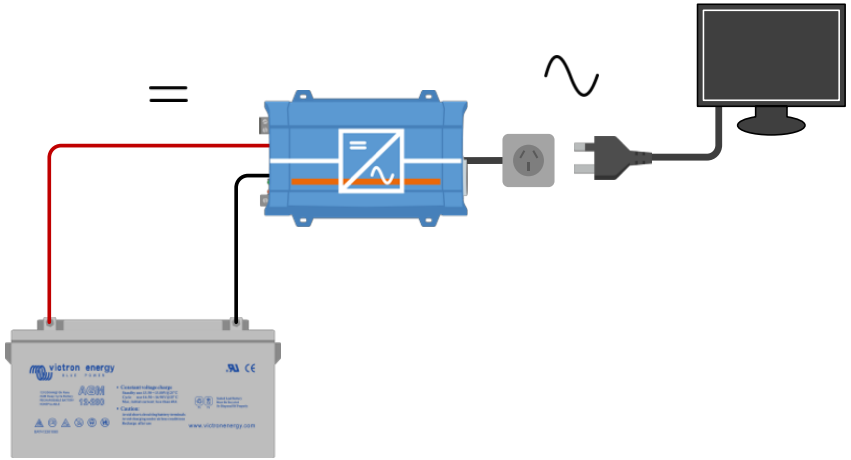
victron energy
BLUE POWER

Training – Inverters and inverter/chargers

Inverter

Inverter

- An inverter converts DC power into AC power
- This so you can run an AC load from a DC battery



Inverters

Phoenix inverters VE.Direct

- Very high start-up power, proven full bridge + toroidal transformer technology
- VE.Direct port for VictronConnect App or GX device
- Fixed or dynamic low voltage cut-off
- Power Saving mode operation
- Remote on/off switch connection or remote control panel
- LED diagnostics

12 Volt	24 Volt	48 Volt
250 VA	250 VA	250VA
375 VA	375 VA	375 VA
500 VA	500 VA	500 VA
800 VA	800 VA	800 VA
1200 VA	1200 VA	1200 VA

Phoenix inverters Smart

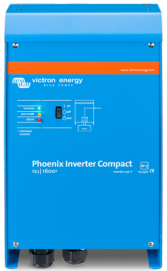
- Very high start-up power, proven full bridge + toroidal transformer technology
- Bluetooth for communication with VictronConnect App
- VE.Direct port for VictronConnect App or CCGX
- Fixed or dynamic low voltage cut-off
- Remote on/off switch connection or remote control panel
- Power Saving mode operation
- LED diagnostics

12 Volt	24 Volt	48 Volt
1600 VA	250 VA	250VA
2000 VA	375 VA	375 VA
3000 VA	500 VA	500 VA

Phoenix Inverters VE.Bus

- Very high start-up power, proven full bridge + toroidal transformer technology
- VE.Bus port for programming via MK3 interface or for connection to a GX device
- Remote on/off via control panel or switch
- Parallel and 3-phase operational
- Power saving mode operation
- Led diagnostics

12 Volt3	24 Volt	48 Volt
1200 VA	1200 VA	
1600 VA	1600 VA	
2000 VA	2000 VA	
3000 VA	3000 VA	3000 VA
	5000 VA	5000 VA



1200 and 1600

2000

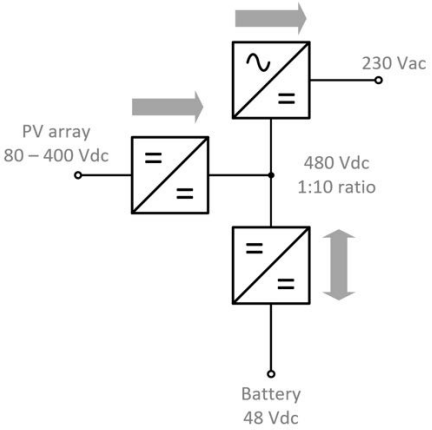
3000

5000

Inverter RS Smart - HF inverter 48V/ 6000

Soon

- 48V 6kVA Inverter with 450V 4kWp PV input
- Small display, VE.Can and VE.Direct
- Supports AC-Coupled PV frequency shift without assistant
- Similar efficiency but lower standby power



Inverter overview

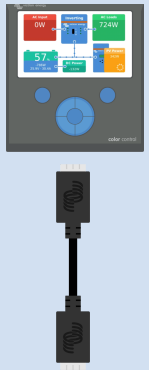
Inverters VE.Direct										
12 V	250	375	500	800	1200	1600	2000	3000		
24 V	250	375	500	800	1200	1600	2000	3000		
48 V	250	375	500	800	1200	1600	2000	3000		

Inverters VE.Bus										
12 V					1200	1600	2000	3000		
24 V					1200	1600	2000	3000	5000	
48 V								3000	5000	

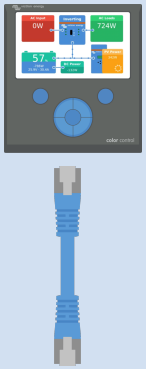
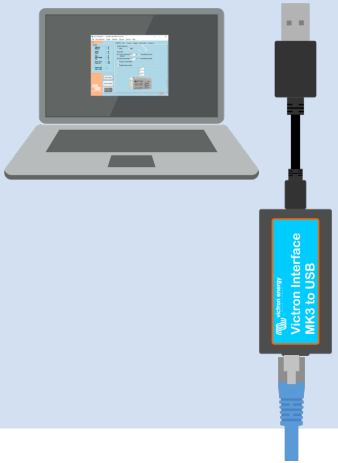
Soon

Inverters RS Smart										
48 V										6000

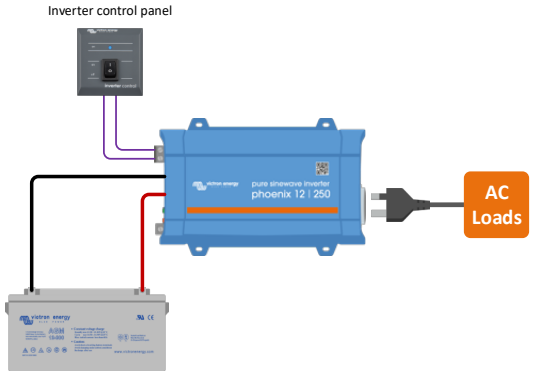
VE Direct inverter accessories

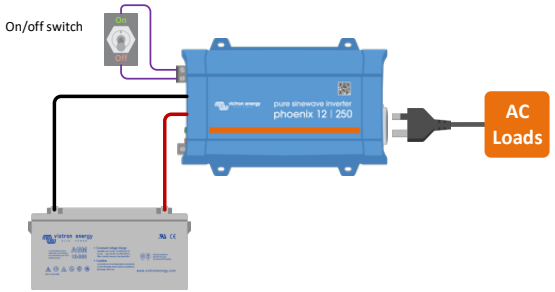
VictronConnect Bluetooth smart dongle	VictronConnect Bluetooth USB interface	VE.Direct cables 0.3 - 10 meter	Inverter control panel
			

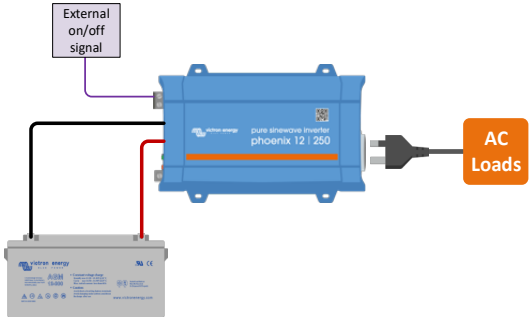
VE.Bus inverter accessories

RJ45 cable 0.3 - 30 meter	Inverter control panel	MK3 - USB interface
		

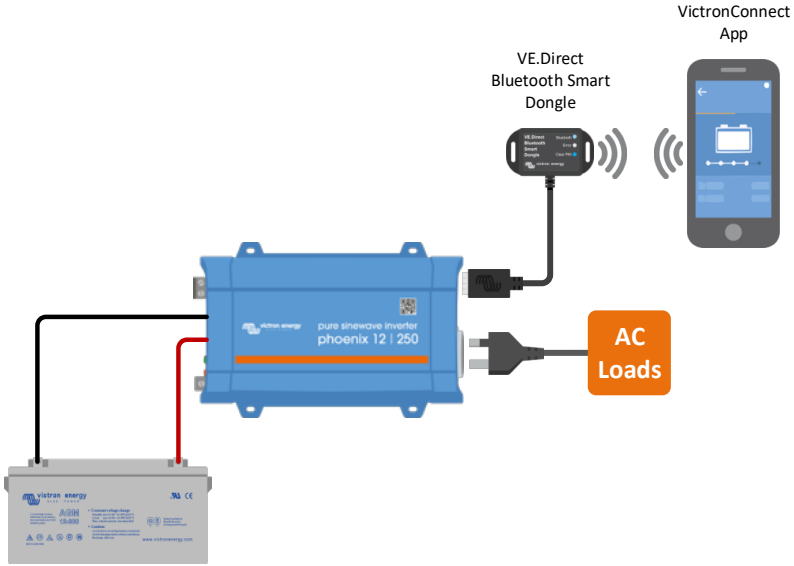
System examples using remote on/off

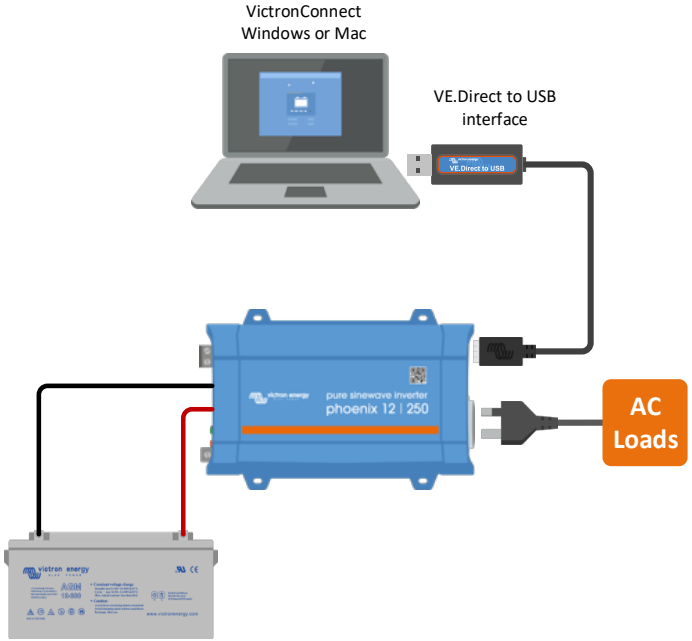




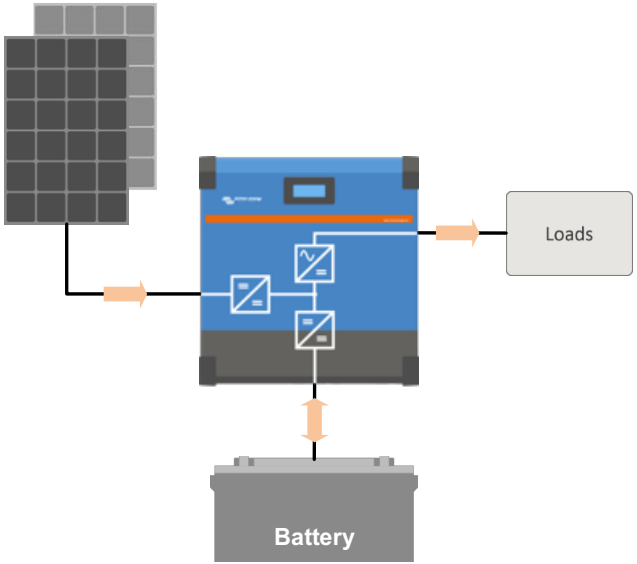


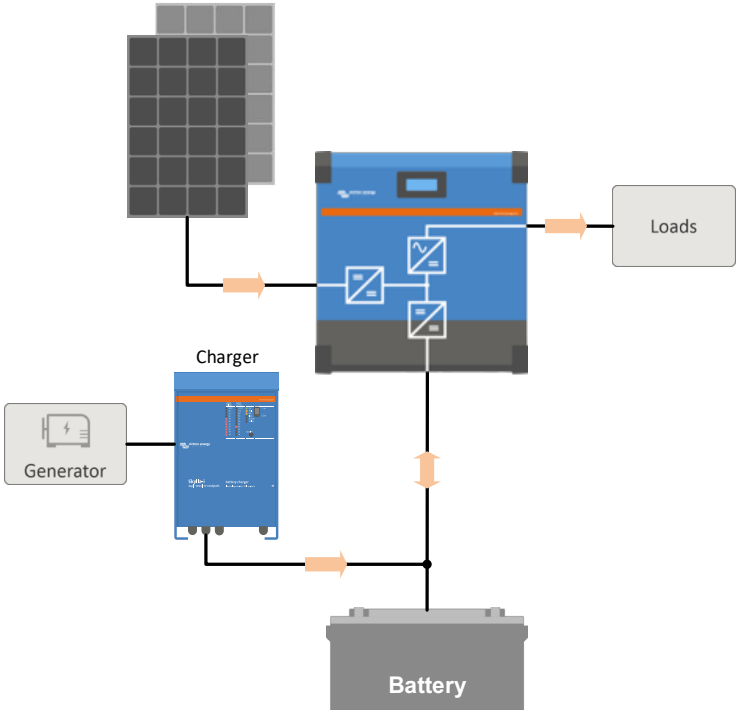
VE.Direct monitoring and setup via VictronConnect





RS inverter system examples





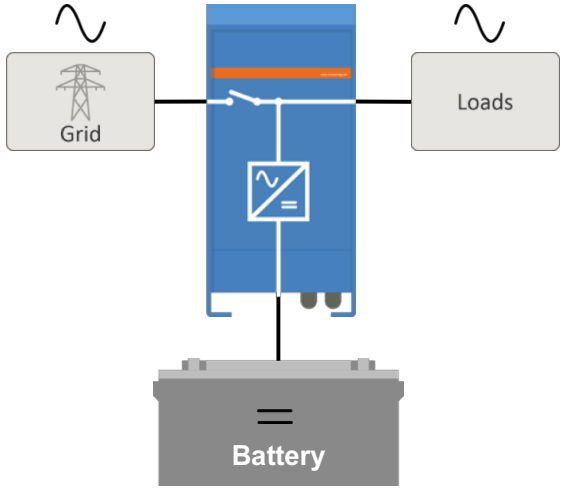
Inverter/charger

Inverter/charger

- An inverter/charger has the functionality of an inverter, a charger and an AC transfer switch.
- The inverter and charger are combined into a bidirectional converter

Main features:

- Unique PowerControl and PowerAssist feature
- Uninterrupted AC power, UPS functionality
- Multiple units can operate in parallel and/or in 3 phase
- Fully computer configurable
- Intelligent and able to communicate with networks
- Available in 230Vac and limited models also in 110Vac



Inside the Victron MultiPlus with Johannes

A detailed explanation of how the MultiPlus works

20 minute video

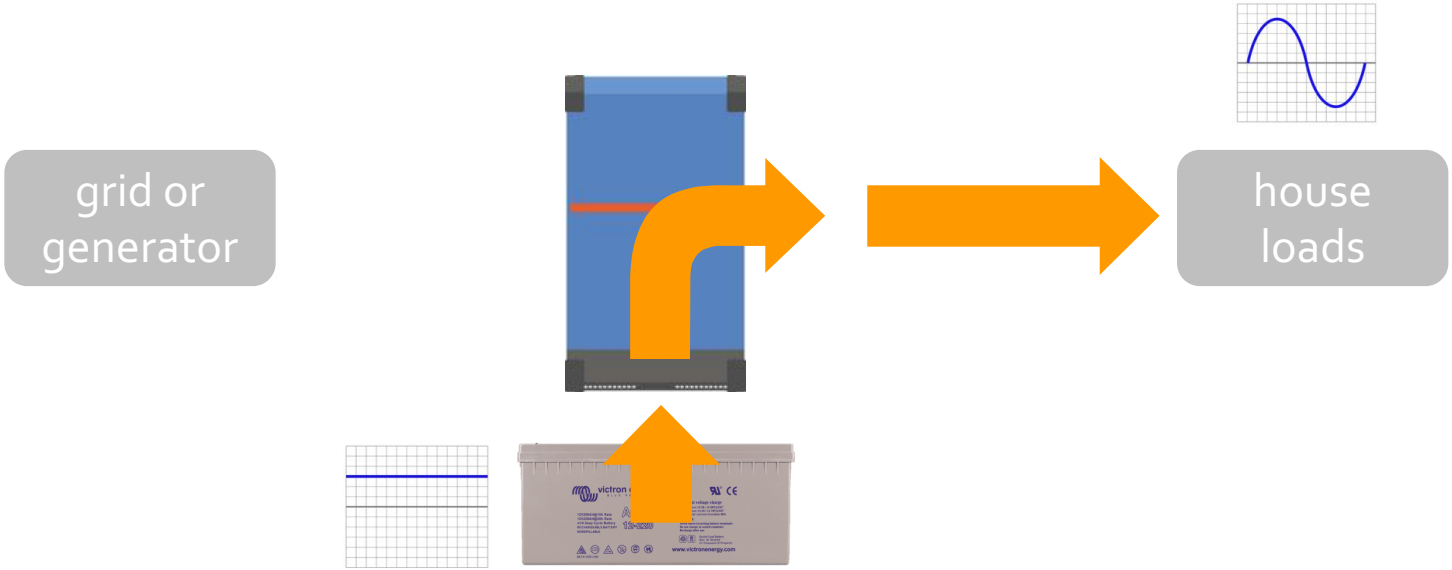
See:

https://www.victronenergy.com/blog/2019/11/28/inside-the-victron-multiplus-with-johannes-boonstra/

Inverting - changing DC into AC

When no grid or generator is connected the Multi is in inverter mode

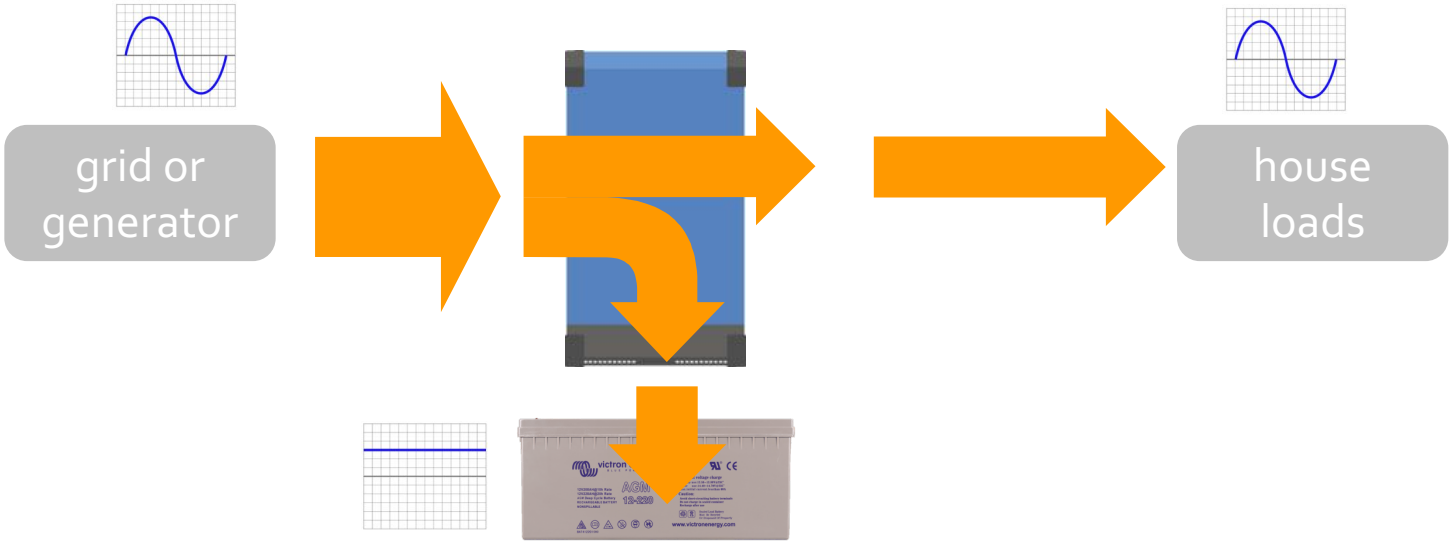
It will supply the AC loads from the battery



Charging - changing AC into DC

When connected to an AC supply the Multi will phase match to this supply

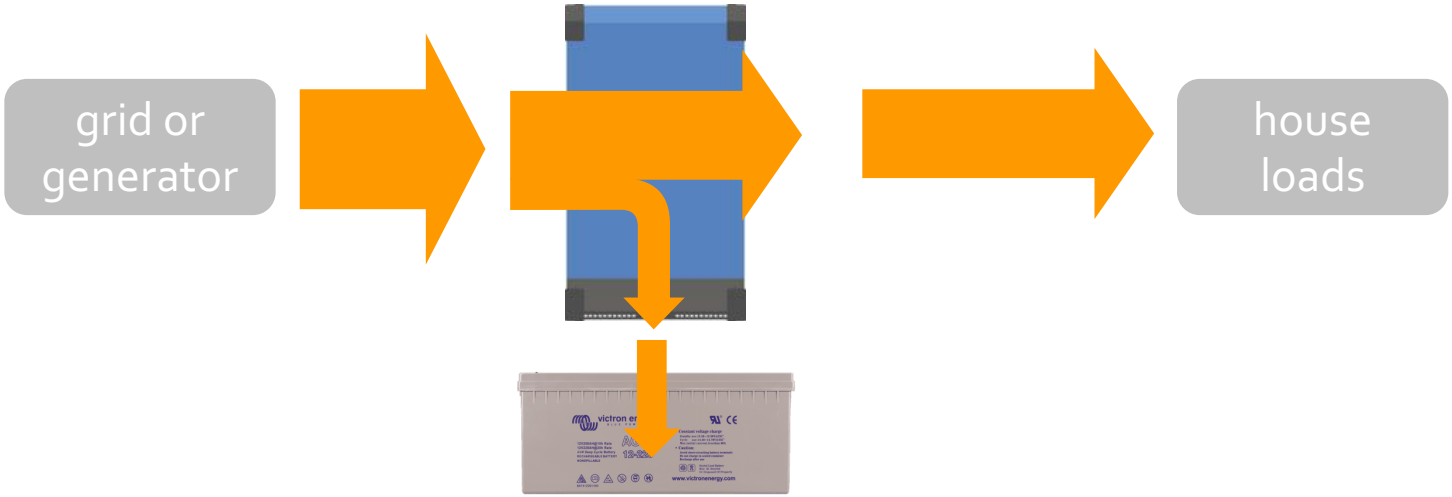
Once matched, the AC supply will supply the AC loads and will charge the battery



PowerControl

If the loads increase the battery charge current will eventually reduce

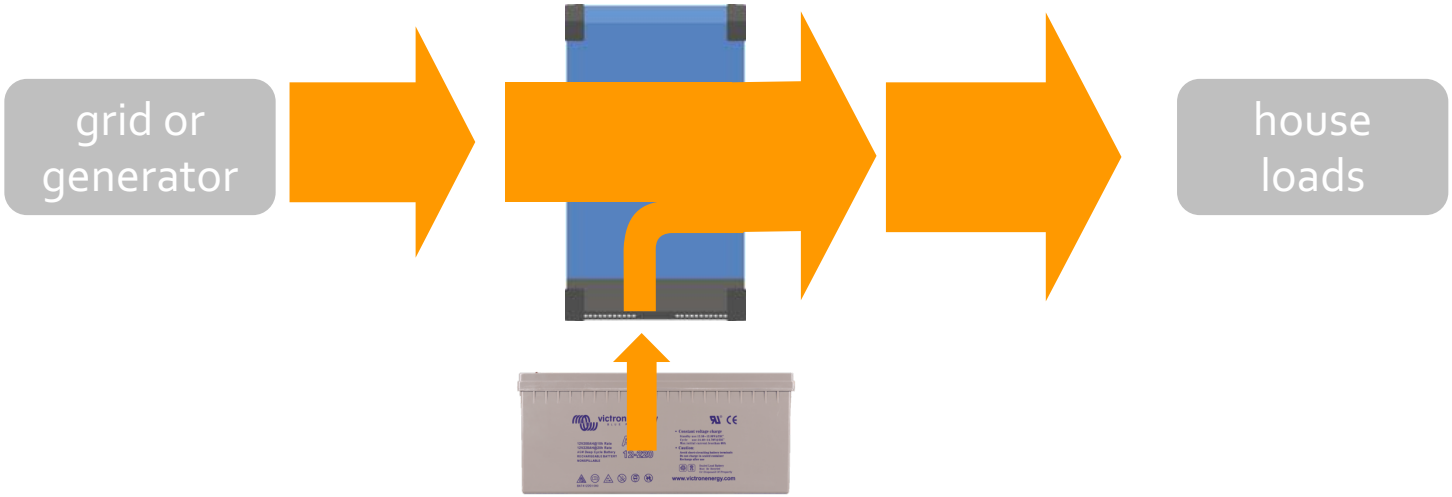
The loads always have first priority and the Multi will not overload the incoming AC supply



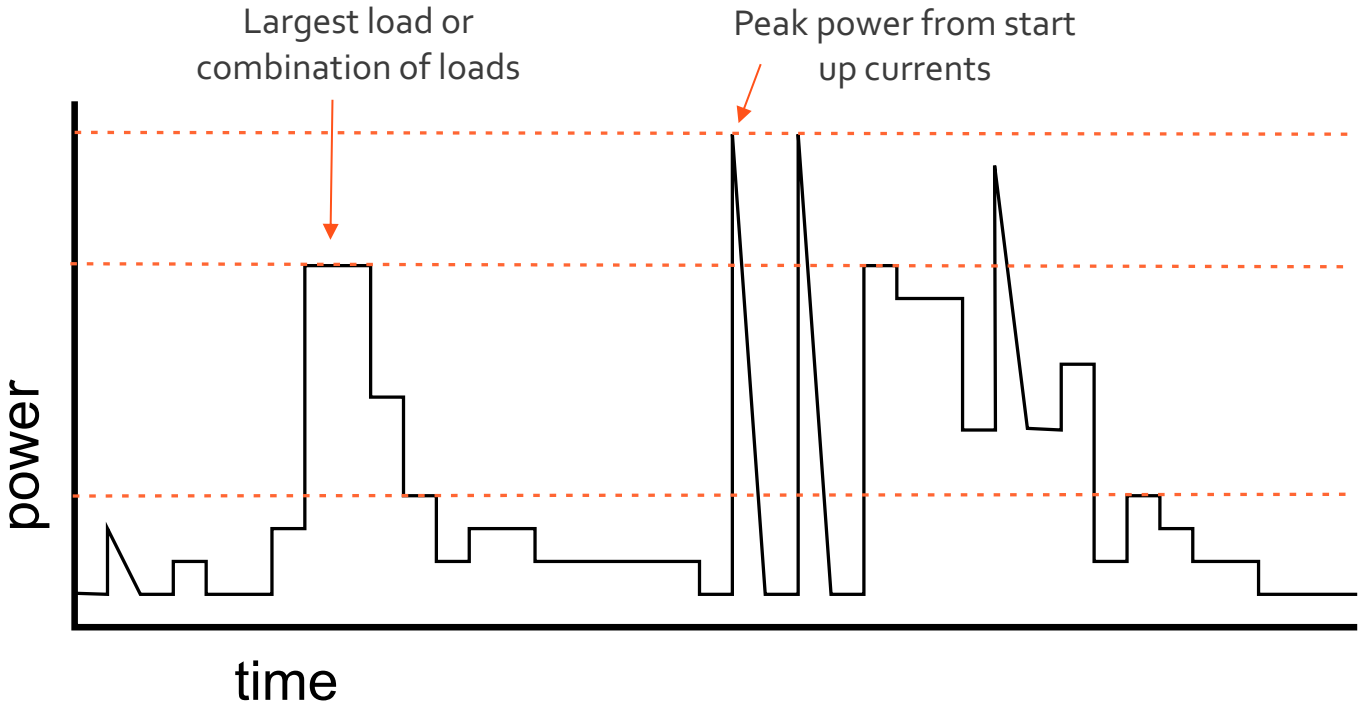
PowerAssist

If the load increases further battery charging will stop

And if the load is further increased, the battery will also provide power to the load



Average load of a system



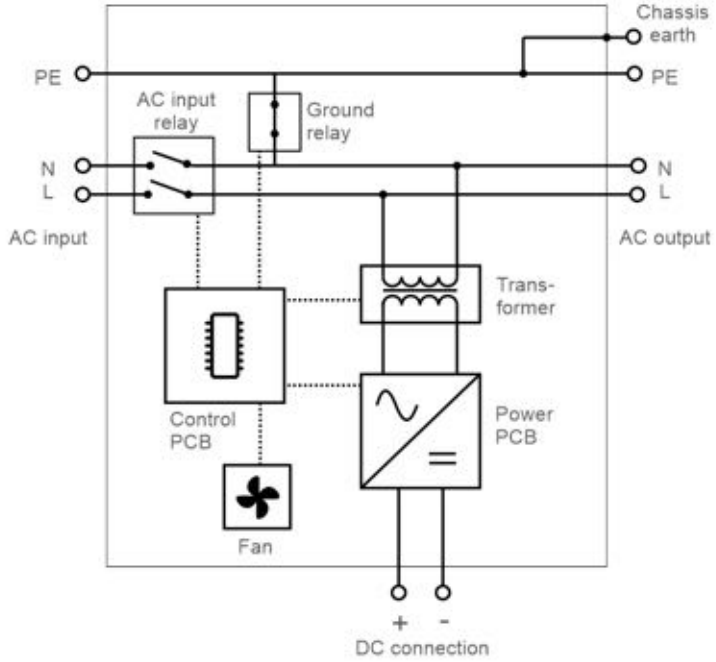
Peak load: This has to match the peak load capability of the Multi

Largest load: This determines the Multi size

Average load:

This determines the generator size in relation to its running hours

Internal wiring diagram basic inverter/charger

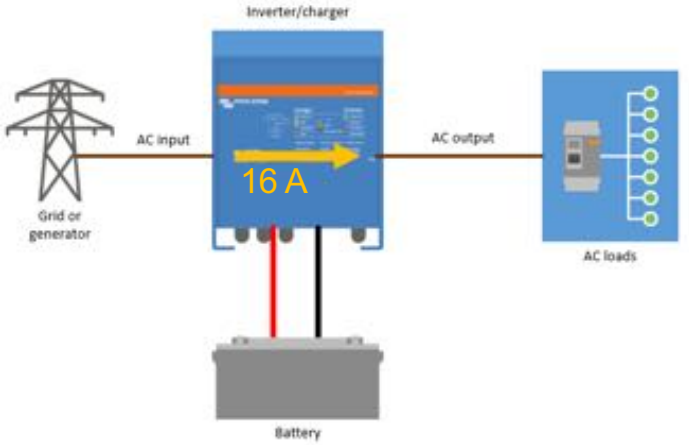


What's in a name?

Example:

PMP483020001 - MultiPlus 48/3000/35-16 - 230V VE.Bus Inverter/Charger

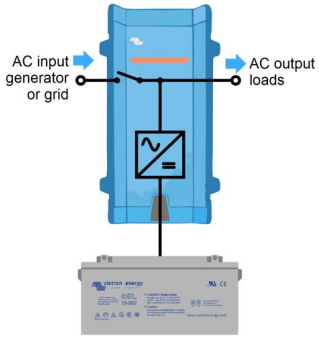
- 48 Volt battery
- 3000 VA continuous power rating
- 35 Amp charger
- 16 Amp AC pass through
- 230Vac model



Inverter/charger models

MultiPlus 500VA - 1600VA

- Very high start-up power, proven full bridge + toroidal transformer technology
- VE.Bus port for programming via MK3 interface or for connection to a GX device
- PowerAssist* and PowerControl), Parallel and 3-phase operational
- Remote on/off via control panel or switch
- Power saving mode operation
- Led diagnostics
- Compact enclosure

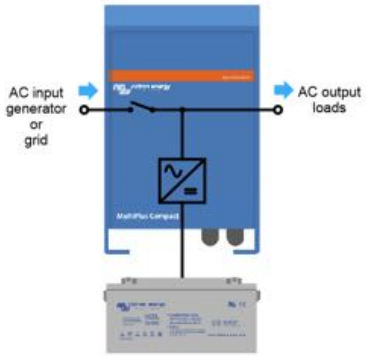


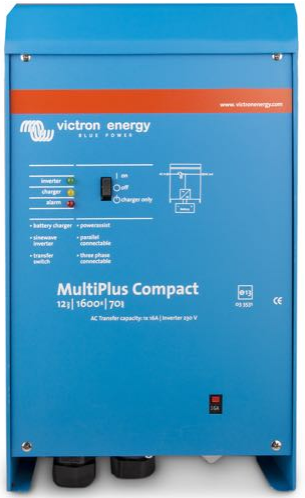
* except for the 500VA model

12 Volt	24 Volt	48 Volt
500VA - 20A	500VA - 10A	500 VA - 6A
800VA - 35A	800 VA - 16A	800VA - 8A
1200VA - 50A	1200 VA - 25A	1200 VA - 12A

MultiCompact

- Very high start-up power, proven full bridge + toroidal transformer technology
- VE.Bus port for programming via MK3 interface or for connection to a GX device
- Remote on/off via control panel or switch
- PowerAssist and PowerControl, Parallel and 3-phase operational
- Power saving mode operation
- Led diagnostics, Compact enclosure
- Battery cables included *



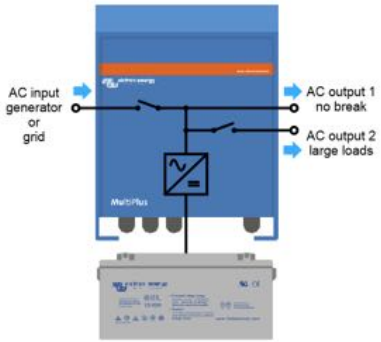


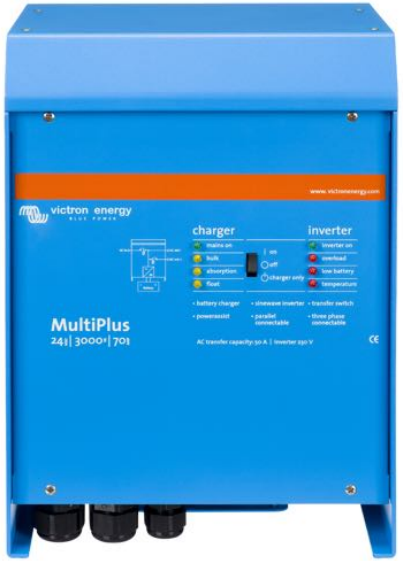
* except for the 2000VA model

12 Volt	24 Volt
800 VA - 35A	800 VA - 16A
1200 VA - 50A	1200 VA - 25A
1600 VA -70A	1600 VA - 40A
2000 VA - 80A	2000 VA - 50A

MultiPlus

- Very high start-up power, proven full bridge + toroidal transformer technology
- VE.Bus port for programming via MK3 interface or for connection to a GX device
- Remote on/off via control panel or switch
- PowerAssist and PowerControl Parallel and 3-phase operational
- Power saving mode operation
- Led diagnostics



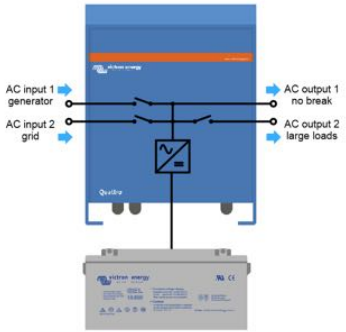


12 Volt	24 Volt	48 Volt
3000 VA - 120 A	3000 VA - 70 A	3000 VA - 35 A
	5000 VA - 120 A	5000 VA - 70 A

Quattro

- Very high start-up power, proven full bridge + toroidal transformer technology
- VE.Bus port for programming via MK3 interface or for connection to a GX device
- Remote on/off via control panel or switch
- PowerAssist and PowerControl, Parallel and 3-phase operational
- Power saving mode operation
- Led diagnostics

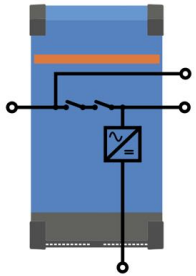
12 Volt	24 Volt	48 Volt
3000 VA - 120 A	3000 VA - 70 A	
5000 VA - 220 A	5000 VA - 120 A	5000 VA - 70 A
	8000 VA - 200 A	8000 VA - 110 A
		10 kVA - 140 A
		15 kVA - 200 A

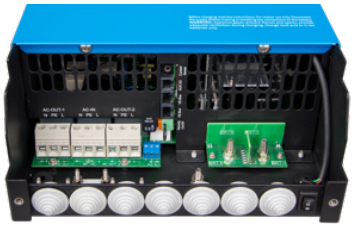


MultiPlus II

- Proven full bridge + toroidal transformer technology
- VE.Bus port for programming via MK3 interface or for connection to a GX device
- PowerAssist and PowerControl, Parallel and 3-phase operational
- IEC 62109-2 and 4777.2 certification
- Internal and optional external current sensor
- LED diagnostics
- Compact enclosure

24 Volt	48 Volt
3000VA - 70A	3000VA -35 A
	5000VA - 70A





MultiPlus II GX

- Ethernet & Wi-Fi inside
- All GX device functionalities included
- VE.Can port (for managed batteries or MPPTs)

48 Volt
3000 VA
5000 VA

The widest range in the industry

Inverter/chargers										
12 V	500	800	1200	1600	2000	3000	5000			
24 V	500	800	1200	1600	2000	3000	5000	8000	10.000	
48 V	500	800	1200			3000	5000	8000	10.000	15.000

MultiPlus

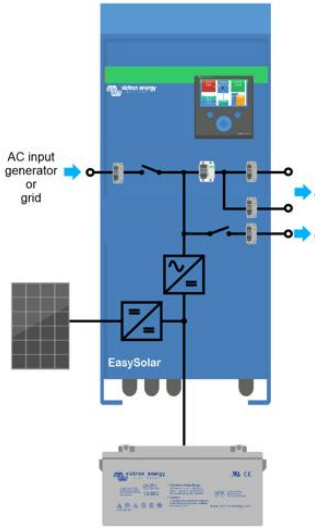
MultiPlus-II

2020

EasySolar - System in a box

Combination of:

- Inverter/charger
- Solar charge controller
- CCGX (3K and 5K models)
- AC breakers and a RCD
- DC battery cables (1600 model)



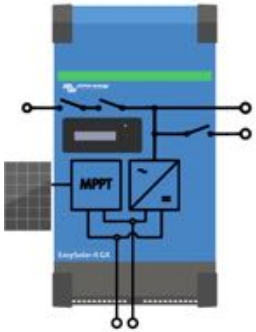
12 Volt	24 Volt	48 Volt
1600 VA + 100/50 MPPT	1600 VA + 100/50 MPPT	
	3000 VA + 150/70 MPPT + CCGX	
		5000 VA + 150/100 MPPT + CCGX

EasySolar-II GX

Combination of:

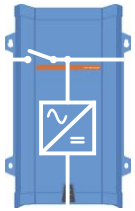
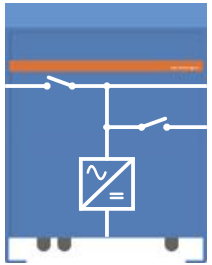
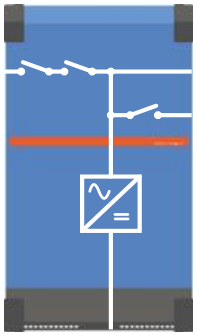
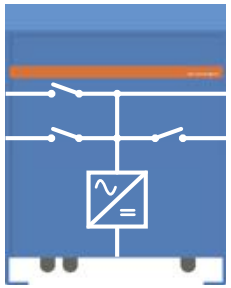
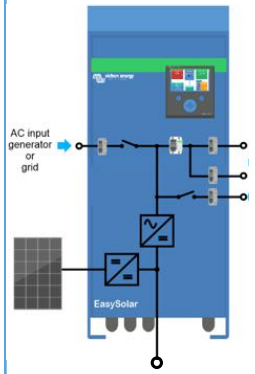
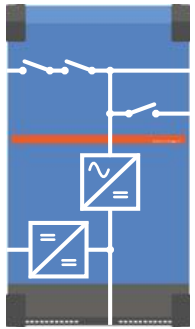
- Inverter/charger
- Solar charge controller
- GX device

Note: No more circuit breakers and RCD

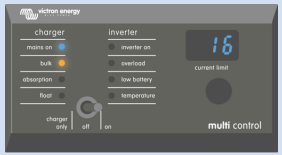
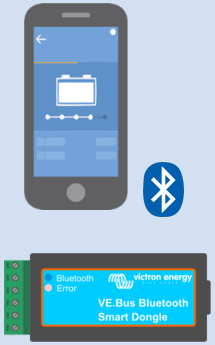


48 Volt
3000 VA + 250/70 MPPT + GX

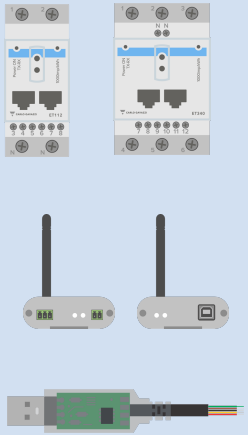
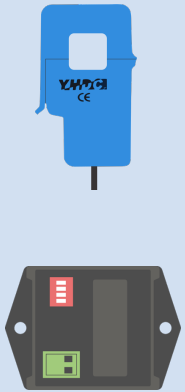
Inverter/charger models

Multi	MultiCompact	MultiPlus	MultiPlus-II	Quattro	EasySolar	EasySolar-II
500-1200	800-2000	3000 – 5000	3000 – 5000	3000 – 15000	1600 - 5000	3000
						

VE.Bus Inverter/charger accessories

RJ45 cable 0.3 - 30 meter	Multi control panel	MK3 - USB interface	VE.Bus smart Bluetooth dongle
			

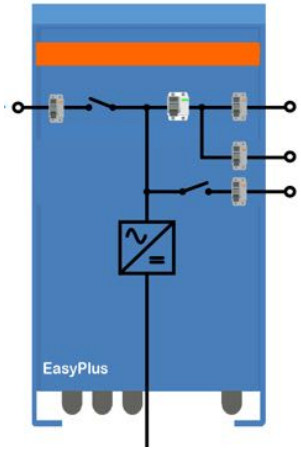
ESS Accessories

GX device	Energy meters and communication	Current sensors	Anti Islanding relay
			

EasyPlus

Combination of:

- 1600 VA inverter/charger
- MPPT 100/50 solar charge controller
- AC breakers and a RCD
- DC battery cables

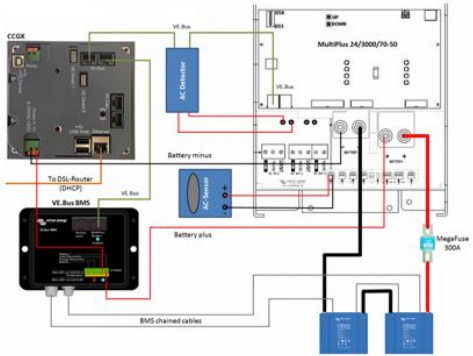


12 Volt	24 Volt	48 Volt
1600 VA		

ECO Multi

Combination of:

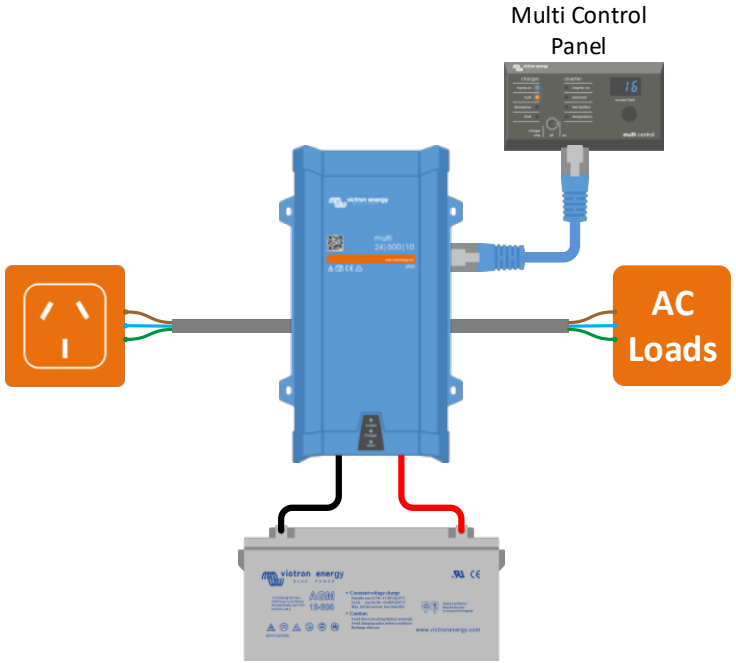
- 24V 3000 VA inverter/charger
- 24V 90Ah LiFePo battery bank (batteries not included)
- Color Control GX
- BMS system
- Ac sensor and AC detector



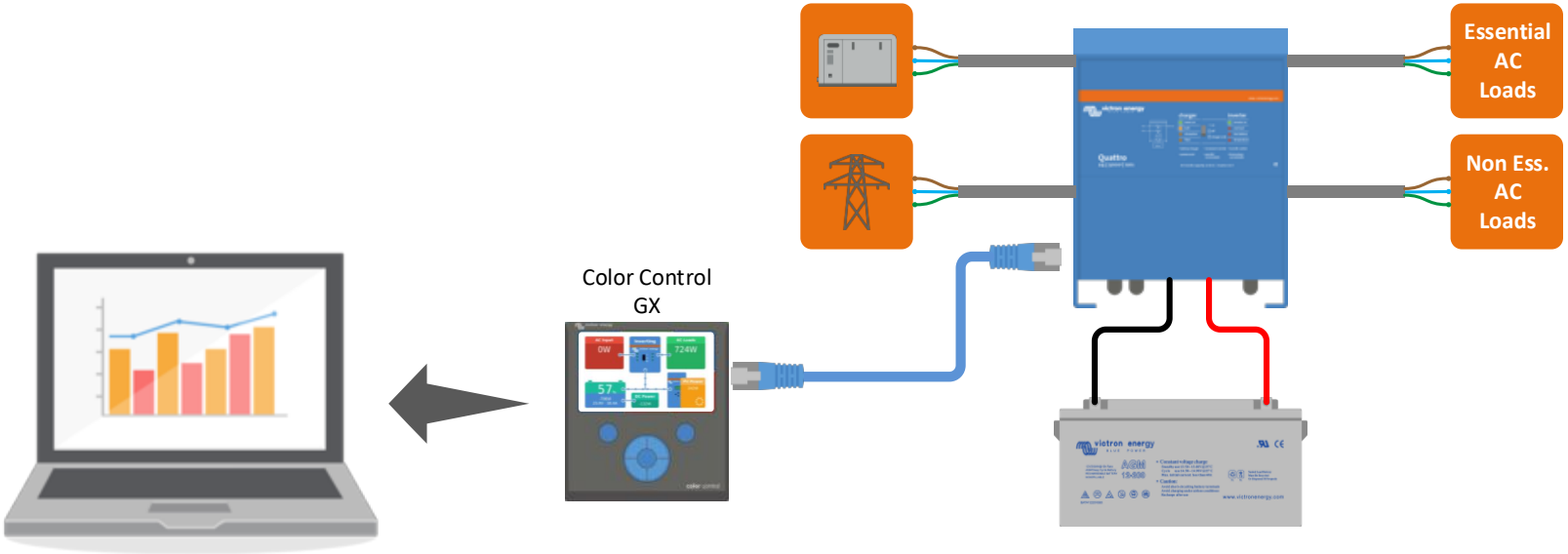
12 Volt	24 Volt	48 Volt
	3000 VA	

Monitoring and configuring

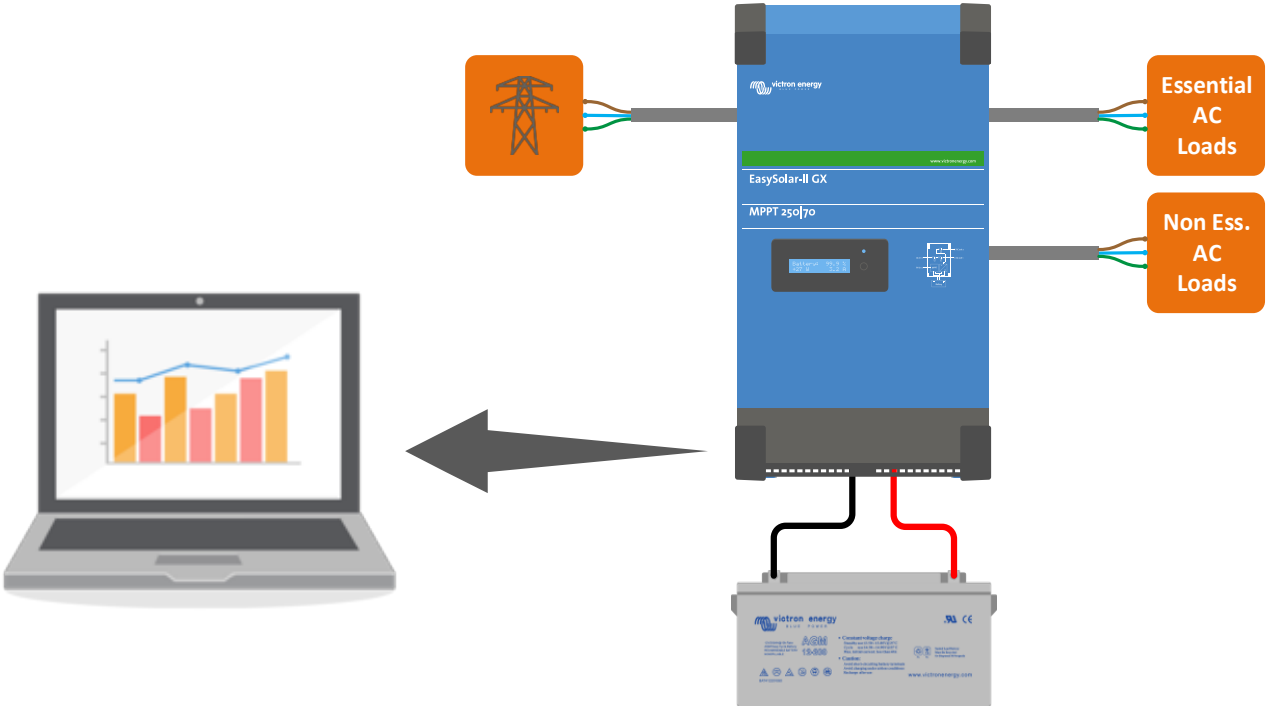
Control the system with the Multi Control Panel



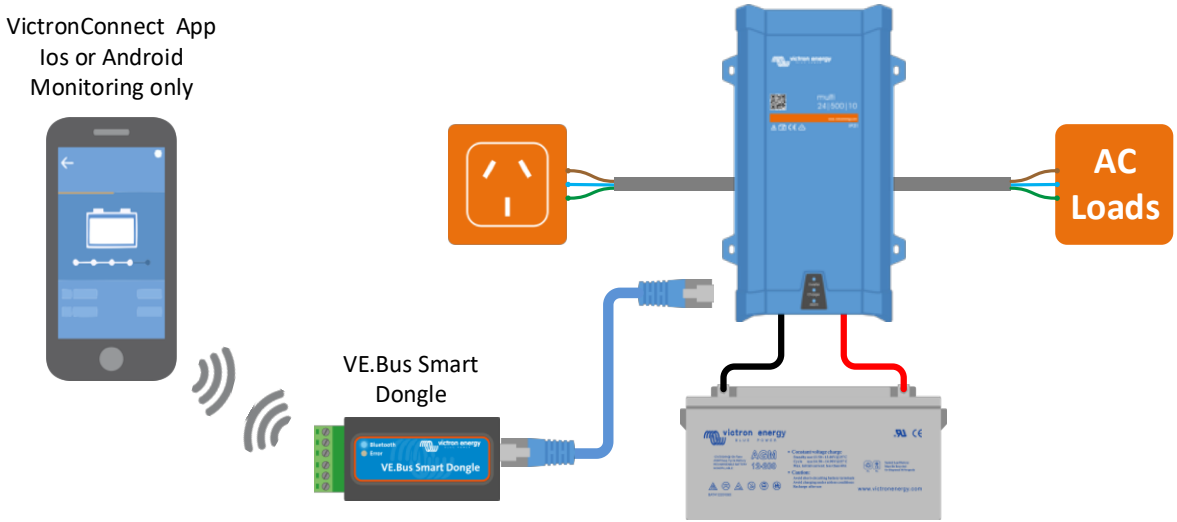
Monitoring the system with a Color Control GX



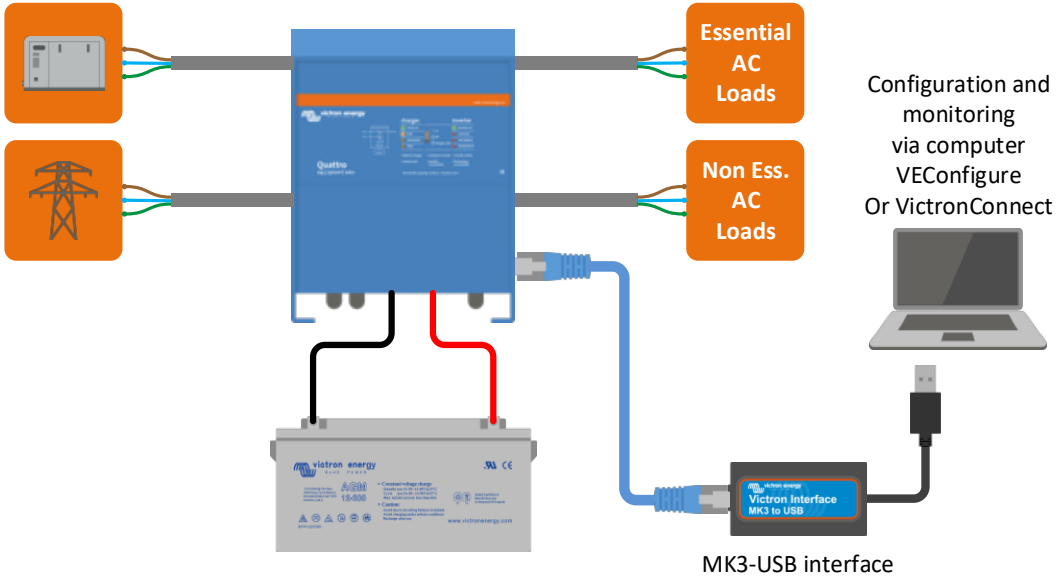
Or use a MultiPlus-II GX with built-in Venus



Monitoring via Bluetooth with VictronConnect



Programming via USB



Additional features

On / off / Charger only switch

- When switched to charger only the battery charger and the AC feed through are operational

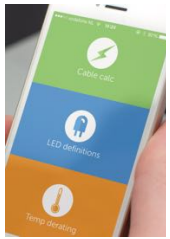
- If the AC input is lost or disconnected, the unit will switch-off
- The unit will remain switched-off until the AC input is restored

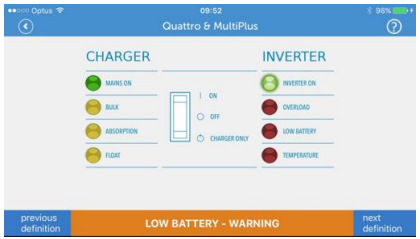
- This prevents the inverter from being switched on if AC is lost. This prevents discharge of the batteries due to the inverter self consumption.

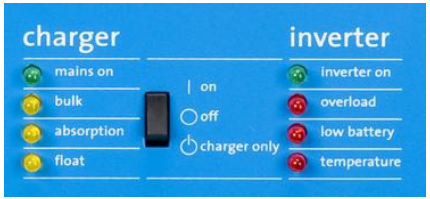
MultiPlus	12 Volt 24 Volt 48 Volt	12/3000/120 24/3000/70 48/3000/35
Zero load power (W)		20 / 20 / 25

LEDs

- The LEDs indicate the unit status
- A MultiPlus or Quattro have full read out
- A Multi or MultiCompact have a limited readout, consider using the Multi Control Panel to get full LED readout
- To find the correct LED definition use the Victron Toolkit App or the product manual





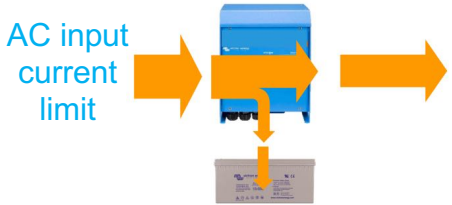


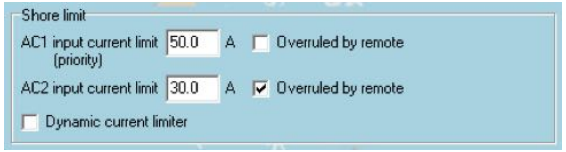
Current limit

The Multi needs to know how much current is allowed to be taken from grid or the generator.

You will need to set the current limit using the:

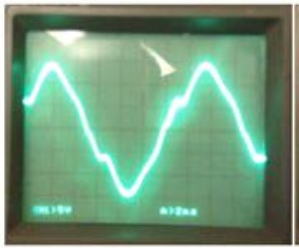
- Multi Control panel
- CCGX
- VE.Configure software



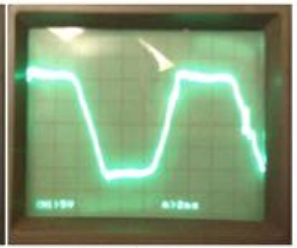


Generators

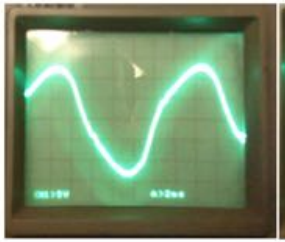
- When the sine wave is of good quality, the Inverter of the MultiPlus will hook up on it, thus allowing a synchronised and fast transfer when the generator stops.
- Many generators have ill-shaped sine waves, in particular during sudden load changes. In these situations, the MultiPlus will disconnect frequently or not connect at all. The UPS function must then be deactivated. The drawback is a slightly longer transfer time.



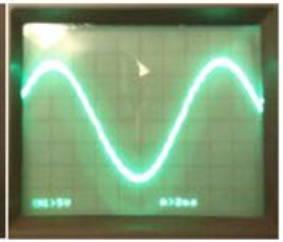
Generator output no load



Generator output large load



Generator output mid-size load

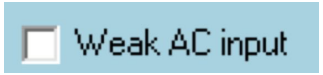


Quattro output

Grid tab

General tab

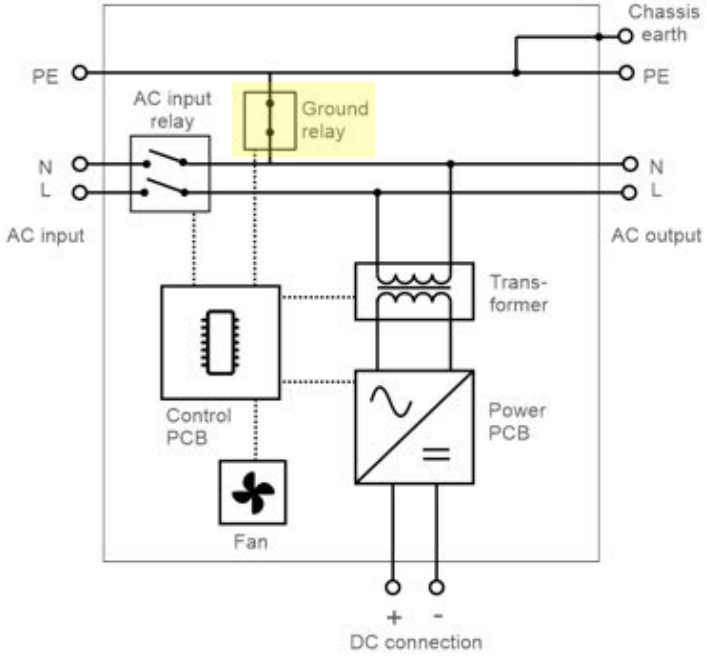
Charger tab



Internal ground relay

- The ground relay is closed when the back-feed relay is open - Inverting
- The ground relay is open when the back-feed relay is closed - Charging
- This is an essential feature for an RCD connected to the output to function

- The ground relay can be disabled if undesirable. Use in VE.Configure

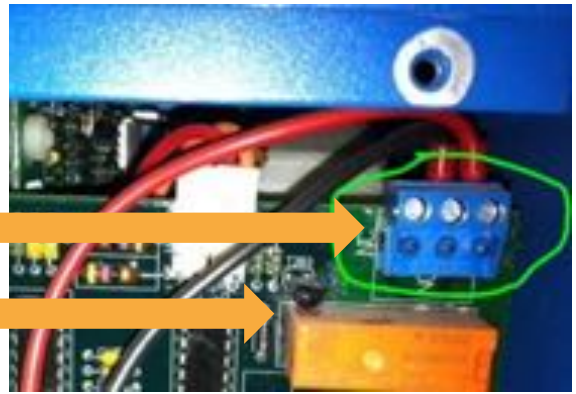


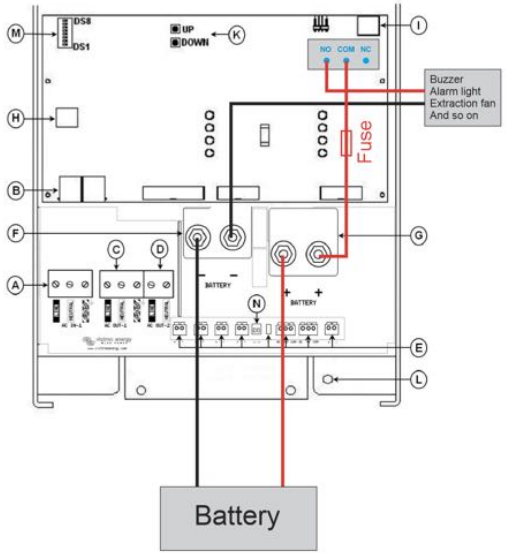
Programmable relay (Virtual switch)

- The relay and the connector are both located on the control pcb in the top right hand corner
- Use VEConfigure to configure these settings

Connector

Relay



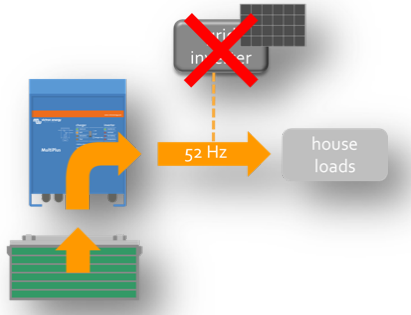


AC input relay

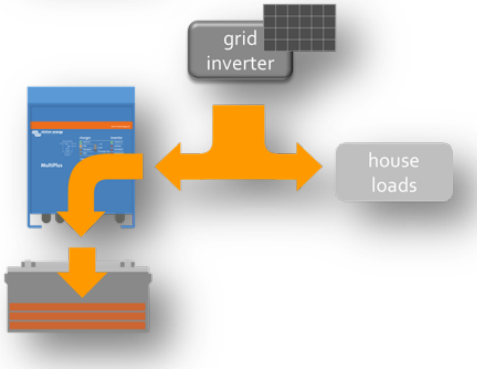
- The AC input relay can be configured to open at more times rather than its normal safety function
- This way the grid can be ignored while the batteries are still full enough and the grid can be used like a backup generator
- Use VEConfigure to configure these settings

Frequency shift for communication with PV inverter

- When the battery is full the Multi increases its output frequency
- The PV inverter turns off when it detects a frequency change
- When the battery has been discharged again the Multi will shift the frequency back to 50Hz and the PV inverter will again charge the battery

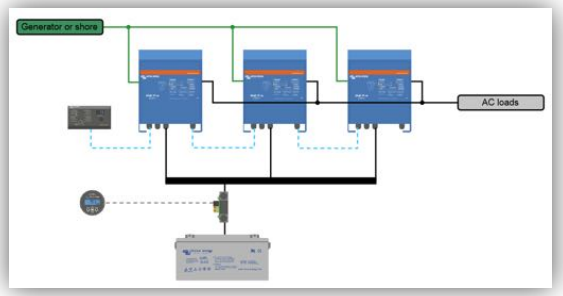


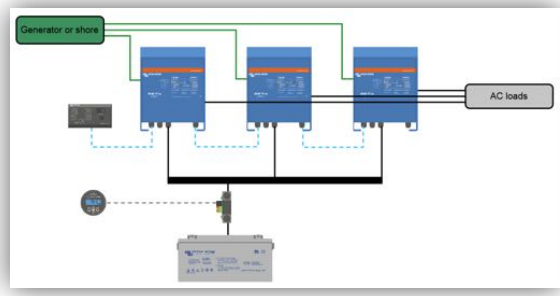
- PV power is **not allowed to be more** than the Multi Power
- Frequency shift is **always** needed when a PV inverter is connected to the output of a Multi. This to protect the battery

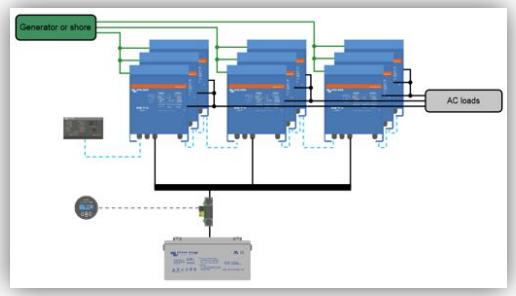


Parallel and/or 3 phase systems

- MultiCompact, MultiPlus, Quattros and large Phoenix inverters can be connected in parallel and/or 3 phase and 2 phase
- The maximum in a parallel string is 5 units up to 10 kVA or 4 units 15 kVA
- All units need to be the same model and be the same age and have the same firmware







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