ENGLISH



MultiPlus 2kW 230V

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1. Safety instructions

General

Please read the documentation supplied with this product first, so that you are familiar with the safety signs en 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 ELECTRIC 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 uninterruptible 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

During 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 °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. General

Multifunctional

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

Uninterrupted AC power

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

Parallel and 3-phase operation capability

Up to 6 inverters can operate in parallel to achieve higher power output.

Operation in 3-phase configuration is also possible.

PowerControl – Dealing with limited generator or shore side power

With a Multi Control Panel a maximum generator or shore current can be set. The MultiPlus will then take account of other AC loads and use whatever is extra for charging, thus preventing the generator or shore supply from being overloaded.

PowerAssist – Boosting the capacity of shore or generator power

This feature takes the principle of PowerControl to a further dimension allowing the MultiPlus Compact to supplement the capacity of the alternative source. Where peak power is so often required only for a limited period, it is possible to reduce the size of generator needed or conversely enable more to be achieved from the typically limited shore connection. When the load reduces, the spare power is used to recharge the battery.

Programmable relay

The MultiPlus 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 generator.

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 Battery Safe 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 1A and has a slightly lower output voltage.

Increasing service life of the battery: temperature compensation

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.

The temperature sensor is not supplied with 48V models. It can be ordered separately. Order number: ASS000001000

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 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 ‘Charger’ LED will light up and the charger commences charging. If the voltage at the ‘AC-in’ terminal is not within specifications, the inverter will switch on.

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

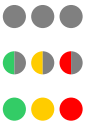


When only the charger function is required, ensure that the switch is switched to ‘charger only’. This prevents the inverter from being switched on if the mains voltage is lost, thus preventing the batteries from running flat.

3.2. Remote control

Remote control is possible with a 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 in Section 2.

3.3. LED Indications



LED off

LED flashes

LED illuminated

Inverter/Charger

	**On / Off / Charger-only switch = On** The inverter is switched on and supplies power to the load.
	**On / Off / Charger-only switch = On** The inverter is switched on and supplies power to the load. Pre-alarm: overload, or battery voltage low, or inverter temperature high
	**On / Off / Charger-only switch = On** The inverter is switched off due to one of the following alarms: overload, or battery voltage low, or inverter temperature high, or DC ripple voltage too high.
	**On / Off / Charger-only switch = On** The AC input voltage is switched through and the charger operates in float mode.

	**On / Off / Charger-only switch = On. PowerControl and PowerAssist:** The AC input is switched through and the charge current is zero. The inverter is switched on and, in case of PowerAssist, assists the AC input by supplying additional power to the load (see section 2.1).
	**On / Off / Charger-only switch = On. Energy Storage System (ESS):** The AC input voltage is switched through. The inverter is switched on and supplies power to the load, or excess power to the mains.

Charger only

	**On / Off / Charger-only switch = Charger only** The AC input voltage is switched through and the charger operates in bulk or absorption mode.
	**On / Off / Charger-only switch = Charger only** The AC input is switched through and the charger operates in float or storage mode.



The MultiPlus will shut down if four abnormal events occur within 30 seconds. The MultiPlus can be reset by switching to Off and then to On.

4. Installation

This product should be installed by a qualified electrician.

CAUTION – To reduce risk of injury, charge only VRLA or Li-Ion batteries. Other types of batteries may burst causing personal injury and damage!

4.1. Location

The product must be installed in a dry and well-ventilated area, as close as possible to the batteries. There should be a clear space of at least 10cm above and below the MultiPlus for cooling.

Never mount the product directly above the batteries.

For mounting dimensions see Appendix G [23].

For safety purposes, this product should be installed in a heat-resistant environment. Prevent the presence of e.g. chemicals, synthetic components, curtains or other textiles, etc., in the immediate vicinity.

4.2. Connection of the Battery cables

NO internal DC Fuses.

In order to fully utilize the full capacity of the product, batteries with sufficient capacity and battery cables with sufficient cross section should be used. See table below:

	12/2k/100	48/2k/30
Recommended battery capacity (Ah)	350-1000	100-250
Recommended DC fuse	300A	100A
Recommended cross section (mm2) per + and - connection terminal		
0 – 5 m	70mm-2	25 mm2
5 – 10 m	95mm2	50mm2

Remark: Internal resistance is the important factor when working with low capacity batteries. Please consult your supplier or the relevant sections of our book ‘Energy Unlimited’, downloadable from our website.

Procedure

Proceed as follows to connect the battery cables:

Use a torque wrench with insulated box spanner in order to avoid shorting the battery.

Recommended torque: 12 Nm (M8 nut)

Avoid shorting the battery cables.

- Undo the two screws at the bottom of the enclosure and remove the service panel.
- Connect the battery cables: see Appendix A.
- Tighten the nuts well for minimal contact resistance.

All servicing must be undertaken by qualified personnel.

4.3. Connection of the AC cabling

This is a Safety Class I product (supplied with a protective grounding terminal). **Uninterruptible protective grounding must be provided at the AC input and/or output terminals and/or chassis grounding point located externally on the product.**

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

- In a fixed installation, 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, 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 case of a boat, direct connection to the shore ground is not recommended because of potential galvanic corrosion. The solution to this is using an isolation transformer.

The mains input & output terminal connector can be found on the bottom of the MultiPlus, see appendix A. The shore or mains cable must be connected to the connector with a three-wire cable. Use a three-wire cable with a flexible core and a cross section of at least 6 mm². **Recommended torque: 1,6 Nm**

Procedure (see appendix A) Do not invert neutral and phase when connecting the AC.

The inverter does incorporate a mains frequency isolating transformer. This precludes the possibility of DC current at any AC port. Therefore type A RCD's can be used.

4.4. Optional Connections

A number of optional connections are possible:

Undo the four screws at the front of the enclosure and remove the front panel.

4.4.1. Second Battery

The Multi has a connection (+) for charging a starter battery. For connection see appendix A.

Trickle charge output is protected by automatic overcurrent & overload protection (trip current 1A Imax= 5,5A)

4.4.2. Temperature Sensor

The temperature sensor may be used for temperature-compensated charging. The sensor is insulated and must be mounted on the battery minus pole. Default output voltages for Float and Absorption are at 25°C. In adjust mode temperature compensation is disabled.



The temperature sensor is not supplied with 48V models. It can be ordered separately. Order number: ASS000001000

4.4.3. Remote Control

The product can be remotely controlled in two ways:

- With an external on/off switch (Remove Link "Remote Switch connector H")
- With a Multi Control Panel

Please see section 5.4 for appropriate DIP switch settings.

4.4.4. Programmable relay

The MultiPlus 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).

4.4.5. Parallel Connection (see appendix C)

The MultiPlus 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 MultiPlus units plus optional control panel) will require subsequent configuration (see Section 5).

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

- A maximum of six units connected in parallel.
- Only identical devices may be connected in parallel.
- 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 MultiPlus units.
- Place the MultiPlus units close to each other, but allow at least 10 cm for ventilation purposes under, above and beside the units.
- 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 MultiPlus units in the system (with a maximum of one sensor per MultiPlus). Temperature compensation during battery charging responds to the sensor indicating the highest temperature.
- Only one remote can be connected to the system.

4.4.6. Three-phase operation (see appendix D)

The MultiPlus 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 (MultiPlus units plus an optional control panel) will require subsequently configuration (see Section 5).

Pre-requisites: see Section 4.4.5.

5. Configuration

Settings may only be changed by a qualified engineer.

Carefully read the instructions before changes are made.

Batteries should be placed in a dry and well-ventilated area during charging.

5.1. Standard settings: ready for use

On delivery, the MultiPlus is set to standard factory values. In general, these settings are suitable for single-unit operation.

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

Standard MultiPlus factory settings

Inverter frequency	50 Hz
Input frequency range	45 - 65 Hz
Input voltage range	187 - 265 VAC
Inverter voltage	230 VAC
Stand-alone / parallel / 3-phase	stand-alone
Search mode	off
Ground relay	on
Charger on/ off	on
Battery charge algorithm	four-stage adaptive with BatterySafe mode
Charge current	100% of the maximum charge current
Battery type	Victron Gel Deep Discharge (also suitable for Victron AGM Deep Discharge)
Automatic equalisation charging	off
Absorption voltage	14.4 / 28.8 / 57.6V
Absorption time	up to 8 hours (depending on bulk time)
Float voltage	13.8 / 27.6 / 55.2V
Storage voltage	13.2 / 26.4 / 52.8V (not adjustable)
Repeated absorption time	1 hour
Absorption repeat interval	7 days
Bulk protection	off
AC input current limit	12A (= adjustable current limit for PowerControl and PowerAssist functions)
UPS feature	on
Dynamic current limiter	off
WeakAC	off
BoostFactor	2
Programmable relay	alarm function

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.

Input frequency range

Input frequency range accepted by the MultiPlus. The MultiPlus synchronises within this range with the AC input frequency. The output frequency is then equal to the input frequency.

Input voltage range

Voltage range accepted by the MultiPlus. The MultiPlus synchronises within this range with the AC input voltage. The output voltage is then equal to the input voltage.

Adjustability:

Inverter voltage

Output voltage of the MultiPlus in battery operation.

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

create a 3-phase system.

The standard product settings are for standalone operation. For parallel, or three phase operation see section 4.4.5 and 4.4.6.

Search mode

If search mode is ‘on’, the power consumption in no-load operation is decreased by approx. 70%. In this mode the MultiPlus, 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.

Search Mode can be set with a DIP switch.

Search Mode ‘shut down’ and ‘remain on’ load levels can be set with VEConfigure.

The standard settings are:

AES (Automatic Economy Switch)

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

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.

Ground relay (see appendix B)

With this relay (H), the neutral conductor of the AC output is grounded to the chassis when the back-feed safety relay is open. This ensures the correct operation of earth leakage circuit breakers in the output.

If a non-grounded output is required during inverter operation, this function must be turned off. (Use VEConfigure)

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

This is the recommended charge curve. See the help files in the software configuration programs for other features.

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 flooded batteries. Four charging voltages can be set with DIP switches.

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.

Absorption time

The absorption time depends on the bulk time (adaptive charge curve), 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 charge curve, this determines the maximum absorption time.

Storage voltage, Repeated Absorption Time, Absorption Repeat Interval

See Section 2.

Bulk Protection

Default setting: off. 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).

AC input current limit

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 MultiPlus switches to inverter operation practically without interruption. The MultiPlus can therefore be used as an Uninterruptible Power Supply (UPS) for sensitive equipment such as computers or communication systems. The output voltage of some small generator sets is too unstable and distorted for using this setting* – the MultiPlus would continually switch to inverter operation. For this reason, the setting can be turned off. The MultiPlus will then respond less quickly to AC input voltage deviations. The switchover time to inverter operation is consequently slightly longer, but most equipment (most computers, clocks or household equipment) is not adversely impacted. Recommendation: Turn the UPS feature off if the MultiPlus fails to synchronise, or continually switches back to inverter operation.

*In general, the UPS setting can be left ‘on’ if the MultiPlus is connected to a generator with a ‘synchronous AVR regulated alternator’.

The UPS mode may have to be set to ‘off’ if the MultiPlus is connected to a generator with a ‘synchronous capacitor regulated alternator’ or an asynchronous alternator.

Dynamic current limiter

Intended for generators, the AC voltage being generated by means of a static inverter (so-called ‘inverter’ generators). In these generators, rpm 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 MultiPlus will reduce charge current until the set current limit is reached. This allows the generator engine to get up to speed.

This setting is also often used for ‘classic’ 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.

BoostFactor

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

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).

VEConfigure software

With VEConfigure software the relay can also be programmed for other purposes, for example to provide a generator starting signal.

5.3. Configuration of the MultiPlus

The following hardware is required:

A MK3-USB (VE.Bus to USB) interface.

Alternatively, the Interface MK2.2b (VE.Bus to RS232) can be used (RJ45 UTP cable needed).

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 MultiPlusses (parallel or three phase operation) can be configured in a simple manner. 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 MultiPlusses, **VE.Bus System Configurator** software must be used. The software can be downloaded free of charge at www.victronenergy.com

5.4. Configuration with DIP switches

Some settings can be changed with DIP switches.

Procedure:

a) Turn the MultiPlus on, preferably without load and without AC voltage on the input. The MultiPlus will then operate in inverter mode.

b) Set the DIP switches as required.

c) Store the settings by toggling DIP switch 3 one time.

5.4.1. DIP switch 1 to 3

These DIP switches can be used to set:

- Battery charge voltage and Absorption time
- Search mode

Ds1-ds2: Setting the charge algorithm (For more system settings use VEConfigure)

Ds1-ds2	Absorption voltage	Float voltage	Storage Voltage	Absorption Time (hours)	Suitable for
Ds1=off Ds2=off (default)	14.4 57.6	13.8 55.2	13.2 52.8	8	Gel Victron Deep Discharge Gel Exide A200 AGM Victron Deep Discharge
Ds1=on Ds2=off	14.1 56.4	13.8 55.2	13.2 52.8	8	Gel Victron Long Life (OPzV) Gel Exide A600 (OPzV) Gel MK battery Li-ion (LiFePO4)
Ds1=off Ds2=on	14.7 58.8	13.8 55.2	13.2 52.8	5	AGM Victron Deep Discharge Tubular plate or OPzS batteries in semi-float mode AGM spiral cell
Ds1=on Ds2=on	15.0 60.0	13.8 55.2	13.2 52.8	6	Tubular plate or OPzS batteries in cyclic mode

DS3 double function.

Ds3: Search Mode and store **off = off** **on = on**

Store the settings by toggling DIP switch 3 one time.

5.4.2. Exemplary settings

Example 1 is the factory setting (since factory settings are entered by computer, all DIP switches of a new product are set to ‘off’).

DS-1 off Charge voltage DS-2 off Charge voltage DS-3 off Charge voltage	DS-1 off DS-2 on DS-2 off	DS-1 on DS-2 on DS-3 on
Example 1: (factory setting) 1.2 GEL 14.4 V 3 Search mode off 3 Store setting: off→ on→ off	Example 2 1.2 Gel Victron Long Life Li-ion (LiFePO4) 3 Search mode off 3 Store setting: off→ on→ off	Example 3 1.2 Tubular plate 15V 3 Search mode off 3 Store setting: off→ on→ off

Store the settings by toggling DIP switch 3 one time.

The LEDs ‘charger’ and ‘alarm’ will flash to indicate acceptance of the settings.

6. Maintenance

The MultiPlus does not require specific maintenance. All maintenance should be performed by qualified personnel. Avoid moisture and oil/soot/vapours, and keep the device clean.

7. Trouble Shooting Table

Proceed as follows for quick detection of common faults.

DC loads must be disconnected from the batteries and the AC loads must be disconnected from the inverter before the inverter and/or battery charger is tested.

Consult your Victron Energy dealer if the fault cannot be resolved.

Problem	Cause	Solution
The inverter fails to operate when switched on	The battery voltage is too high or too low	Ensure that the battery voltage is within the correct value.
The inverter fails to operate	Processor in no function-mode	Disconnect mains voltage. Switch front switch off, wait 4 seconds. Switch front switch on.
The alarm LED flashes	Pre-alarm alt. 1. The DC input voltage is low	Charge the battery or check the battery connections.
The alarm LED flashes	Pre-alarm alt. 2. The ambient temperature is too high	Place the inverter in a cool and well-ventilated room, or reduce the load.
The alarm LED flashes	Pre-alarm alt. 3. The load on the inverter is higher than the nominal load	Reduce the load.
The alarm LED flashes	Pre-alarm alt. 4. Voltage ripple on the DC input exceeds 1.25Vrms	Check the battery cables and terminals. Check the battery capacity; increase if necessary.
The alarm LED flashes intermittantly	Pre-alarm alt. 5. Low battery voltage and excessive load	Charge the batteries, reduce the load or install batteries with a higher capacity. Use shorter and/or thicker battery cables.
The alarm LED is on	The inverter did cut out following a pre-alarm	Check the table for the appropriate course of action.
The charger is not functioning	The AC input voltage or frequency is out of range	Ensure that the input voltage is between 185Vac and 265Vac, and that the frequency matches the setting.
The battery is not being charged fully	Incorrect charging current	Set the charging current at between 0.1 and 0.2x battery capacity.
	A defective battery connection	Check the battery terminals.
	The absorption voltage has been set to an incorrect value	Adjust the absorption voltage to the correct value.
	The float voltage has been set to an incorrect value	Adjust the float voltage to the correct value.
	The internal DC fuse is defective	Inverter is damaged.
The battery is overcharged	The absorption voltage has been set to an incorrect value	Adjust the absorption voltage to the correct value.
	The float voltage has been set to an incorrect value	Adjust the float voltage to the correct value.
	A defective battery	Replace the battery.
	The battery is too small	Reduce the charging current or use a battery with a higher capacity.
	The battery is too hot	Connect a temperature sensor.
Battery charge current drops to 0 when the absorption voltage is reached	Alt. 1: Battery overtemperature (> 50°C)	• Allow battery to cool down • Place battery in a cool environment • Check for shorted cells

Problem	Cause	Solution
	Alt 2: Battery temperature sensor faulty	Unplug battery temperature sensor from the MultiPlus. Reset the MultiPlus by switching it off, then wait for 4 seconds and switch it on again. If the MultiPlus now charges normally, the battery temperature sensor is faulty and needs to be replaced.

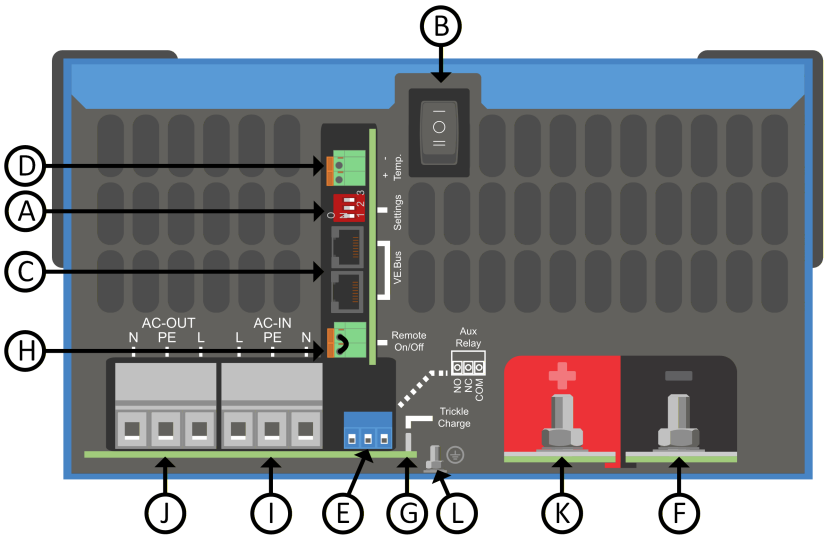
8. Technical Data

MultiPlus	12/2k/100	48/2k/30
PowerControl / PowerAssist	Yes	
Transfer switch	35A	
INVERTER		
Input voltage range	9.5 - 17Vdc	38 - 66Vdc
Output voltage	230Vac ± 2%	
Output frequency[1]	50Hz ± 0,1%	
Cont. output power at 25°C (77°F)	2000W	
Cont. output power at 40°C (104°F)	1800W	
Cont. output power at 65°C (149°F)	1200W	
Peak power	4000W	
Maximum efficiency	93%	95%
Zero-load power	11W	13W
Zero-load power search mode	3W	
CHARGER		
AC Input voltage range	187 - 265Vac	
AC input frequency range	45 - 65Hz	
Charge voltage 'absorption'	14.4V	57.6V
Charge voltage 'float'	13.8V	55.2V
Storage mode	13.2V	52.8V
Charge current house battery [4]	100A	30A
Charge current starter battery	1A	n/a
Battery temperature sensor	Yes	Not included. Order number: ASS000001000
GENERAL		
Programmable relay [5]	Yes	
Protection [2]	a – g	
Operating temperature	-40 to +65°C (-40 to + 140°F), fan assisted cooling	
Humidity	Maximum 95%, non-condensing	
Maximum altitude	2000m	
ENCLOSURE		
Material & colour:	Steel/ABS, blue RAL 5012	
Protection category:	IP 21	
Battery-connection	M8 bolts	
230V AC-connection	Screw terminals 13 mm² (6 AWG)	
Weight	15.5kg (34.2lb)	
Dimensions (h x w x d)	506 x 236 x 147mm (19.92 x 9.29 x 5.79 inch)	
STANDARDS		
Safety	EN-IEC 60335-1, EN-IEC 60335-2-29, EN 62109-1	
Emission / Immunity	EN 55014-1, EN 55014-2, EN-IEC 61000-3-2, EN-IEC 61000-3-3 IEC 61000-6-1, IEC 61000-6-2, IEC 61000-6-3	
Road vehicles	ECE R10-5	

MultiPlus	12/2k/100	48/2k/30
1) Can be adjusted to 60Hz 2) Protection a. Output short circuit b. Overload c. Battery voltage too high d. Battery voltage too low e. Temperature too high f. 230Vac on inverter output g. Input voltage ripple too high	4) Up to 25°C (77°F) ambient 5) Programmable relay which can be set for: • general alarm, DC under voltage or generator start/stop signal function • AC rating: 230V/4A • DC rating: 4A up to 35Vdc, 1A up to 60Vdc	

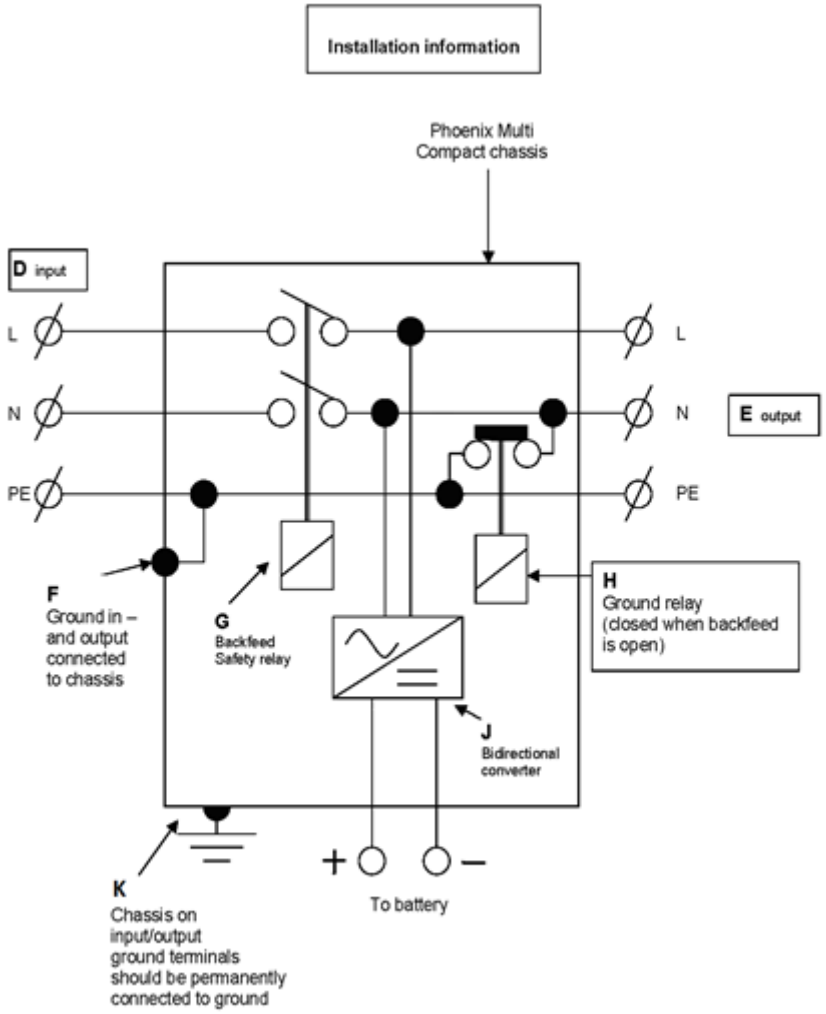
9. APPENDIX

9.1. Appendix A: overview connections



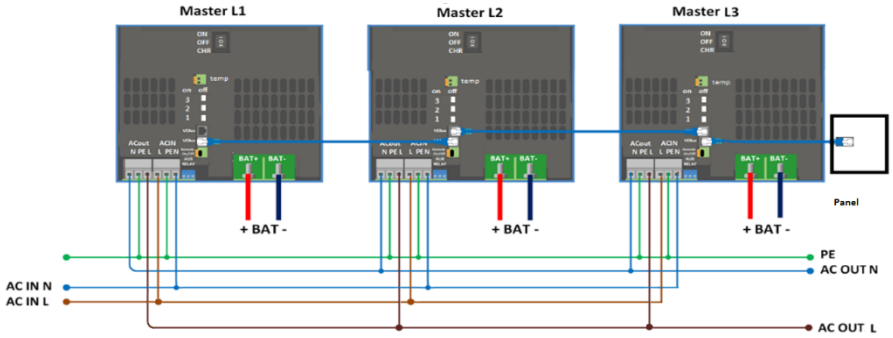
Letter	Description
A	DIP switch (remove cover)
B	On/off/charger only switch
C	VE.BUS Communications port
D	Temperature sensor
E	Alarm contact
F	Battery negative
G	Starter battery plus
H	Remote control
I	AC input
J	AC output
K	Battery positive
L	Earth connection

9.2. Appendix B: installation information

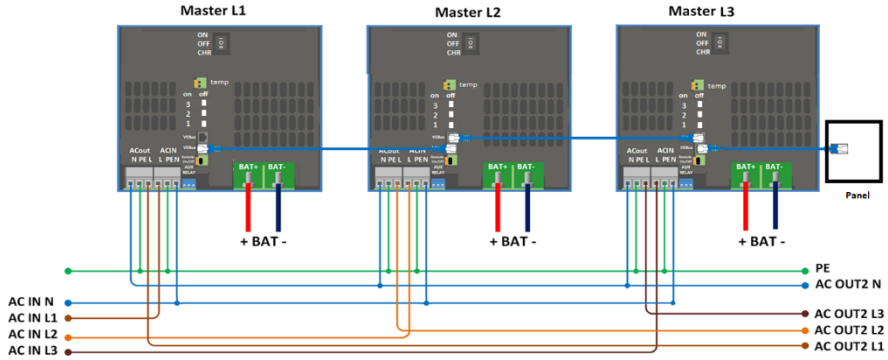


Letter	Description
D	Input
E	Output
F	Ground in– and output connected to chassis
G	Backfeed safety relay
H	Ground relay (closed when backfeed is open)
J	Bidirectional converter
K	Chassis on input/output ground terminals should be permanently connected to ground

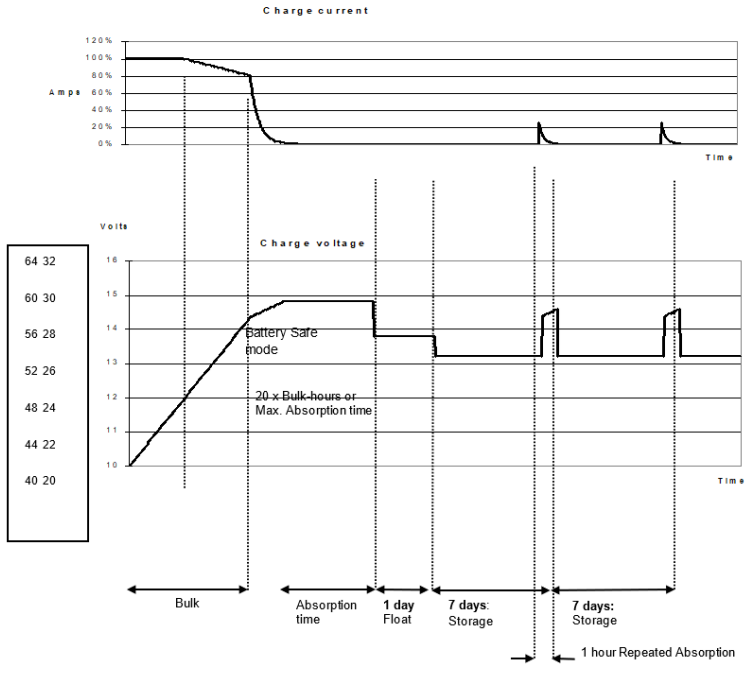
9.3. Appendix C: parallel connection



9.4. Appendix D: three-phase connection



9.5. Appendix E: charge algorithm



4-stage charging:

Bulk: Entered when charger is started. Constant current is applied until the gassing voltage is reached (14.4V resp. 28.8V, temperature compensated).

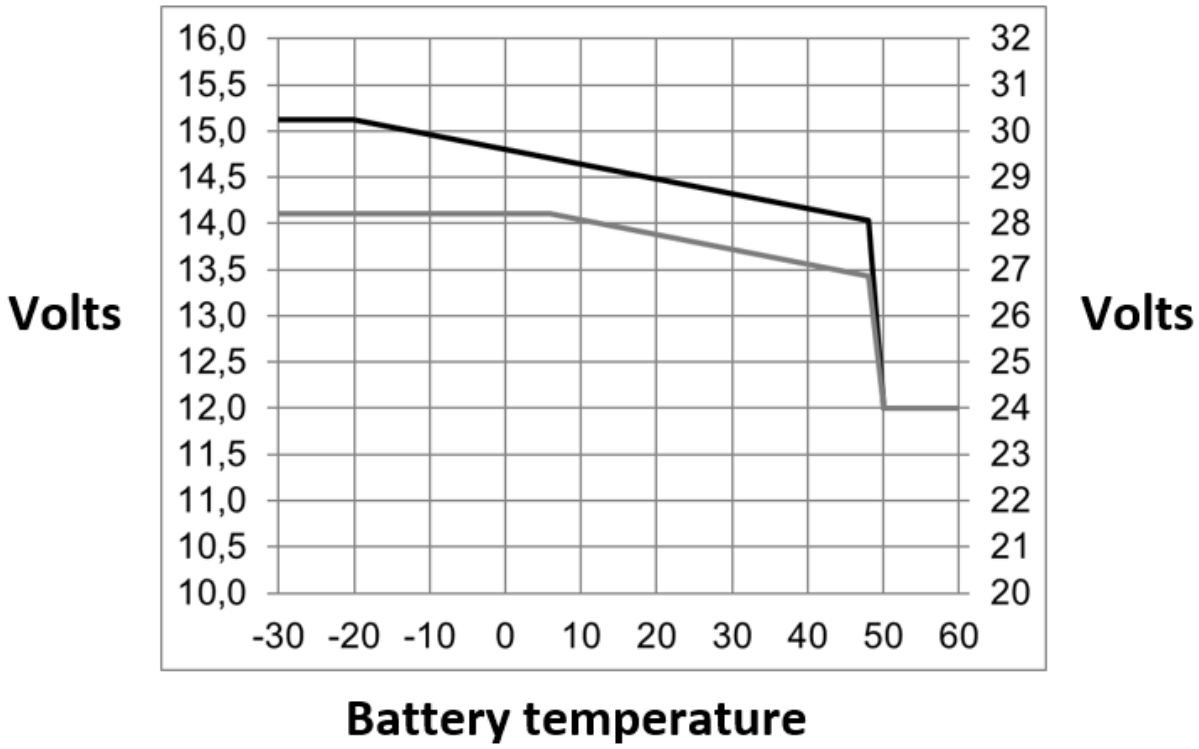
Battery Safe: If, in order to quickly charge a battery, a high charge current in combination with a high absorption voltage has been chosen, the Multi will prevent damage due to excessive gassing by automatically limiting the rate of voltage increase once the gassing voltage has been reached. The Battery Safe period is part of the calculated absorption time.

Absorption: A constant voltage period to fully charge the battery. The absorption time is equal to 20x bulk time or the set maximum absorption time, whichever comes first.

Float: Float voltage is applied to keep the battery fully charged and to protect it against self-discharge.

Storage: After one day of Float charge the charger switches to storage. This is 13,2V resp. 26,4V (for 12V and 24V charger). This will limit water loss to a minimum. After an adjustable time (default = 7 days) the charger will enter Repeated Absorption for an adjustable time (default = 1 hour).

9.6. Appendix F: temperature compensation



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.

9.7. Appendix G: dimensions

