched on.
★ ★ ★	26	Internal error.	Should not occur. Switch all equipment off, and then on again. Contact Victron Energy if the problem persists.

8. TECHNICAL SPECIFICATIONS

Quattro	48/3000/35-50/50 120V		
PowerControl / PowerAssist	Yes		
Integrated Transfer switch	Yes		
AC inputs (2x)	Input voltage range: 95-130 VAC	Input frequency: 45 – 65 Hz	Power factor: 1
Maximum feed through current (A)	AC-in-1: 50A	AC-in-2: 50A	
Minimum PowerAssist current (A)	AC-in-1: 5,3A	AC-in-2: 5,3A	
INVERTER			
Input voltage range (V DC)	38 – 66		
Output (1)	Output voltage: 120 VAC ± 2%	Frequency: 60 Hz ± 0,1%	
Cont. output power at 25°C (VA) (3)	3000		
Cont. output power at 25°C (W)	2400		
Cont. output power at 40°C (W)	2000		
Cont. output power at 65°C (W)	1700		
Peak power (W)	6000		
Maximum efficiency (%)	95		
Zero-load power (W)	25		
Zero-load power in AES mode (W)	20		
Zero-load power in Search mode (W)	12		
CHARGER			
Charge voltage 'absorption' (V DC)	57,6		
Charge voltage 'float' (V DC)	55,2		
Storage mode (V DC)	52,8		
Charge current house battery (A) (4)	35		
Charge current starter battery (A)	4		
Battery temperature sensor	yes		
GENERAL			
Auxiliary AC output	Max load: 25A Switches off when in inverter mode		
Programmable relay (5)	Yes		
Protection (2)	a - g		
Common Characteristics	Operating temp.: -40 to +65°C (fan assisted cooling)	Humidity (non condensing): max 95%	
ENCLOSURE			
Common Characteristics	Material & Colour: aluminium (blue RAL 5012)	Protection: IP 21	
Battery-connection	Four M8 bolts (2 plus and 2 minus connections)		
120 V AC-connection	Screw terminals 13mm² (6 AWG)		
Weight (kg)	19		
Dimensions (h x w x d in mm)	362 x 258 x 218		
STANDARDS			
Safety	EN 60335-1, EN 60335-2-29		
Emission / Immunity	EN 55014-1, EN 55014-2, EN 61000-3-3		

1) Can be adjusted to 50Hz

2) Protection

- a. Output short circuit
- b. Overload
- c. Battery voltage too high
- d. Battery voltage too low
- e. Temperature too high
- f. 120VAC on inverter output
- g. Input voltage ripple too high

3) Non-linear load, crest factor 3:1

4) At 25°C ambient

5) Programmable relay which can be set for general alarm, DC undervoltage or genset start/stop function

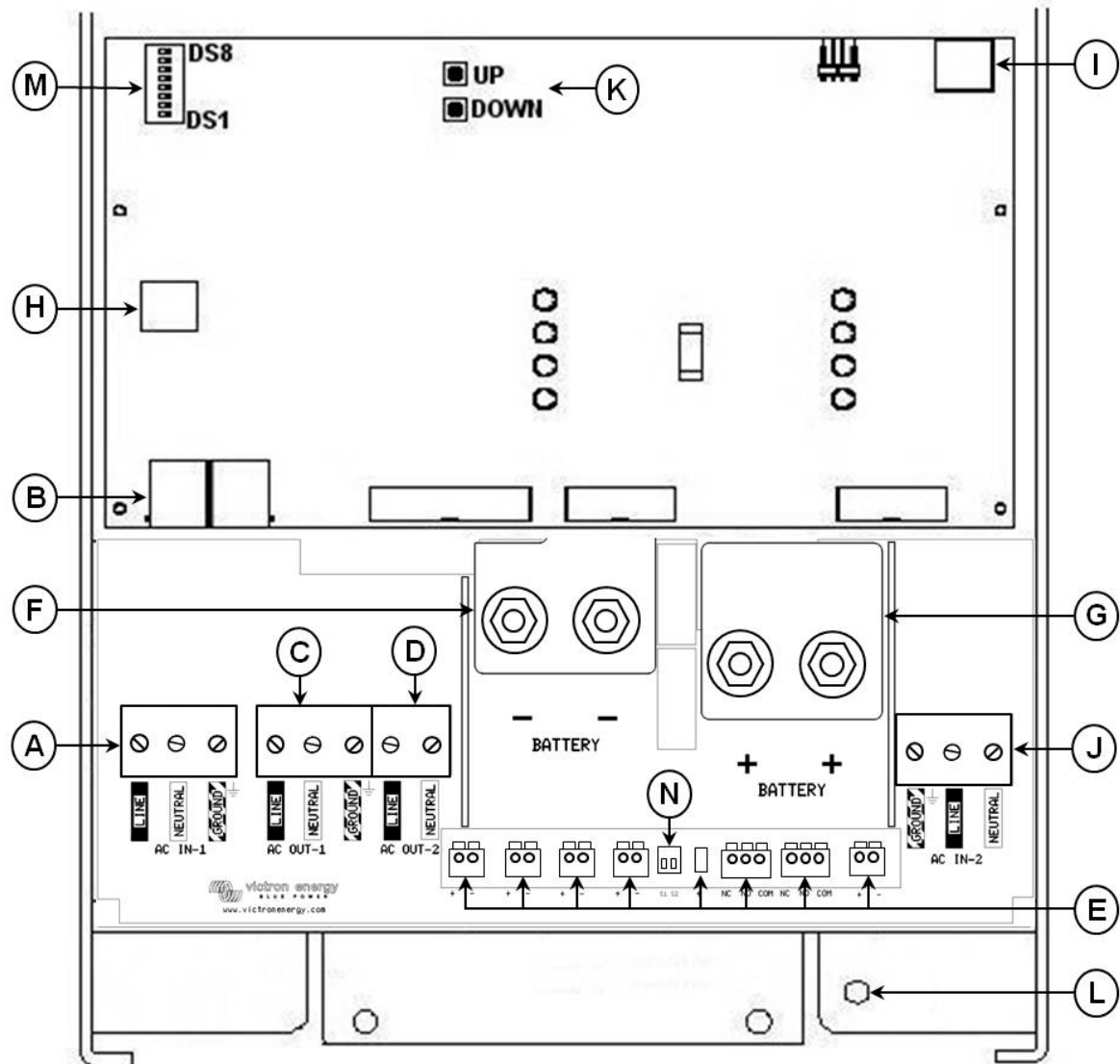
AC rating: 120V/4A

DC rating: 4A up to 35VDC and 1A upto 60VDC

APPENDIX A: Connection overview

EN

Appendix



APPENDIX A: Connection overview

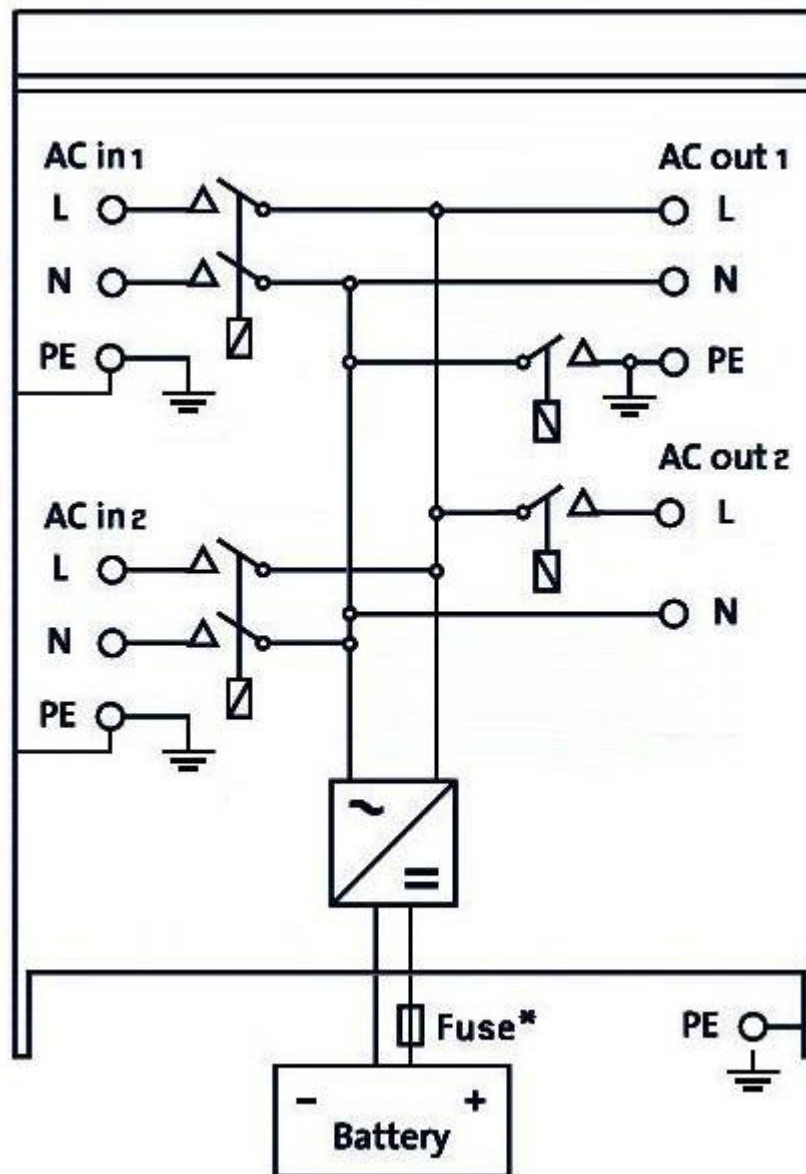
EN:

A	AC input (generator input) AC-in-1. Left to right: GROUND (earth), L (phase), N (neutral).
B	2x RJ45 connector for remote panel and/or parallel and 3-phase operation.
C	AC output AC-out-1. Left to right: L (phase), N (neutral), GROUND (earth).
D	AC output AC-out-2. Left to right: L (phase), N (neutral).
E	Terminals for: (left to right) Temperature sensor Aux input 1 Aux input 2 GND-relay Starter battery plus + (starter battery minus must be connected to service battery minus) Programmable relay contacts K1 Programmable relay contacts K2 Voltage sense
F	Double M8 battery minus connection.
G	Double M8 battery positive connection.
H	Connector for remote switch: Short left and middle terminal to switch "on". Short right and middle terminal to switch to "charger only".
I	Alarm contact: (left to right) NC, NO, COM.
J	AC input (shore/grid supply) AC-in-2. Left to right: L (phase), N (neutral), GROUND (earth).
K	Pushbuttons for set-up mode
L	Primary ground connection (PE).
M	DIP switches for set-up mode.
N	Slide switches, factory setting SW1= right position, SW2 = right position. SW1: No application. To be used for future features. SW2: INT(R) = internal GND relay selected, EXT(L) = external GND relay selected (to connect ext GND relay: see E).

APPENDIX B: Block diagram

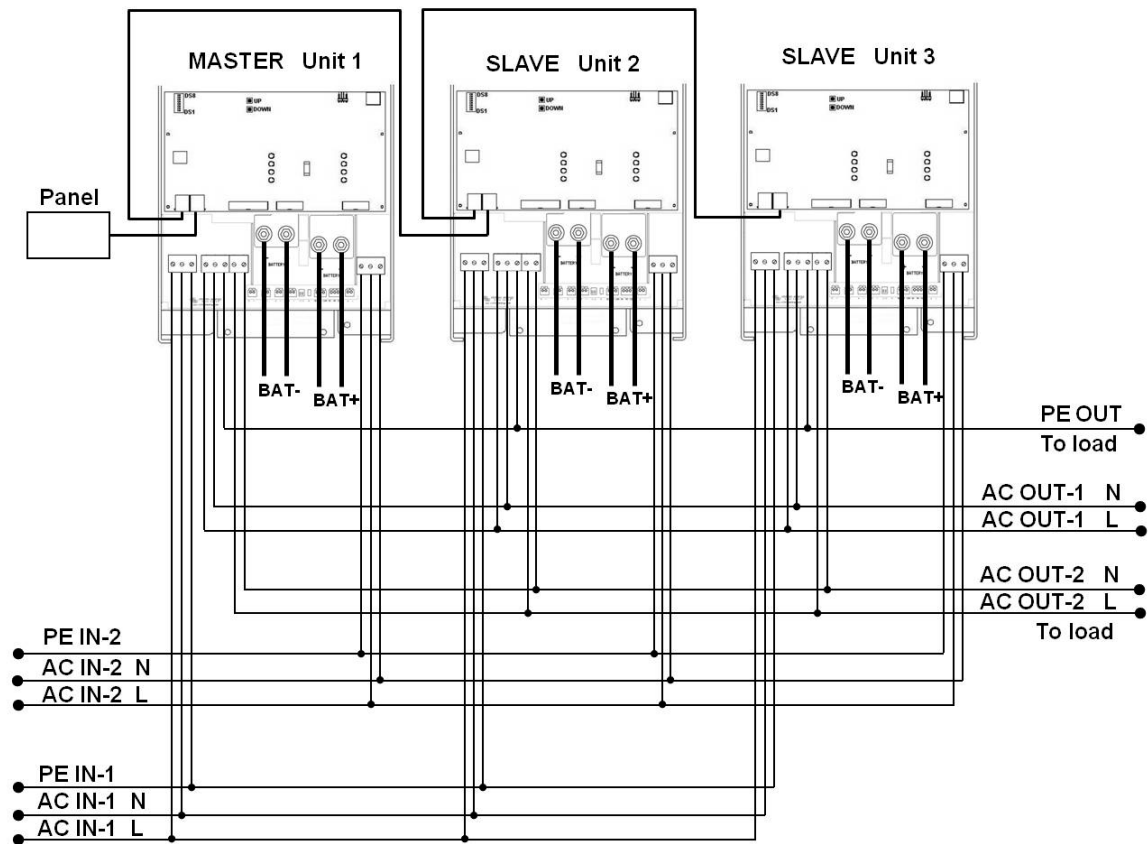
EN

Appendix



* See table in Chapter 4.2 "Recommended DC fuse".

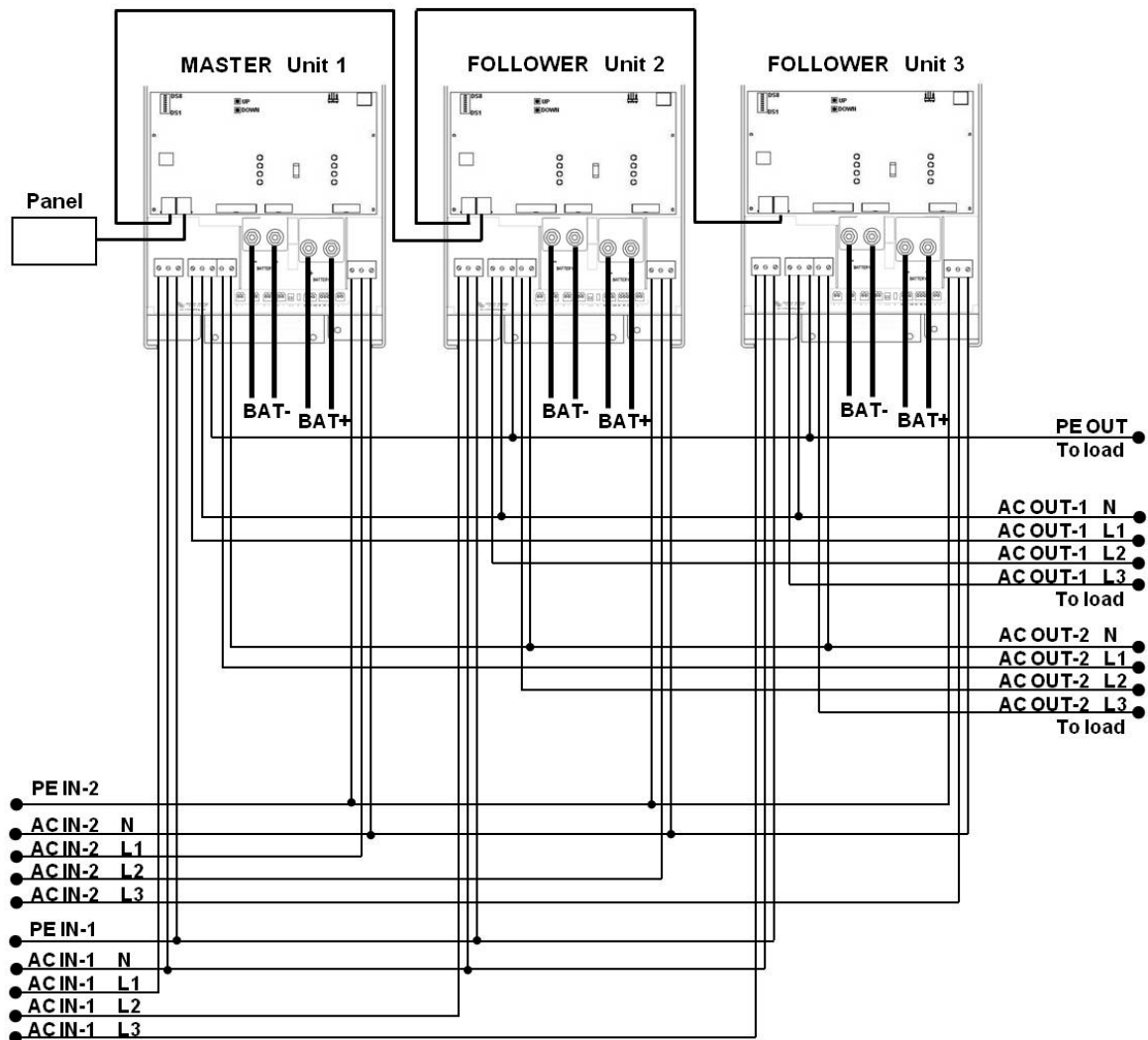
APPENDIX C: Parallel connection



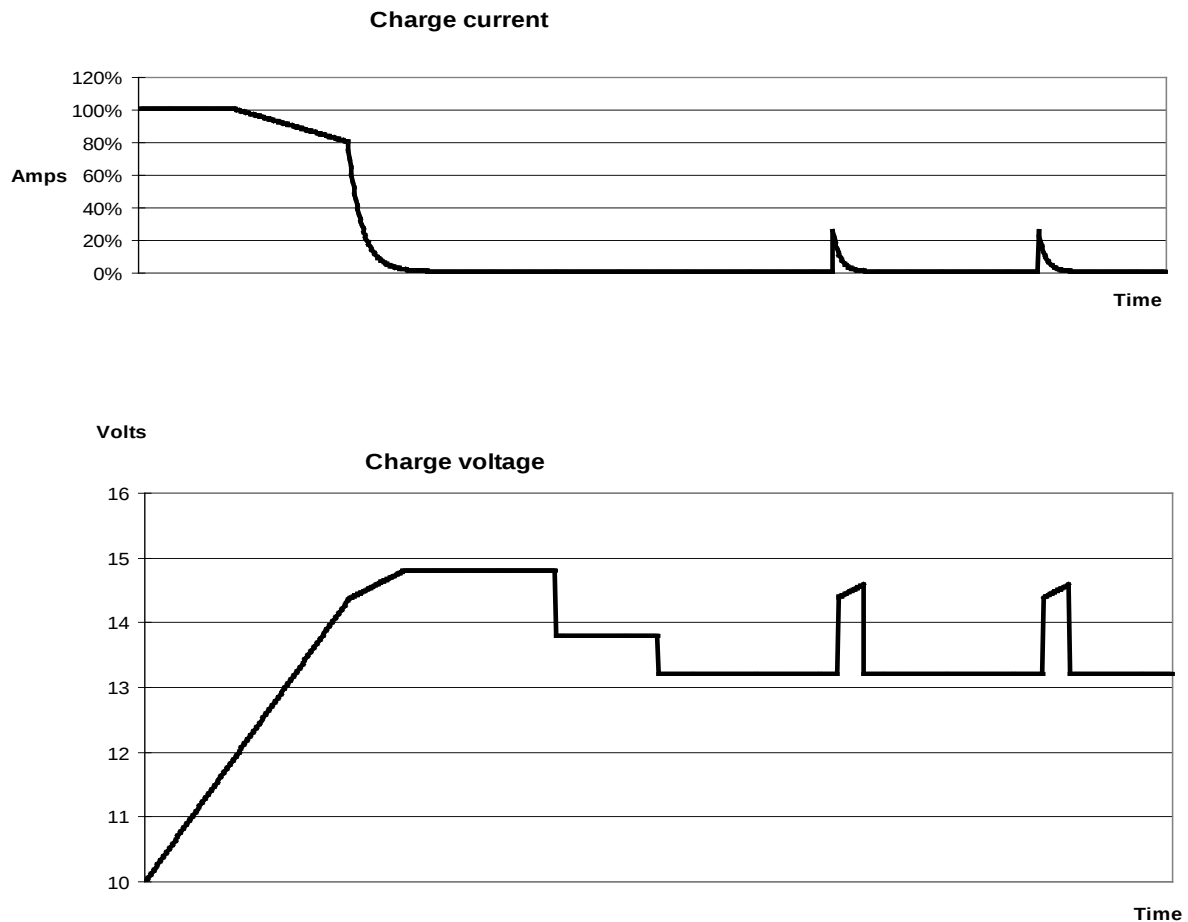
APPENDIX D: Three-phase connection

EN

Appendix



APPENDIX E: Charge characteristics



4-stage charging:

Bulk

Entered when charger is started. Constant current is applied until nominal battery voltage is reached, depending on temperature and input voltage, after which constant power is applied up to the point where excessive gassing is starting (14.4V resp. 28.8V, temperature-compensated).

Battery Safe

The applied voltage to the battery is raised gradually until the set Absorption voltage is reached. The Battery Safe Mode is part of the calculated absorption time.

Absorption

The absorption period is dependent on the bulk period. The maximum absorption time is the set Maximum Absorption time.

Float

Float voltage is applied to keep the battery fully charged

Storage

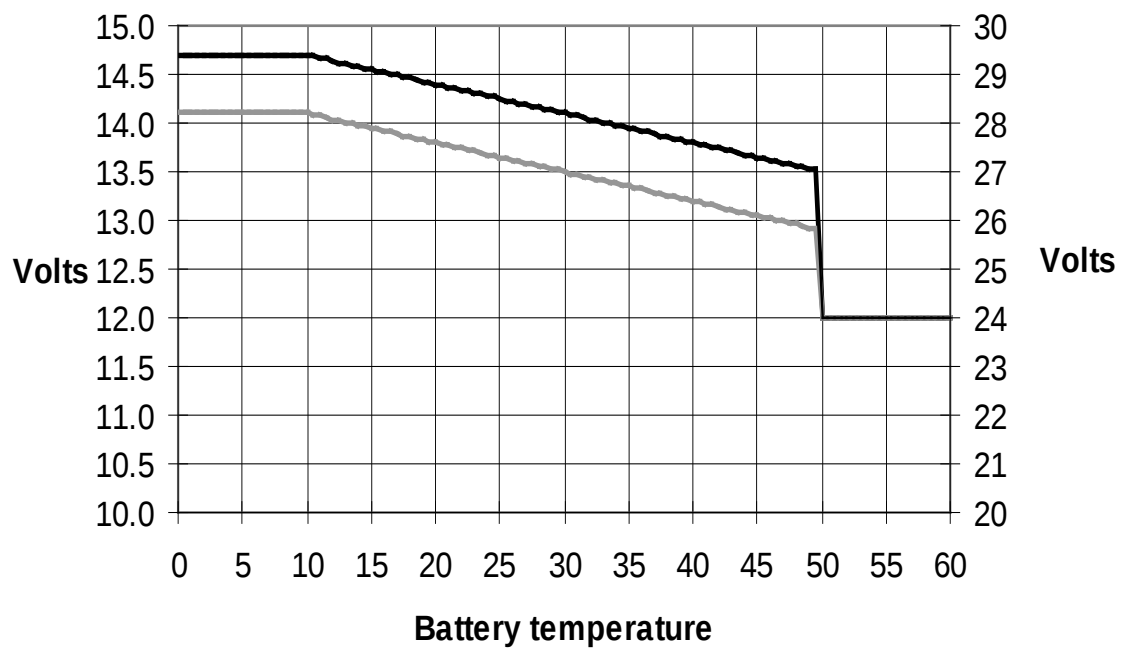
After one day of float charge the output voltage is reduced to storage level. This is 13,2V resp. 26,4V (for 12V and 24V charger). This will limit water loss to a minimum when the battery is stored for the winter season.

After an adjustable time (default = 7 days) the charger will enter Repeated Absorption mode for an adjustable time (default = one hour) to 'refresh' the battery.

APPENDIX F: Temperature compensation

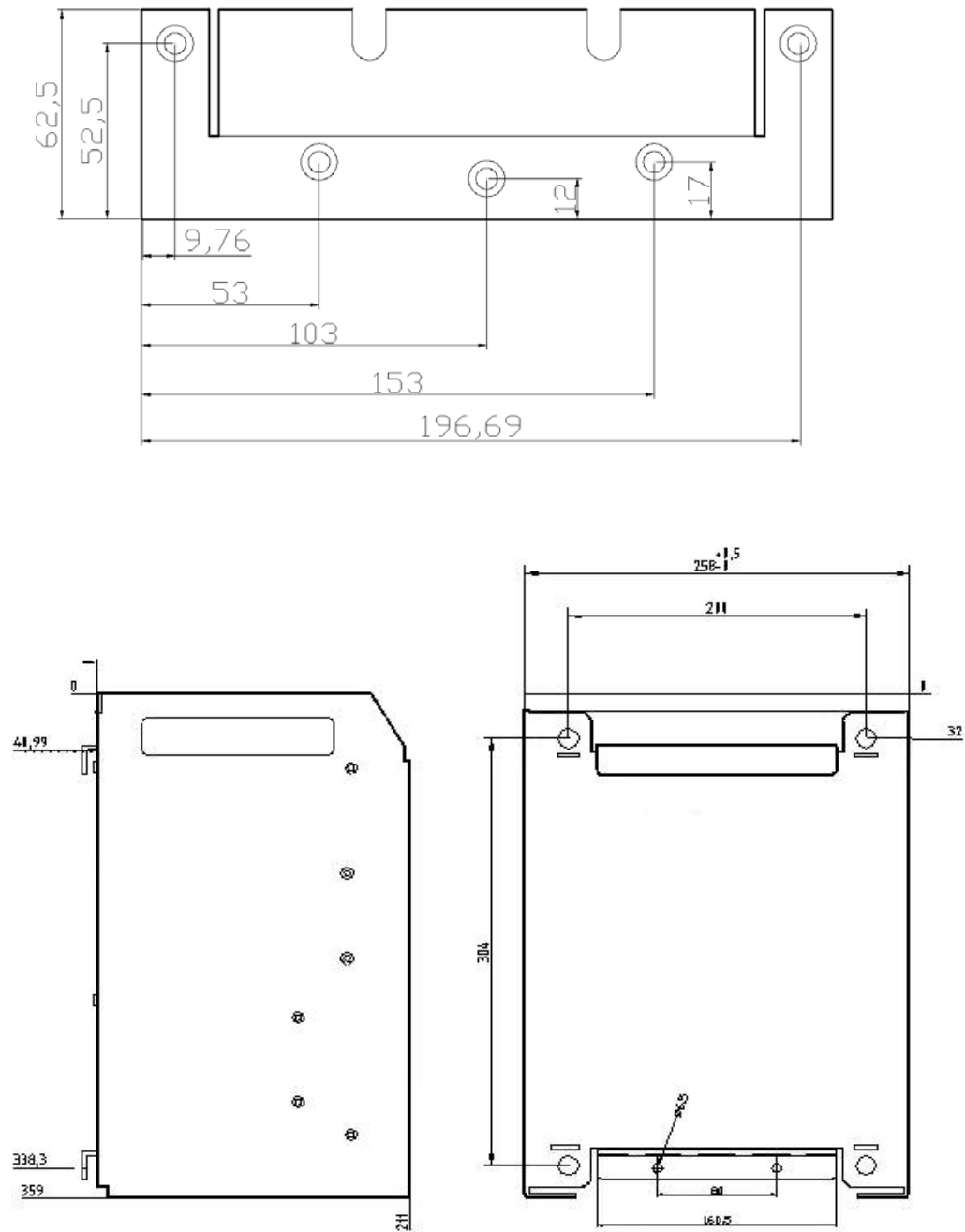
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Appendix



Default output voltages for Float and Absorption are at 25°C.
Reduced Float voltage follows Float voltage and Raised Absorption voltage follows Absorption voltage.
In adjust mode temperature compensation does not apply.

APPENDIX G: Dimensions



Victron Energy Blue Power

Distributor:

Serial number:

Version : 08
Date : September 5th, 2017

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