



# Self-consumption & energy storage



**victron energy**  
BLUE POWER



Energy. Anytime. Anywhere.



## INDEX

Introduction	4
Why choose Victron Energy for your Energy Storage system	6
Tiny House	8
Smartflower	9
Which Hub-system to choose	10
VE Storage Hub-1	11
VE Storage Hub-2	12
VE Storage Hub-4	13
Monitoring	14
Tools	16
Accessories	17
Technical information	19
About Victron Energy	66



### Self-consumption or grid independence

The primary goal of a self-consumption system is to optimise the use of solar and/or wind power. The major obstacle in such a system is that power generation times do not match with the actual times of power use. This results in a system being forced to import energy from the grid and export it when there is a surplus.

In an optimised self-consumption system, surplus energy is stored locally for local on demand use. Such energy storage is becoming an increasingly attractive proposition, especially with feed-in tariffs decreasing and grid supplies becoming less stable and more expensive.

### Self-consumption versus off-grid systems

There are some major considerations which should be taken into account when comparing an off-grid system with a self-consumption system.

An off-grid system is a system that is not (or mostly not) connected to grid power and is used to supply the total energy needs of the complete energy system. Therefore it is sized to cope in a worst case scenario. This worst case scenario can occur when there is simultaneous usage of high loads which then requires a high power inverter for occasional use.

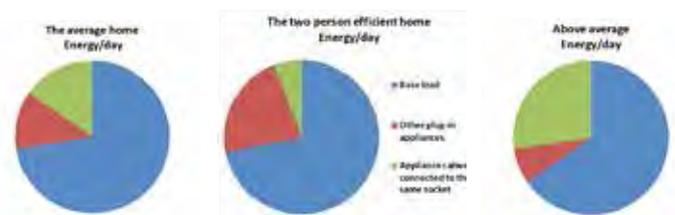
The other worst case scenario is the lack of ability to generate energy in periods of overcast weather and/or wind outages. This results in substantial battery storage to overcome this, which, like the large inverter power situation mentioned above, is only used on occasion.

In general it can therefore be stated that an off-grid system is oversized in both inverter power and storage capacity in order to deal with such situations.

For a self-consumption system this is different, as there is always a grid present. With Grid assist functionality the grid can be used seamlessly, whenever there is a high peak load, meaning the inverter can be sized according to the base load.

The baseload is the part of the total energy-need which generally comes from low powered equipment and these loads continue to draw energy almost constantly over the 24 hours of a day.

Examples of this are heating pumps, chargers and the standby power of household equipment. In order to optimise PV usage and limit the import of energy this base-load is the most efficient part to target.



Avoiding the import of the total energy need is possible but this would require a higher investment in the inverter, as it must then be able to cover for high loads. Most high loads are however peak loads and active over a limited period of time. So even though this requires a high energy supply, the time period is limited and the energy value within this peak-load period is quite low - so the investment in a larger inverter is often not justified.

When considering battery capacity, a self-consumption system is able to work with a smaller battery capacity. The energy stored in such a system is limited to the surplus PV power as part of the generated PV power is directly used by the loads. In this case PV power is sized according to the base load and any surplus energy is used overnight.

More information:

<https://www.victronenergy.com/upload/documents/Whitepaper-Self-Consumption-and-Grid-independence-with-the-Victron-Energy-Storage-Hub-EN.pdf>



## Why choose Victron Energy for your Energy Storage system



### A wide range of inverter/charger sizes and configurations

Our inverter/charger models range from a small 500VA unit all the way up to a 15kVA unit. Multiple units can be connected in parallel and/or 3-phase configuration. Thus it is possible to create systems ranging in power size from a small single phase system up to an impressive 180kVA 3-phase system.



Reinout Vader showing first inverter

### Unrivalled experience with battery storage systems

Victron Energy was founded in 1973, back then we started with providing inverters and chargers for the marine industry. This quickly expanded to the land based and automotive market. We therefore have an unrivalled length of experience with battery storage systems.



### DC-Coupled PV or AC-Coupled PV. Or even a combination of both

We can work with DC-Coupled PV: MPPT solar chargers. We have a broad range of efficient MPPT solar chargers. Starting from the MPPT 75V/15A (290 W charger) up to the 250V/100A (5.7kW solar charger).

We can also work with AC-Coupled PV etc. We are compatible with many brands of PV Inverters; with a strong collaboration with Fronius PV Inverters.

We can even combine AC and DC coupled PV in one system.



### Excellent remote monitoring and diagnostics tools

Our remote monitoring website (VRM) can display all your systems data in a comprehensive graphical format. System settings can be changed via the portal. Alarms can be received by e-mail.



**UPS no-break output, operate without any disruption**

Our inverter/charger takes over supplying power to the connected loads in the event of a grid or generator failure. This happens so fast (less than 20 milliseconds) that computers and other electronic equipment will continue to operate without any disruption.



**Wide range of compatible battery technologies**

We sell our own brand of lead acid and lithium batteries. Also, our programmable inverter/chargers work with a wide range of battery technologies such as: Victron Energy, Aquion Energy, Redflow, LG, BMZ, Garamanta and Freedomwon.

Battery technologies we work with:



And many more!

## Tiny House



### Tiny House

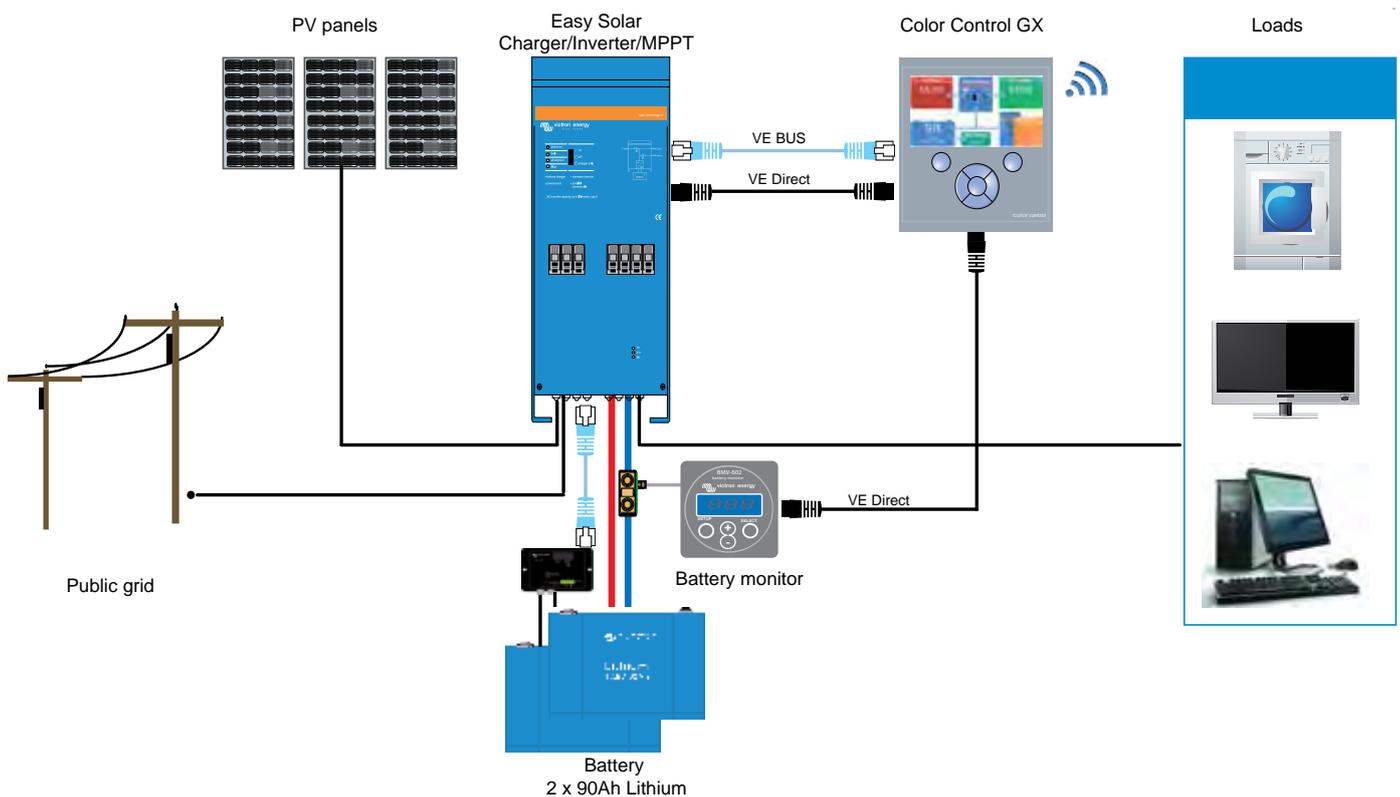
Tiny Houses are very small homes that enable simple living in a smaller, more efficient space. They are usually made of wood, being creatively designed to maximise the utility of a small living space. The principal reasons for living in a Tiny House are to live sustainably in a financially and environmentally conscious way, whilst at the same time enjoying the resulting freedom. The Tiny House in the photograph belongs to Marjolein Jonker. She lives in The Netherlands and is building her own Tiny House, together with a team of specialists.

### Victron equipment

The Tiny house of Marjolein is equipped with:

- EasySolar
- 2 x 90A Lithium-ion batteries
- BMV-700 Battery Monitor
- Color Control GX

For additional information about Marjolein Jonker's Tiny House please visit: <https://www.marjoleininhetklein.com/>





### Smartflower POP+

The smartflower POP+ can not only turn the sun's energy into electricity very efficiently; it can store it in sufficient quantities too.

### Enjoy the energy of the sun. Around the clock, almost independently of the grid

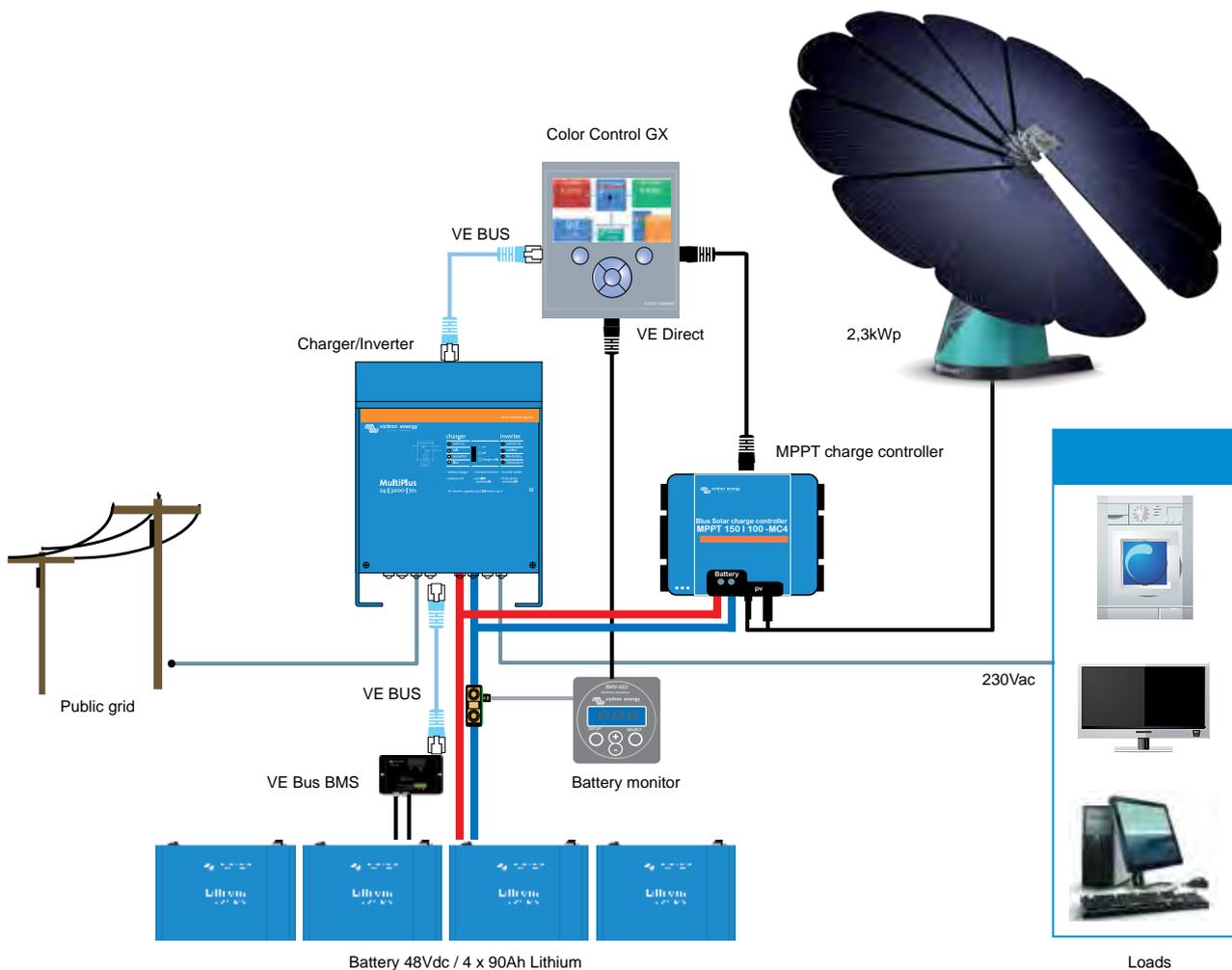
Completely integrated in an innovative all-in-one solar system that works on a plug-and-play principle like any normal household appliance. The intelligent tracking function of the PV modules ensures that the system makes the most efficient use of the sun's energy at all times of the day and year, while the battery is continuously recharged. So you can even enjoy cloudy days with a bright smile on your face.

### Monitoring – access to the most important system data

With your personal access to the Monitoring System you can keep an eye on your current production, storage and consumption figures at all times. The system also allows you to make a number of different custom settings.

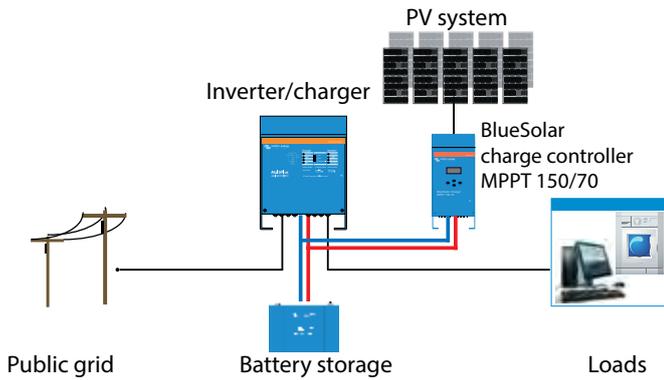
### Victron inside & out

The Smartflower Pop+ uses a Victron Energy inverter, solar charge controller and Lithium batteries, plus this standalone unit connects to Victron Energy's VRM web portal for system monitoring.



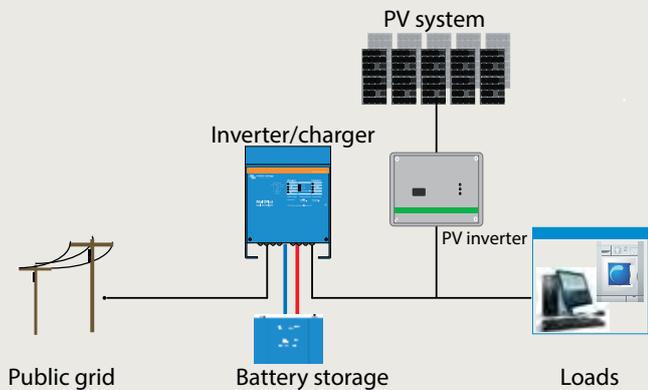
## Which Hub-system to choose

There is a solution for every situation, from simple to more complex solutions. We have three different setups available: Hub-1, Hub-2 and Hub-4.



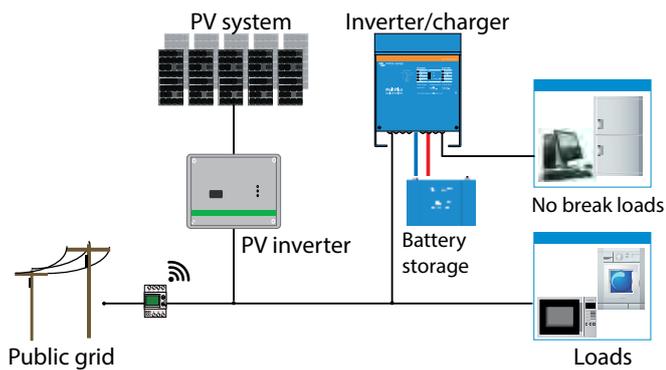
### Hub-1 (DC-Coupled PV)

- Simplest
- Most robust
- Lowest cost solution
- Most efficient charging
- No break functionality



### Hub-2 (AC-Coupled PV, battery inverter/charger in series with the loads)

- Most practical solution to add battery storage to an existing grid connected PV system
- No break functionality

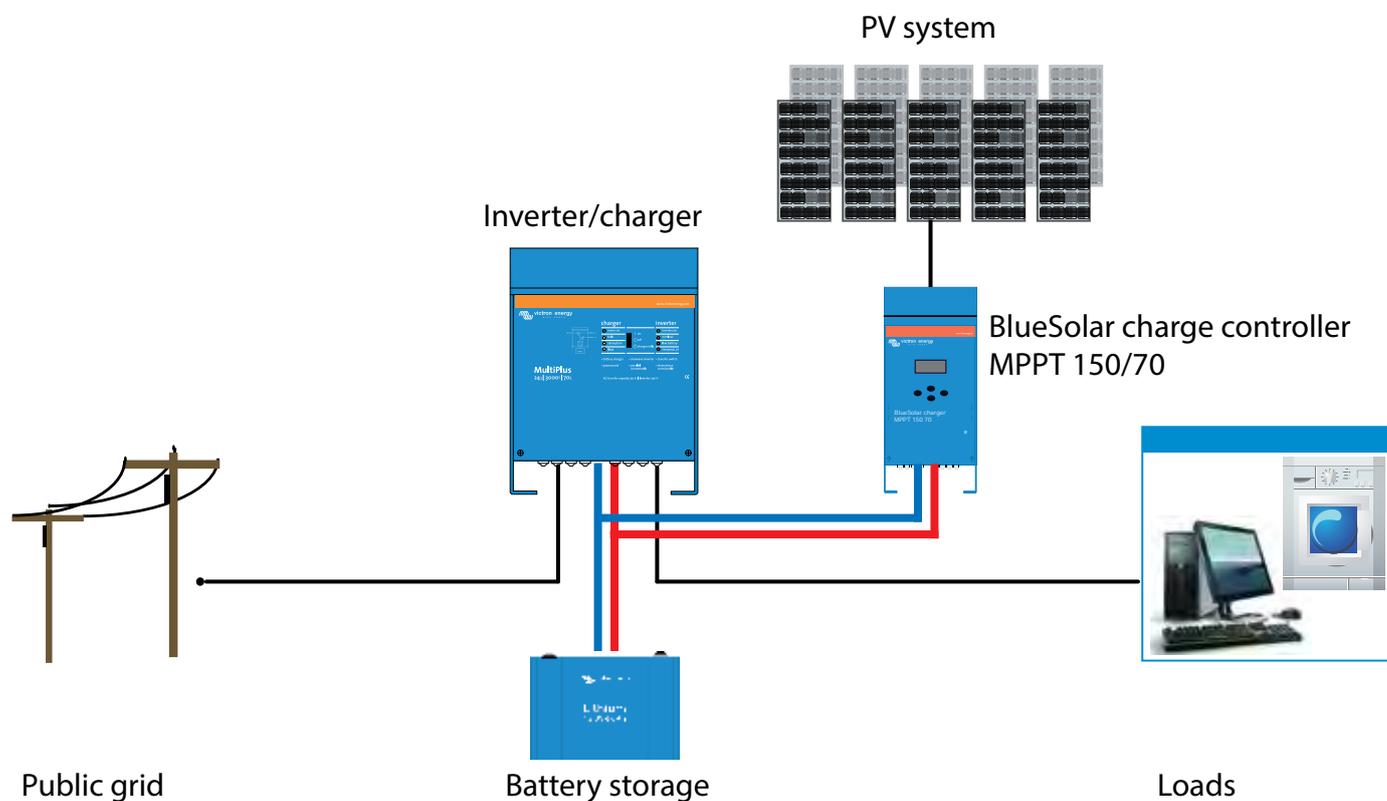


### Hub-4 (AC-Coupled PV, battery inverter/charger in parallel with the loads)

- More complex -> more advanced
- The size of the PV array and the PV inverter is not limited by the maximum nominal power of the inverter/charger
- Grid parallel
- No break functionality



VE Storage Hub-1 is the highest efficiency solution when most of the energy produced has to be stored in the battery prior to use. It is also the simplest, most robust and lowest cost solution.



The BlueSolar MPPT charge controller uses solar power to charge the battery.

The stored energy is used by a MultiPlus or Quattro inverter/charger to supply AC power to the load and to feed excess power back into the grid.

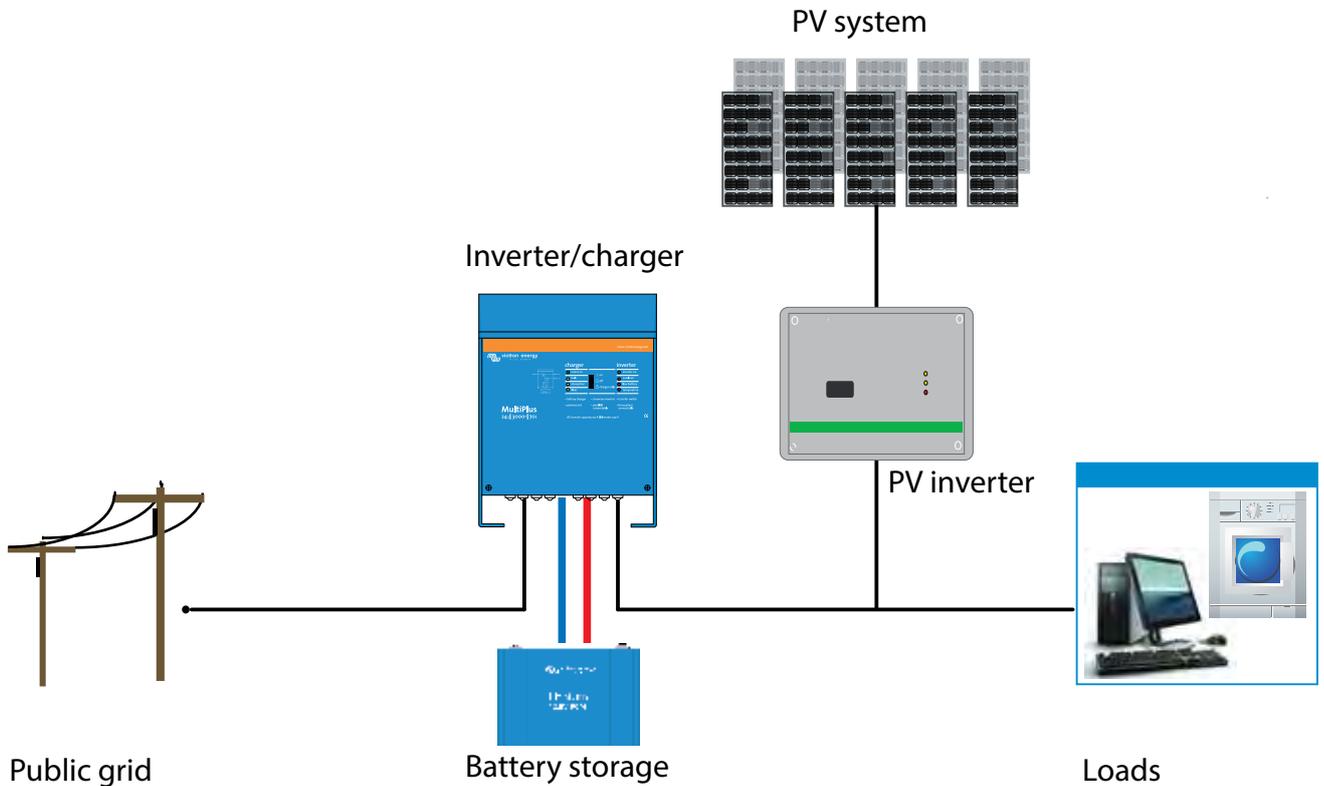
In case of a utility power outage, the Hub will disconnect from the grid and continue to operate as a standalone system.

If power will be fed back into the grid an anti-islanding device that complies to local regulations has to be added to the system.

## VE Storage Hub-2



VE Storage Hub-2 is the most practical solution to add battery storage to an existing grid connected PV system.



DC electrical power generated by the solar panels is converted to AC by a PV inverter connected to the AC output of an inverter/charger.

The AC input of the inverter/charger is connected to the grid.

If power will be fed back into the grid an anti-islanding device may have to be added to the system, depending on local regulations.

Power from the PV inverter is supplied directly to the load.

In case of insufficient PV power, the inverter/charger will supply additional power from the battery, or from the grid.

In case of excess PV power the inverter/charger will use the excess power to recharge the battery, and/or to feed power back into the grid.

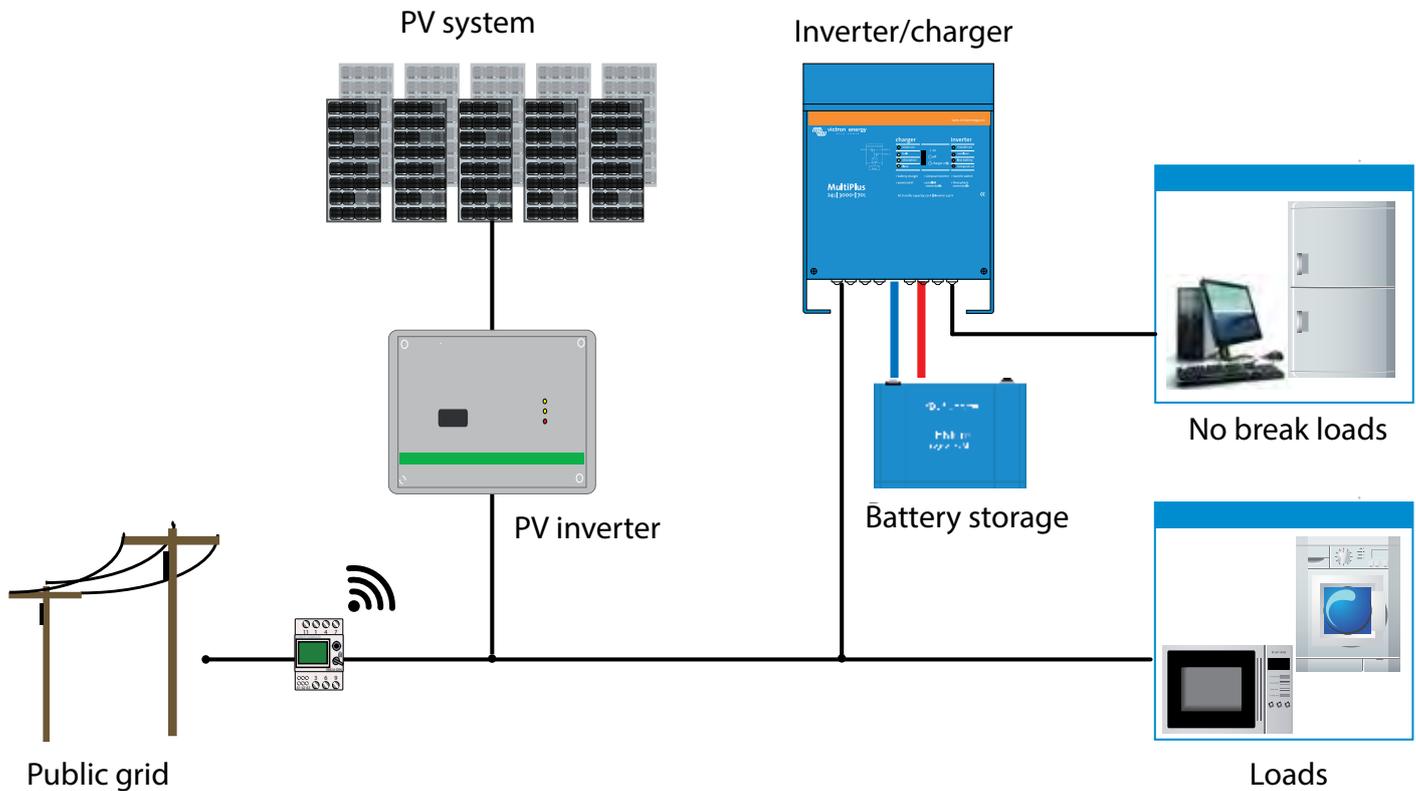
In case of a utility power outage, the Hub will disconnect from the grid and continue to operate as a standalone system.

Planning and commissioning of this solution is more complicated than Hub-1 due to interaction between the inverter/charger and the PV inverter.



VE Storage Hub-4 is a grid-parallel energy storage system, using the Multi or Quattro bidirectional inverter/charger as its main component.

The system is managed by the Color Control GX (CCGX), which also provides extensive monitoring, both locally and remotely via our VRM Portal and the VRM App. The VRM app is available for both iOS and Android.



### Features

- Grid parallel energy storage system that optimizes self-consumption.
- Wide range of available inverter/chargers: 800 VA to 10.000 VA in 12, 24 and 48 VDC.
- Flexible:
  1. a single phase inverter/charger installation in a single-phase system
  2. a single phase inverter/charger installation in a multi-phase system
  3. a split- or three-phase inverter/charger system in a multi-phase system
- Both wired and a wireless connection to the meter central distribution box is possible.
- (optional) No-break UPS output.
- (optional) Phase compensation.
- Built-in anti-islanding/loss of mains detection. Currently certified for limited number of countries/models, more certification coming.
- No restrictions on PV Array size.
- No minimum or maximum battery size.
- Suitable for many battery types.
- Three operating modes, from basic to custom, covering both standard and custom systems.
- Free usage of the VRM Portal and the VRM App for remote monitoring.
- Advanced battery protection system which adaptive discharge level

## Monitoring

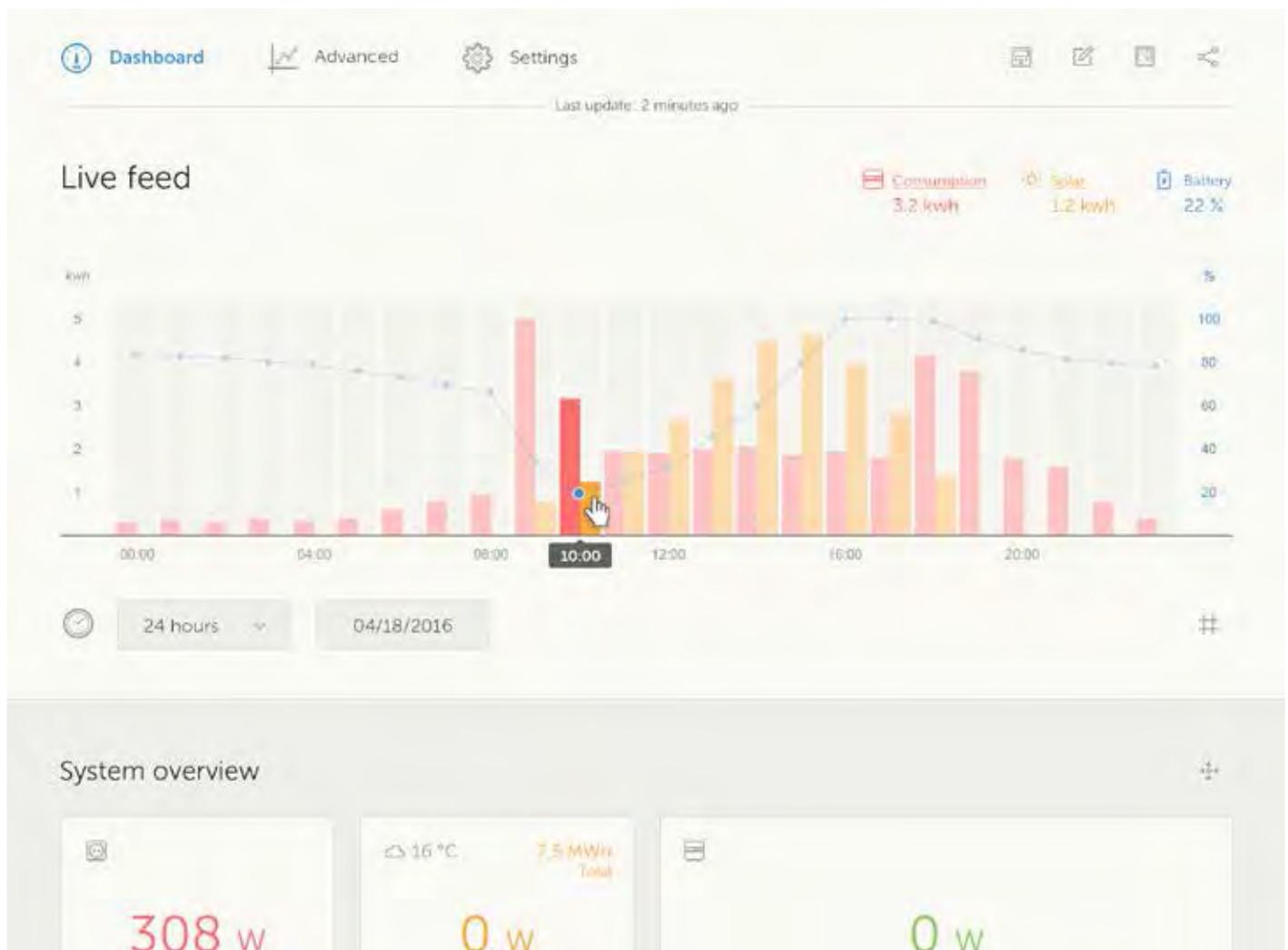
The major considerations for installing a self-consumption system are often financially and/or morally driven. For both, the goal is to minimise the import of grid energy and to optimise the consumption of self-generated power.

Modern inverter and battery monitoring technology helps to achieve this, by detecting how much energy to store and how and when to best use it. Besides this there is another important factor to consider.

This factor is the energy behaviour of the end-user themselves. This can differ between households and it is heavily dependent on circumstances, which can change from day to day. This makes coding the software, to precisely achieve optimal use of energy, quite a challenge.

If for example the washing machine is required on a particular day, the ideal day would be a sunny one just after the battery is (almost) full. Having said that direct power usage is preferable, which saves having to export energy to the grid or use battery power momentarily.

In order to be able to make these kinds of energy use decisions, monitoring is crucial to fine tune and optimise energy use based on ever changing circumstances. This makes monitoring systems an essential feature for every self-consumption system. Tests have shown that users of self-consumption systems with monitoring score a much higher level of self-consumption than those systems which lack it.



VRM: Live feed overview



Color Control GX



VRM app

**Victron Energy self-consumption systems can offer the best of both worlds**

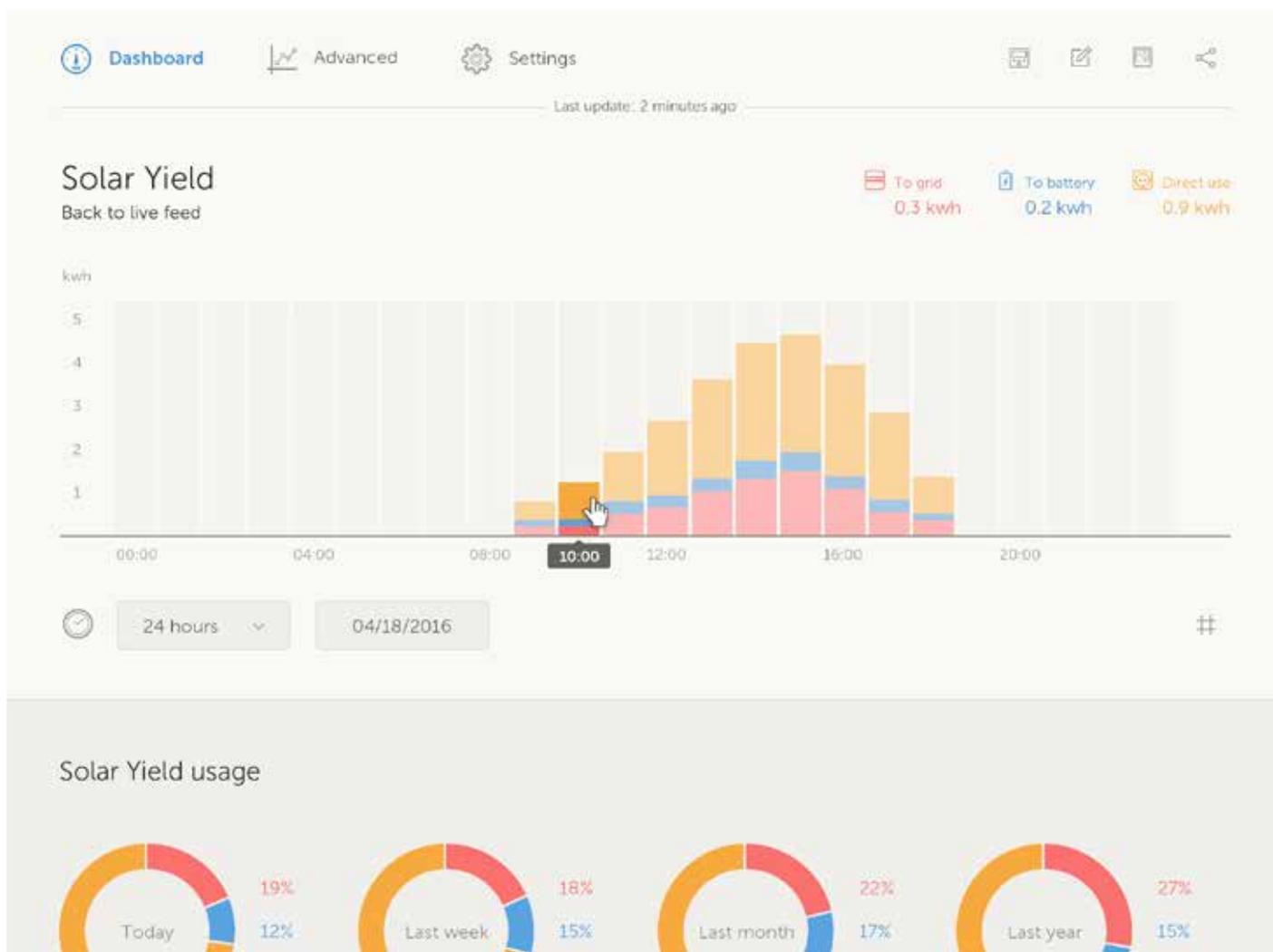
By using a Color Control GX, with its easy to use display, a clear system overview will show all the details needed to make crucial decisions as to which loads to use or to delay. Behind the overview screens other advanced information can be found - enough to satisfy even the most data-hungry users.

**VRM Online Portal**

All this data is automatically sent to our free remote monitoring website: the VRM Online Portal, which allows even more options. It provides data analysis via the free VRM app which can be used on virtually every smart phone, so even when away from the Color Control GX the system can be easily monitored. Also the webserver is able to provide an advanced system overview, such as calculations of total solar yield, power generation and graphs - for all the equipment connected to the system.

To get an impression of the VRM Online Portal, please visit:

<https://vrm.victronenergy.com>



VRM: Solar Yield overview

## Tools

There are a lot of tools available that makes it easy to work with Victron Energy products, for both Victron installers as Victron distributors. Whether you would like to configure and read out your Victron products with VictronConnect using your smartphone, tablet or computer or you want to show or share your VRM site.



### Instruction videos on Victron youtube channel

On our youtube channel you can watch Victron Energy instruction videos, such as 'How to get a readout from an MPPT with a VE.Direct Bluetooth Smart dongle'

<https://www.youtube.com/user/VictronEnergyBV>

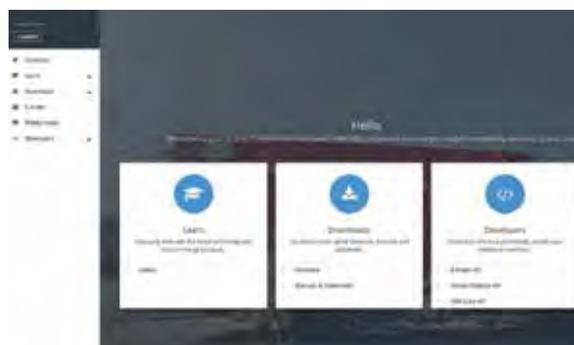


### MPPT Calculator Excel sheet

With the MPPT Calculator Excel sheet you can match solar modules to MPPT charge controllers.

Download the Excel sheet from our software page:

<https://www.victronenergy.com/support-and-downloads/software>



### Victron Professional

With Victron Professional you can get insight into training sessions, videos, firmware files, APIs and the latest news. If you already use E-Order you can login with those credentials.

Sign up for Victron Professional here:

<https://professional.victronenergy.com>



### VRM World: View shared VRM sites around the world

Ever wanted to show your clients, friends, colleagues how much solar energy your installation is generating or indeed any other data that you can see on your VRM site? Well now you can – using VRM World.

You need a VRM account to be able to view shared VRM sites. In your VRM portal it is possible to publicly share on VRM World.

Visit VRM World here:

<https://vrm.victronenergy.com/world/>

Our systems are comprised of various components. Some of which are specifically designed for specific markets. Other Victron components are applicable for a wide range of applications. You are able to find the specifications and other detailed information about these components in the 'Technical Information' section.



### Battery Monitor

Key tasks of the Victron Battery Monitor are measuring charge and discharge currents as well as calculating the state-of-charge and time-to-go of a battery. An alarm is sent when certain limits are exceeded (such as an excessive discharge). It is also possible for the battery monitor to exchange data with the Victron Global Remote. This includes sending alarms.



### Color Control GX

The Color Control GX provides intuitive control and monitoring for all products connected to it. The list of Victron products that can be connected is endless: Inverters, Multis, Quattros, MPPT 150/70, BMV-700 series, Skylla-i, Lynx-Ion and even more.



### MPPT Control

The MPPT Control lets you see the status as well as setup all BlueSolar MPPT Charge Controllers that have a VE.Direct communications port. The new MPPT Control is mounted in the familiar BMV-700 series housing, maintaining a consistent and professional look to your panels and systems monitoring equipment.



### VE.Direct Bluetooth Smart dongle

Using the VE.Direct Bluetooth Smart dongle you can display your BMV or MPPT information on iOS and Android devices, using the **VictronConnect app**. View information wirelessly such as battery status and solar panel power, plus other useful data.



Note - for our newest datasheets please refer to our website:  
[www.victronenergy.com](http://www.victronenergy.com)

## TECHNICAL INFORMATION

EasySolar 12V and 24V, 1600VA	20
EasySolar 24V and 48V, 3000VA	22
ECOMulti	25
Phoenix inverters 250VA - 500VA 230V	28
Phoenix inverters 1200VA - 5000VA 230V	30
MultiPlus inverter/charger 800VA- 5kVA 230V	32
Quattro inverter/charger 3kVA - 15kVA 230V	34
MultiPlus inverter/charger 2kVA and 3kVA 120V	36
Quattro inverter/charger 3kVA - 5kVA 120V	38
Color Control GX	40
BMV 700 series: Precision battery monitoring	44
BlueSolar charge controller MPPT 75/10, 75/15 & MPPT 100/15	48
BlueSolar charge controller MPPT 100/30	49
BlueSolar charge controller MPPT 100/50	50
BlueSolar charge controller MPPT 150/35	51
BlueSolar charge controller MPPT 150/45 up to MPPT 150/100	52
BlueSolar charge controller MPPT 150/70 & MPPT 150/85 - VE.Can	53
SmartSolar charge controllers MPPT 150/85 & MPPT 150/100	54
Battery Balancer	56
12,8 Volt lithium iron phosphate batteries	58
VE.Bus BMS	60
24V 180Ah Lithium-ion battery and Lynx-ion	62
Telecom batteries	64
OPzS Solar batteries	65



### All-in-one solar power solution

The EasySolar combines a MPPT solar charge controller, an inverter/charger and AC distribution in one enclosure. The product is easy to install, with a minimum of wiring.

### The solar charge controller: Blue Solar MPPT 100/50

Up to three strings of PV panels can be connected to three sets of MC4 (PV-ST01) PV connectors.

### The inverter/charger: MultiPlus Compact 12/1600/70 or 24/1600/40

The MPPT charge controller and the MultiPlus Compact inverter/charger share the DC battery cables (included). The batteries can be charged with solar power (BlueSolar MPPT) and/or with AC power (inverter/charger) from the utility grid or a genset.

### AC distribution

The AC distribution consists of a RCD (30 mA/16 A) and four AC outputs protected by two 10A and two 16A circuit breakers.

One 16A output is controlled by the AC input: it will switch on only when AC is available.

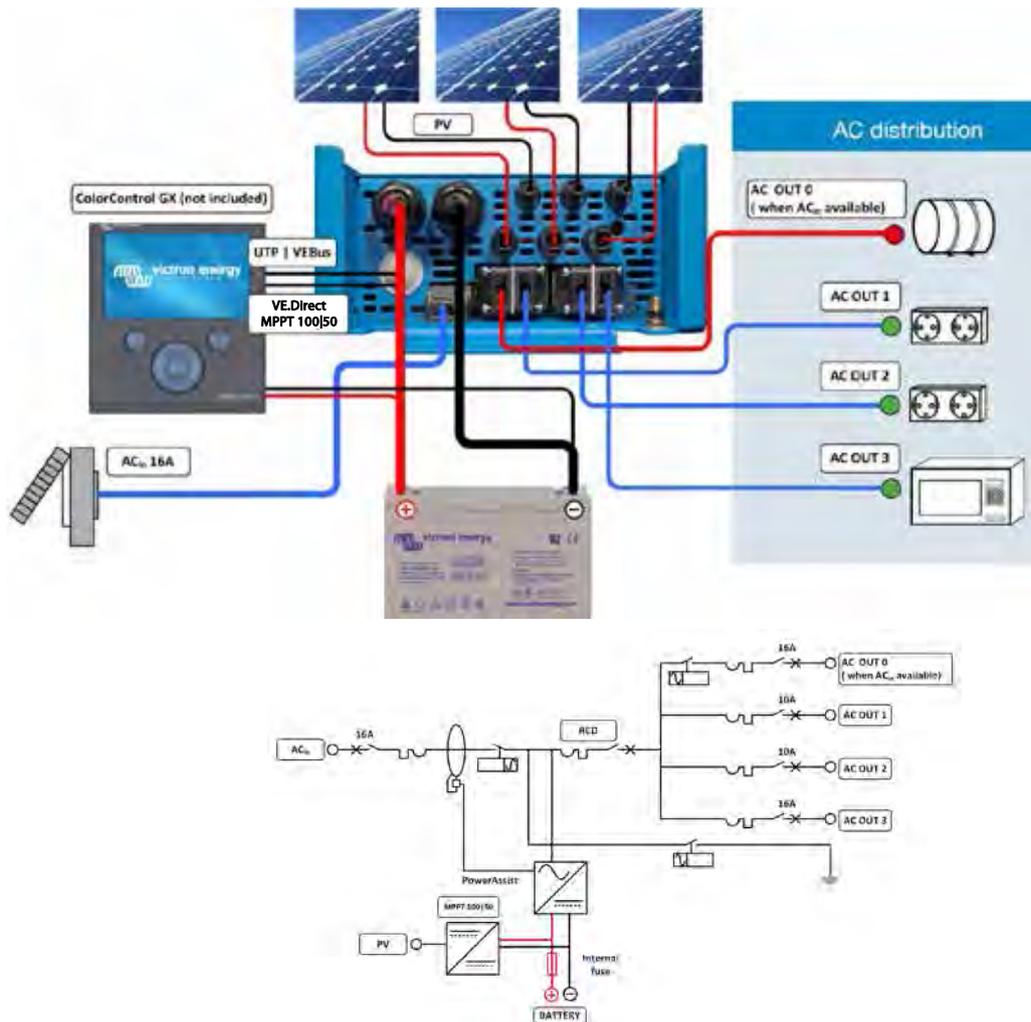
### PowerAssist

Unique PowerAssist technology protects the utility or generator supply from being overloaded by adding extra inverter power when needed.

### Unique solar application software

Several software programs (Assistants) are available to configure the system for various grid interactive or stand-alone applications. Please see

<http://www.victronenergy.nl/support-and-downloads/software/>



EasySolar	EasySolar 12/1600/70	EasySolar 24/1600/40
<b>Inverter/charger</b>		
Transfer switch	16A	
<b>INVERTER</b>		
Input voltage range	9,5 – 17V	19 – 33V
'Heavy duty' output AC 0	16A	
Output AC1, 2, 3	Output voltage: 230 VAC $\pm$ 2% Frequency: 50 Hz $\pm$ 0,1% (1)	
Cont. output power at 25°C (3)	1600VA / 1300W	
Cont. output power at 40°C	1200W	
Peak power	3000W	
Maximum efficiency	92%	94%
Zero load power	8W	10W
Zero load power in search mode	2W	3W
<b>CHARGER</b>		
AC Input	Input voltage range: 187-265VAC Input frequency: 45 – 65Hz      Power factor: 1	
Charge voltage 'absorption'	14,4V	28,8V
Charge voltage 'float'	13,8V	27,6V
Storage mode	13,2V	26,4V
Charge current house battery (4)	70A	40A
Charge current starter battery (A)	4	
Battery temperature sensor	Yes	
Programmable relay (5)	Yes	
Protection (2)	a – g	
<b>Solar Charge Controller</b>		
Model	MPPT 100/50	
Maximum output current	50A	
Maximum PV power, 6a,b)	700W	1400W
Maximum PV open circuit voltage	100V	100V
Maximum efficiency	98%	
Self-consumption	10 mA	
Charge voltage 'absorption', default setting	14,4V	28,8V
Charge voltage 'float', default setting	13,8V	27,6V
Charge algorithm	multi-stage adaptive	
Temperature compensation	-16mV/°C	-32mV/°C
Protection	a - g	
<b>COMMON CHARACTERISTICS</b>		
Operating temp. range	-20 to +50°C (fan assisted cooling)	
Humidity (non-condensing):	max 95%	
<b>ENCLOSURE</b>		
Material & Colour	aluminium (blue RAL 5012)	
Protection category	IP 21	
Battery-connection	Battery cables of 1.5 meter	
PV connection	Three sets of MC4 (PV-ST01) PV connectors.	
230 V AC-connection	G-ST18i connector	
Weight	15kg	
Dimensions (hxwx d)	745 x 214 x 110mm	
<b>STANDARDS</b>		
Safety	EN 60335-1, EN 60335-2-29, EN 62109	
Emission / Immunity	EN 55014-1, EN 55014-2, EN 61000-3-3	
Automotive Directive	2004/104/EC	
1) Can be adjusted to 60Hz and to 240V 2) Protection a. Output short circuit b. Overload c. Battery voltage too high d. Battery voltage too low e. Temperature too high f. 230 VAC 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 under voltage or genset start signal function 6a) If more PV power is connected, the controller will limit input power to 700W resp. 1400W 6b) PV voltage must exceed Vbat + 5V for the controller to start. Thereafter minimum PV voltage is Vbat + 1V	

**All-in-one solar power solution**

The EasySolar combines two MPPT solar charge controller and an inverter/charger in one enclosure.

The product is easy to install, with a minimum of wiring.

**Two solar charge controllers: 2x Blue Solar MPPT 100/50, or 2x Blue Solar MPPT 150/35**

Up to six strings of PV panels can be connected to six sets of MC<sub>4</sub> (PV-ST01) PV connectors.

**The inverter/charger: MultiPlus Compact 24/3000/70-50 or 48/3000/35-50**

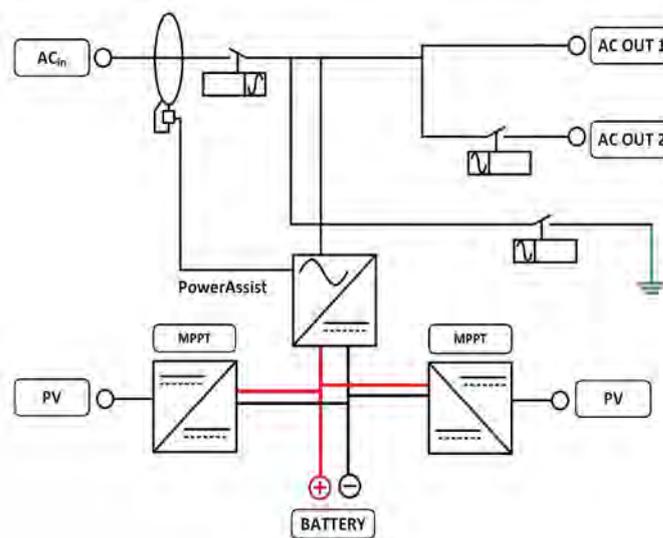
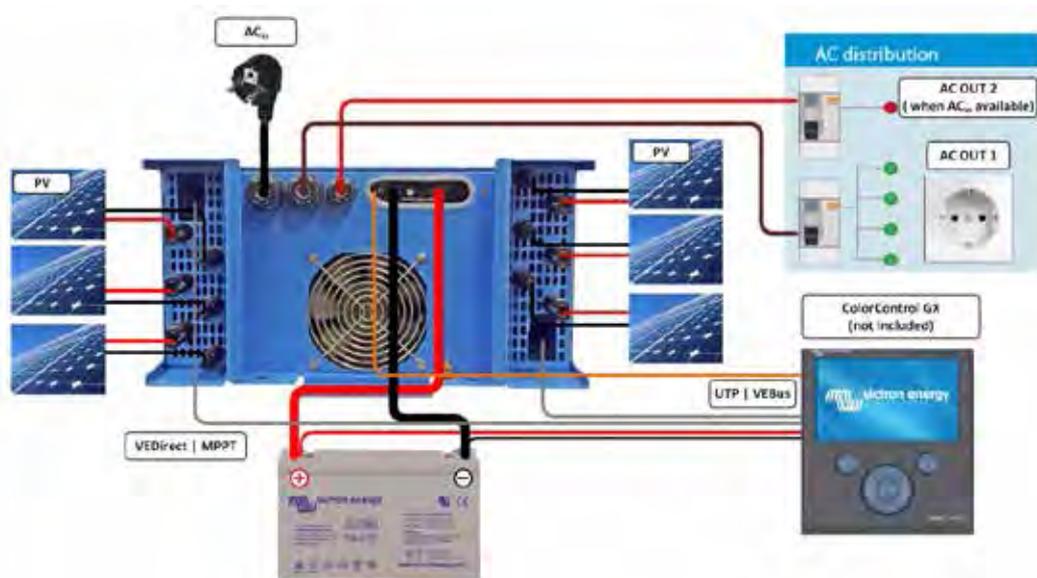
The MPPT charge controllers and the MultiPlus inverter/charger share the DC battery connection. The batteries can be charged with solar power (2x BlueSolar MPPT) and/or with AC power (inverter/charger) from the utility grid or a genset.

**PowerAssist**

Unique PowerAssist technology protects the utility or generator supply from being overloaded by adding extra inverter power when needed.

**Unique solar application software**

Several software programs (Assistants) are available to configure the system for various grid interactive or stand-alone applications. Please see <http://www.victronenergy.nl/support-and-downloads/software/>



EasySolar	EasySolar 24/3000/70-50	EasySolar 48/3000/35-50
<b>Inverter/charger</b>		
Transfer switch	50 A	
<b>INVERTER</b>		
Input voltage range	19 - 33V	38 – 63V
Output	Output voltage: 230 VAC ± 2% Frequency: 50 Hz ± 0,1% (1)	
Cont. output power at 25°C (3)	3000VA / 2500W	
Cont. output power at 40°C	2200W	
Peak power	6000W	
Maximum efficiency	94%	95%
Zero load power	15W	16W
Zero load power in search mode	5W	5W
<b>CHARGER</b>		
AC Input	Input voltage range: 187-265 VAC Input frequency: 45 – 65 Hz    Power factor: 1	
Charge voltage 'absorption'	28,8V	57,6V
Charge voltage 'float'	27,6V	55,2V
Storage mode	26,4V	52,8V
Charge current house battery (4)	70A	35A
Charge current starter battery (A)	4	
Battery temperature sensor	yes	
Programmable relay (5)	yes	
Protection (2)	a - g	
<b>Solar Charge Controller</b>		
Model	2x MPPT 100/50	2x MPTT 150/35
Maximum output current	2x 50A	2x 35A
Maximum PV power, 6a,b)	2x 1400W	2x 2000W
Maximum PV open circuit voltage	100V	150V
Maximum efficiency	98%	
Self-consumption	10 mA	
Charge voltage 'absorption', default setting	28,8V	57,6V
Charge voltage 'float', default setting	27,6V	55,2V
Charge algorithm	multi-stage adaptive	
Temperature compensation	-16 mV / °C	-32 mV / °C
Protection	a - g	
<b>COMMON CHARACTERISTICS</b>		
Operating temp. range	-20 to +50°C (fan assisted cooling)	
Humidity (non-condensing):	max 95%	
<b>ENCLOSURE</b>		
Material & Colour	aluminium (blue RAL 5012)	
Protection category	IP 21	
Battery-connection	Four M8 bolts (2 plus and 2 minus connections)	
230 V AC-connection	Screw terminals 13 mm <sup>2</sup> (6 AWG)	
PV connection	Six sets of MC4 (PV-ST01) PV connectors.	
Weight	21 kg	
Dimensions (h x w x d)	362 x 374 x 218 mm	
<b>STANDARDS</b>		
Safety	EN 60335-1, EN 60335-2-29, EN 62109, IEC 62109	
Emission / Immunity	EN 55014-1, EN 55014-2, EN 61000-3-3	
1) Can be adjusted to 60Hz and to 240V 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	3) Non-linear load, crest factor 3:1 4) At 25°C ambient 5) Programmable relay which can a.o. be set for general alarm, DC under voltage or genset start signal function 6a) If more PV power is connected, the solar charge controllers will limit input power to 1400W resp. 2000W 6b) PV voltage must exceed Vbat + 5V for the controller to start. Thereafter minimum PV voltage is Vbat + 1V	

BIDIRECTIONAL CONVERTER	
GridAssist function	In case of overload the ECOMulti will import power from the grid to prevent system shutdown.
Maximum AC current feed-through	50 A
AC voltage	230 V 50 Hz single phase
Cont. output power at 25°C	3000 VA
Cont. output power at 25°C	2500 W
Cont. output power at 40°C	2200 W
Peak power	6000 W
Maximum efficiency	94%
Power factor range (when connected to the grid)	0,7 inductive to 0,7 capacitive (programmable)
Zero load power (W)	15 W
Zero load power in AES mode	10 W (island mode operation with AC output lowered to 200 V when load < 50 Watt)
Charge voltage 'absorption'	28,2 V
Charge voltage 'float'	26,7 V
Maximum charge current	70 A
Maximum battery depth of discharge (DoD)	80%
Auxiliary output	To connect additional loads once the battery has been fully charged: 16 A relay
Programmable relay	For monitoring, alarm or other purposes
VE.Bus communication port	For parallel and three phase operation, remote monitoring, remote control and system integration
General purpose communication port	Yes
Remote on-off	Yes
BATTERY	
Technology	Lithium Iron Phosphate
Nominal voltage	25,6 V
Nominal energy at 25°C	2,3 kWh
Nominal capacity at 25°C	90 Ah
Nominal capacity at 0°C	72 Ah
Nominal capacity at -20°C	45 Ah
Battery Management System	Cell balancing, and system shutdown in case of cell over voltage, cell under voltage and over temperature
Cycle life, 80% DoD	2000 cycles
Cycle life, 70% DoD	3000 cycles
Cycle life, 50% DoD	5000 cycles
Max storage time at 25 °C	1 year
OTHER	
Display	Graphical display Graphical User Interface (GUI) Ethernet (standard) and Wifi (optional) for remote monitoring and control Data storage and graphical display on <a href="http://vrm.victronenergy.com">vrm.victronenergy.com</a> Android and iPhone apps
Operating temperature	-20 to + 40°C
Storage temperature	-40 to + 50°C
Protection category	IP22
Humidity	95% non condensing
Warranty	System: 5 years Battery: 3 years full warranty plus 7 years prorated warranty
ENCLOSURE	
Colour	Blue RAL 5012
Weight	Without battery: 28 kg      With battery: 60 kg
Dimensions (h x w x d)	475 x 575 x 360 mm
STANDARDS	
Safety	EN 60335-1, EN 60335-2-29, VDE-AR-N 4105
Emission, Immunity	EN 55014-1, EN 55014-2, EN 61000-3-3





# ECOmulti

simple wall mounted energy storage solution



## Nighttime

During the night the **ECOmulti** is disconnected from the grid. The home is powered by energy stored in the battery. The **ECOmulti** will reconnect the grid when the battery is discharged.



## Battery charging

The next day, when the PV array produces sufficient power to supply the loads and to start charging the battery, the **ECOmulti** will regulate charge current to absorb nearly 100% of the surplus PV power.

## Discharging during the day

When PV output is reduced by clouds or when a power hungry load is switched on, resulting in no surplus PV power available, battery charging will stop. Insufficient PV power will be supplemented by power from the **ECOmulti**. In case of overload power will be imported from the grid to supplement power from the **ECOmulti** (GridAssist function), and system shut down due to overload will be prevented.



## Battery fully charged

Once the battery is fully charged, additional loads (for example the water heater) can be switched on, or surplus power will be exported to the grid.

## End of the day

The **ECOmulti** disconnects from the grid about 10 minutes after PV power has become insufficient to provide any charge current. In order to prevent false disconnections due to lack of sun during the day, the inverter/charger also uses an internal timer to predict the end of the day.



## UPS function

When the grid fails, the **ECOmulti** will continue to power the home.

### Sizing the PV array

Sufficient energy must be harvested to recharge the battery and to power the home, even on a reasonably clear winter day.

At roughly 50 degrees latitude (Seattle, London, Amsterdam, Berlin, München) the two person energy conscious household will need a 2,5 kWp array. A four person household would need a 5 kWp array.

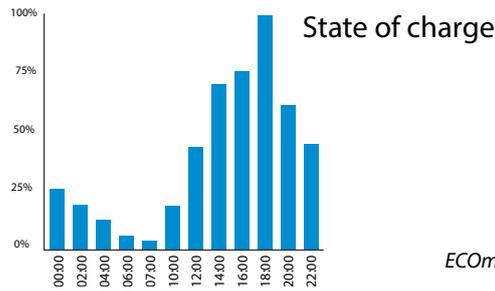
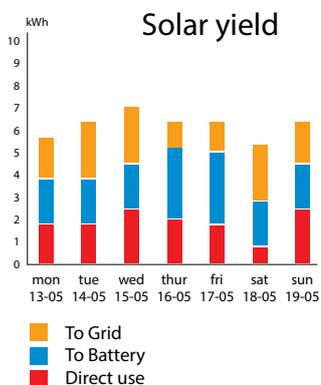
At roughly 30 to 40 degrees latitude (Los Angeles, Marseille, Sevilla) a 1 kWp resp. 2 kWp array will do.

A larger PV array will increase feedback into the grid, but not substantially increase battery utilization and self sufficiency.

### Increasing storage capacity

More battery storage capacity will reduce feedback into the grid and increase self sufficiency, especially during the summer season.

To increase self sufficiency during wintertime both the battery and the PV array have to be enlarged.



ECOMulti app



### Why 2,3 kWh?

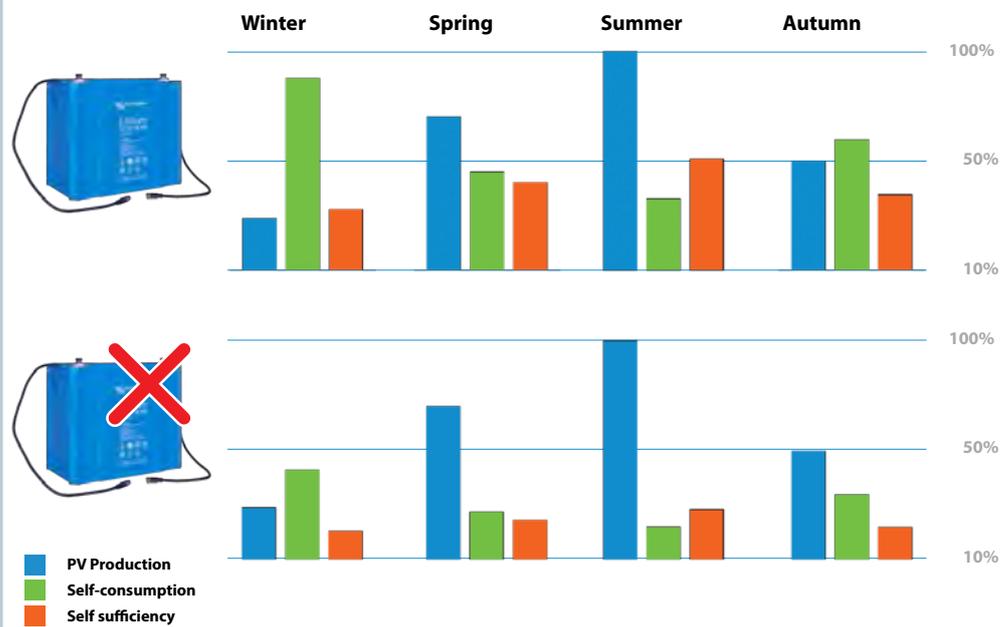
Whenever PV output exceeds consumption, storing excess output for later use will increase self-consumption.

### However

- PV harvest will fluctuate from season to season, from day to day and also within the day.
- Electricity consumption is likewise fluctuating: working days, weekends and holiday periods will all result in different consumption patterns.

A 2,3 kWh Li-ion battery is an efficient solution for a two person energy conscious household. Energy consumption from dusk to dawn will be 2 kWh or more, even when no energy hungry appliances like a dishwasher or clothes dryer are used. A fully charged 2,3 kWh battery will therefore be discharged before the sun starts shining again.

The average household with two children would fully utilize a 4,6 kWh Li-ion battery; one additional battery module.



Typical seasonal variations at roughly 50 degrees latitude ~ Seattle, London, Amsterdam, Berlin, München ~ with battery and without battery.

### Two person energy conscious household

Consumption: 2500 kWh per year  
 PV array: 2,5 kWp  
 Battery: 2,3 kWh Li-ion

### Four person energy conscious household

Consumption: 4500 kWh per year  
 PV array: 5 kWp  
 Battery: 4,6 kWh Li-ion

### A simple wall mounted energy storage solution

The **ECOMulti** can be wall mounted, is easy to install, easy to program and easy to operate.

### Extremely flexible

- Energy storage can be increased by adding battery modules.
- AC power can be increased by paralleling **ECOMulti** modules.
- Three **ECOMulti** modules can be configured for three-phase operation.
- Two **ECOMulti** modules can be configured for split phase operation.

### More self-consumption, more independence

With 2,3 kWh Li-ion storage capacity and a 3 kVA bidirectional inverter, the **ECOMulti** reduces dependence on power from the grid.

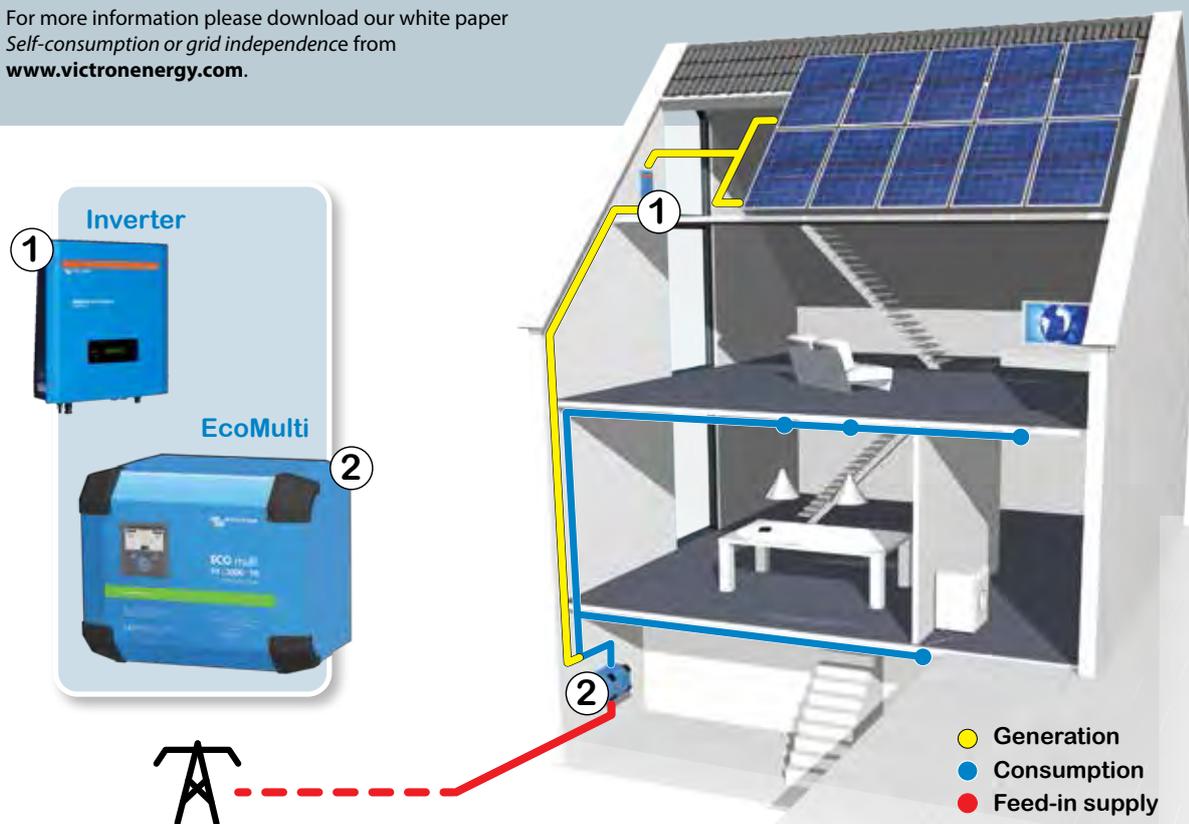
The growing interest in self-consumption is driven by increasing retail electricity prices and simultaneously decreasing feed in tariffs. Feed in tariffs are decreasing a. o. because it becomes increasingly difficult, and expensive, to ensure stability of the grid as more solar and wind power comes on line. Simultaneously, the retail price of electricity is increasing, to cover these same costs plus the cost to keep conventional power plants in hot standby to back-up renewable power generation in case the sun is not shining and/or the wind is not blowing.

The **ECOMulti** meets the German interconnection standard *VDE-AR-N 4105* and the Incentive Program for Solar Energy Storage Systems *Marktanzreizprogramm für Batteriespeicher*.

With Intelligent Battery and Load Management the **ECOMulti** can limit power export to the grid to at most 60% of the installed Wp capacity; *KfW-Programm Erneuerbare Energien "Speicher"*.

According to the Fraunhofer-Institut für Solare Energiesysteme (ISE), a household that consumes 4500 kWh per year can reduce energy import from the grid by 60% when installing a 5 kWp solar array combined with 4 kWh usable energy storage.

For more information please download our white paper *Self-consumption or grid independence* from [www.victronenergy.com](http://www.victronenergy.com).

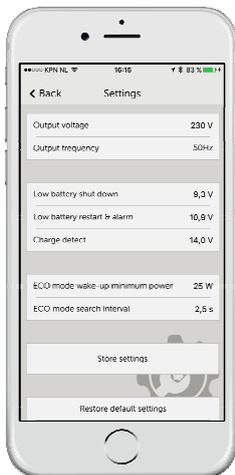




Phoenix 12/375 VE.Direct



Phoenix 12/375 VE.Direct



**VE.Direct communication port**

The VE.Direct port can be connected to:

- A computer (VE.Direct to USB interface cable needed)
- Apple and Android smartphones, tablets, macbooks and other devices (VE.Direct Bluetooth Smart dongle needed)

Fully configurable:

- Low battery voltage alarm trip and reset levels
- Low battery voltage cut-off and restart levels
- Output voltage 210 - 245V
- Frequency 50 Hz or 60 Hz
- ECO mode on/off and ECO mode sense level

Monitoring:

- In- and output voltage and current alarms

**Proven reliability**

The full bridge plus toroidal transformer topology has proven its reliability over many years. The inverters are short circuit proof and protected against overheating, whether due to overload or high ambient temperature.

**High start-up power**

Needed to start loads such as power converters for LED lamps, halogen lamps or electric tools.

**ECO mode**

When in ECO mode, the inverter will switch to standby when the load decreases below a preset value. Once in standby the inverter will switch on for a short period (adjustable, default: every 2,5 seconds). If the load exceeds a preset level, the inverter will remain on.

**Remote on/off**

A remote on/off switch can be connected to a two pole connector, or between battery plus and the left hand contact of the two pole connector.

**LED diagnosis**

Please see manual for a description.

**To transfer the load to another AC source: the automatic transfer switch**

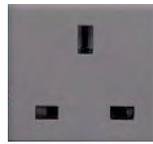
For our low power inverters we recommend our Filax Automatic Transfer Switch. The Filax features a very short switchover time (less than 20 milliseconds) so that computers and other electronic equipment will continue to operate without disruption.

**Available with different output sockets**

Schuko



UK (BS-1363)



AU/NZ (3112)



EC-320 (male plug included)



**Screw terminals**

No special tools needed for installation

Phoenix Inverter	12 Volt 24 Volt 48 Volt	12/250 24/250 48/250	12/375 24/375 48/375	12/500 24/500 48/500
Cont. power at 25°C <sup>(1)</sup>		250VA	375VA	500VA
Cont. power at 25°C / 40°C		200 / 175W	300 / 260W	400/350W
Peak power		400W	700W	900W
Output AC voltage / frequency (adjustable)		230VAC +/- 3% 50Hz or 60Hz +/- 0,1%		
Input voltage range		9,2 - 17 / 18,4 - 34,0 / 36,8 - 62,0V		
DC low shut down (adjustable)		9,3 / 18,6 / 37,2V		
DC low restart and alarm (adjustable)		10,9 / 21,8 / 43,6V		
Battery charged detect (adjustable)		14,0 / 28,0 / 56,0V		
Max. efficiency		87 / 88 / 88%	89 / 89 / 90%	90 / 90 / 91%
Zero-load power		4,2 / 5,2 / 7,9W	5,6 / 6,1 / 8,5W	6 / 6,5 / 9W
Default zero-load power in ECO mode (default retry interval: 2,5 s, adjustable)		0,8 / 1,3 / 2,5W	0,9 / 1,4 / 2,6W	1 / 1,5 / 3,0
ECO mode stop and start power setting		Adjustable		
Protection <sup>(2)</sup>		a - f		
Operating temperature range		-40 to +65°C (fan assisted cooling) (derate 1,25% per °C above 25°C)		
Humidity (non-condensing)		max 95%		
<b>ENCLOSURE</b>				
Material & Colour		Steel chassis and plastic cover (blue Ral 5012)		
Battery-connection		Screw terminals		
Maximum cable cross-section		10 mm <sup>2</sup> / AWG8	10 mm <sup>2</sup> / AWG8	10 mm <sup>2</sup> / AWG8
Standard AC outlets		Schuko (CEE 7/4), IEC-320 (male plug included) UK (BS 1363), AU/NZ (AS/NZS 3112)		
Protection category		IP 21		
Weight		2,4kg / 5,3lbs	3,0kg / 6,6lbs	3,9kg / 8,5lbs
Dimensions (hxxwd, mm) (hxxwd, inch)		86x165x260 3.4x6.5x10.2	86x165x260 3.4x6.5x10.2	86x172x275 3.4x6.8x10.8
<b>ACCESSORIES</b>				
Remote on-off		Yes		
Automatic transfer switch		Filax		
<b>STANDARDS</b>				
Safety		EN/IEC 60335-1 / EN/IEC 62109-1		
EMC		EN 55014-1 / EN 55014-2 / IEC 61000-6-1 / IEC 61000-6-3		
Automotive Directive		2004/104/EC EN 50498		
1) Nonlinear load, crest factor 3:1 2) Protection key: a) output short circuit b) overload c) battery voltage too high d) battery voltage too low e) temperature too high f) DC ripple too high				



#### Battery Alarm

An excessively high or low battery voltage is indicated by an audible and visual alarm, and a relay for remote signalling.



#### BMV Battery Monitor

The BMV Battery Monitor features an advanced microprocessor control system combined with high resolution measuring systems for battery voltage and charge/discharge current. Besides this, the software includes complex calculation algorithms to exactly determine the state of charge of the battery. The BMV selectively displays battery voltage, current, consumed Ah or time to go. The monitor also stores a host of data regarding performance and use of the battery.



VE.Direct Bluetooth Smart dongle  
(must be ordered separately)



**Phoenix Inverter**  
24/5000

### SinusMax - Superior engineering

Developed for professional duty, the Phoenix range of inverters is suitable for the widest range of applications. The design criteria have been to produce a true sine wave inverter with optimized efficiency but without compromise in performance. Employing hybrid HF technology, the result is a top quality product with compact dimensions, light in weight and capable of supplying power, problem-free, to any load.

### Extra start-up power

A unique feature of the SinusMax technology is very high start-up power. Conventional high frequency technology does not offer such extreme performance. Phoenix Inverters, however, are well suited to power up difficult loads such as refrigeration compressors, electric motors and similar appliances.

### Virtually unlimited power thanks to parallel and 3-phase operation capability

Up to 6 units inverters can operate in parallel to achieve higher power output. Six 24/5000 units, for example, will provide 24kW / 30kVA output power. Operation in 3-phase configuration is also possible.

### To transfer the load to another AC source: the automatic transfer switch

If an automatic transfer switch is required we recommend using the MultiPlus inverter/charger instead. The switch is included in these products and the charger function of the MultiPlus can be disabled. Computers and other electronic equipment will continue to operate without disruption because the MultiPlus features a very short switchover time (less than 20 milliseconds).

### Computer interface

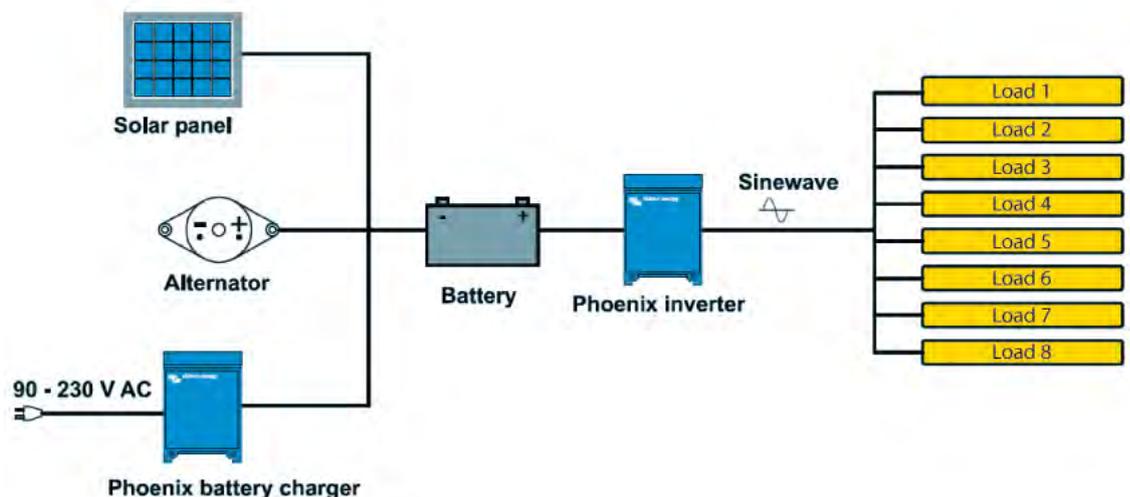
All models have a RS-485 port. All you need to connect to your PC is our MK2 interface (see under accessories). This interface takes care of galvanic isolation between the inverter and the computer, and converts from RS-485 to RS-232. A RS-232 to USB conversion cable is also available. Together with our VEConfigure software, which can be downloaded free of charge from our website, all parameters of the inverters can be customized. This includes output voltage and frequency, over and under voltage settings and programming the relay. This relay can for example be used to signal several alarm conditions, or to start a generator. The inverters can also be connected to VENet, the new power control network of Victron Energy, or to other computerized monitoring and control systems.

### New applications of high power inverters

The possibilities of paralleled high power inverters are truly amazing. For ideas, examples and battery capacity calculations please refer to our book 'Energy Unlimited' (available free of charge from Victron Energy and downloadable from [www.victronenergy.com](http://www.victronenergy.com)).



**Phoenix Inverter Compact**  
24/1600



Phoenix Inverter	C12/1200 C24/1200 C48/1200	C12/1600 C24/1600 C48/1600	C12/2000 C24/2000	12/3000 24/3000 48/3000	24/5000 48/5000
Parallel and 3-phase operation	Yes				
<b>INVERTER</b>					
Input voltage range (V DC)	9,5 – 17V 19 – 33V 38 – 66V				
Output	Output voltage: 230 VAC ±2% Frequency: 50 Hz ± 0,1% (1)				
Cont. output power at 25°C (VA) (2)	1200	1600	2000	3000	5000
Cont. output power at 25°C (W)	1000	1300	1600	2400	4000
Cont. output power at 40°C (W)	900	1200	1450	2200	3700
Cont. output power at 65°C (W)	600	800	1000	1700	3000
Peak power (W)	2400	3000	4000	6000	10000
Max. efficiency 12 / 24 / 48 V (%)	92 / 94 / 94	92 / 94 / 94	92 / 92	93 / 94 / 95	94 / 95
Zero load power 12 / 24 / 48 V (W)	8 / 10 / 12	8 / 10 / 12	9 / 11	20 / 20 / 25	30 / 35
Zero load power in AES mode (W)	5 / 8 / 10	5 / 8 / 10	7 / 9	15 / 15 / 20	25 / 30
Zero load power in Search mode (W)	2 / 3 / 4	2 / 3 / 4	3 / 4	8 / 10 / 12	10 / 15
<b>GENERAL</b>					
Programmable relay (3)	Yes				
Protection (4)	a - g				
VE.Bus communication port	For parallel and three phase operation, remote monitoring and system integration				
Remote on-off	Yes				
Common Characteristics	Operating temperature range: -40 to +65°C (fan assisted cooling) Humidity (non-condensing): max 95%				
<b>ENCLOSURE</b>					
Common Characteristics	Material & Colour: aluminium (blue RAL 5012) Protection category: IP 21				
Battery-connection	battery cables of 1.5 meter included	M8 bolts	2+2 M8 bolts		
230 V AC-connection	G-ST18i plug	Spring-clamp	Screw terminals		
Weight (kg)	10	12	18	30	
Dimensions (hwxwhd in mm)	375x214x110	520x255x125	362x258x218	444x328x240	
<b>STANDARDS</b>					
Safety	EN 60335-1				
Emission Immunity	EN 55014-1 / EN 55014-2				
1) Can be adjusted to 60 Hz and to 240 V 2) Non-linear load, crest factor 3:1 3) Programmable relay that can a.o. be set for general alarm, DC under voltage or genset start/stop function. AC rating: 230 V / 4 A DC rating: 4 A up to 35 VDC, 1A up to 60VDC	4) Protection key: a) output short circuit b) overload c) battery voltage too high d) battery voltage too low e) temperature too high f) 230 V AC on inverter output g) input voltage ripple too high				



### Phoenix Inverter Control

This panel can also be used on a MultiPlus Inverter/Charger when an automatic transfer switch but no charger function is desired. The brightness of the LEDs is automatically reduced during night time.



### Computer controlled operation and monitoring

Several interfaces are available:

- **MK2.2 VE.Bus to RS232 converter**  
Connects to the RS232 port of a computer (see 'A guide to VEConfigure')
- **MK2-USB VE.Bus to USB converter**  
Connects to a USB port (see 'A guide to VEConfigure')
- **VE.Net to VE.Bus converter**  
Interface to VE.Net (see VE.Net documentation)
- **VE.Bus to NMEA 2000 converter**
- **Victron Global Remote**  
The Global Remote is a modem which sends alarms, warnings and system status reports to cellular phones via text messages (SMS). It can also log data from Victron Battery Monitors, Multis, Quattros and Inverters to a website through a GPRS connection. Access to this website is free of charge.
- **Victron Ethernet Remote**  
To connect to Ethernet.
- **Color Control panel**  
Behind the color LCD a Linux microcomputer runs open source software. The Color Control (CCGX) provides intuitive control and monitoring for all products connected to it. The list of Victron products that can be connected is endless: Inverters, Multis, Quattros, all our latest MPPT solar chargers, BMV-700, BMV-600, Lynx Ion + Shunt



### BMV-700 Battery Monitor

The BMV-700 Battery Monitor features an advanced microprocessor control system combined with high resolution measuring systems for battery voltage and charge/discharge current. Besides this, the software includes complex calculation algorithms, like Peukert's formula, to exactly determine the state of charge of the battery. The BMV-700 selectively displays battery voltage, current, consumed Ah or time to go. The monitor also stores a host of data regarding performance and use of the battery.

Several models available (see battery monitor documentation).


**MultiPlus  
24/3000/70**

### Two AC Outputs

The main output has no break functionality. The MultiPlus takes over the supply to the connected loads in the event of a grid failure or when shore/generator power is disconnected. This happens so fast (less than 20 milliseconds) that computers and other electronic equipment will continue to operate without disruption. The second output is live only when AC is available on one of the inputs of the MultiPlus. Loads that should not discharge the battery, like a water heater for example can be connected to this output (second output available on models rated at 3 kVA and more).

### Virtually unlimited power thanks to parallel operation

Up to 6 Multis can operate in parallel to achieve higher power output. Six 24/5000/120 units, for example, will provide 25 kW / 30 kVA output power with 720 Amps charging capacity.

### Three phase capability

In addition to parallel connection, three units of the same model can be configured for three phase output. But that's not all: up to 6 sets of three units can be parallel connected for a huge 75 kW / 90 kVA inverter and more than 2000 Amps charging capacity.

### PowerControl - Dealing with limited generator, shore side or grid power

The MultiPlus is a very powerful battery charger. It will therefore draw a lot of current from the generator or shore side supply (nearly 10 A per 5 kVA Multi at 230 VAC). With the 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. It allows the MultiPlus to supplement the capacity of the alternative source. Where peak power is so often required only for a limited period, the MultiPlus will make sure that insufficient shore or generator power is immediately compensated for by power from the battery. When the load reduces, the spare power is used to recharge the battery.

### Solar energy: AC power available even during a grid failure

The MultiPlus can be used in off grid as well as grid connected PV and other alternative energy systems. Loss of mains detection software is available.

### System configuring

- In case of a stand-alone application, if settings have to be changed, this can be done in a matter of minutes with a DIP switch setting procedure.
- Parallel and three phase applications can be configured with VE.Bus Quick Configure and VE.Bus System Configurator software.
- Off grid, grid interactive and self-consumption applications, involving grid-tie inverters and/or MPPT Solar Chargers can be configured with Assistants (dedicated software for specific applications).

### On-site Monitoring and control

Several options are available: Battery Monitor, Multi Control Panel, Ve.Net Blue Power Panel, Color Control Panel, smartphone or tablet (Bluetooth Smart), laptop or computer (USB or RS232).

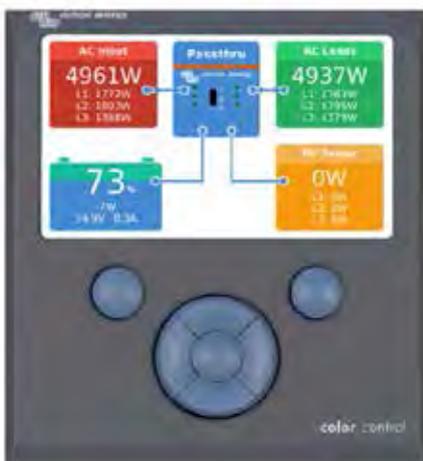
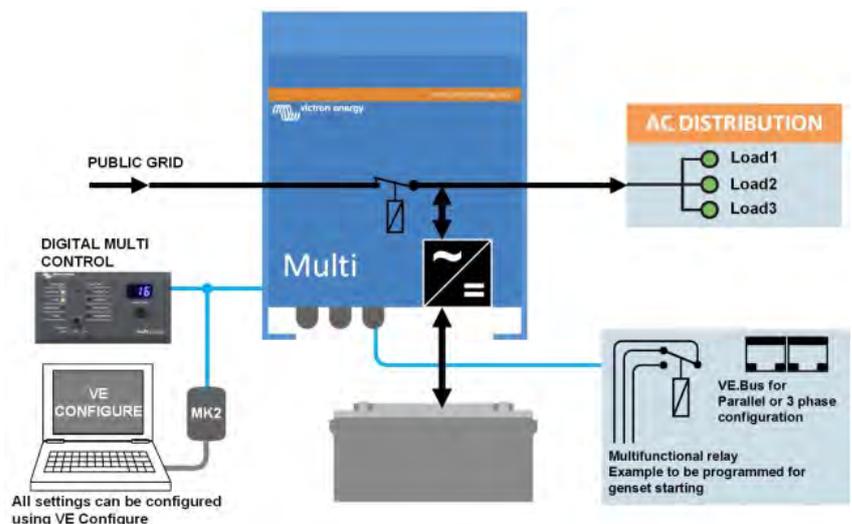
### Remote Monitoring and control

Victron Ethernet Remote, Victron Global Remote and the Color Control Panel.

Data can be stored and displayed on our VRM (Victron Remote Management) website, free of charge.

### Remote configuring

When connected to the Ethernet, systems with a Color Control panel can be accessed remotely and settings can be changed.


**MultiPlus Compact  
12/2000/80**

**Color Control Panel, showing a  
PV application**


MultiPlus	12 Volt 24 Volt 48 Volt	C 12/800/35 C 24/ 800/16	C 12/1200/50 C 24/1200/25	C 12/1600/70 C 24/1600/40	C 12/2000/80 C 24/2000/50	12/3000/120 24/3000/70 48/3000/35	24/5000/120 48/5000/70
<b>PowerControl</b>		<b>Yes</b>	<b>Yes</b>	<b>Yes</b>	<b>Yes</b>	<b>Yes</b>	<b>Yes</b>
<b>PowerAssist</b>		<b>Yes</b>	<b>Yes</b>	<b>Yes</b>	<b>Yes</b>	<b>Yes</b>	<b>Yes</b>
<b>Transfer switch (A)</b>		<b>16</b>	<b>16</b>	<b>16</b>	<b>30</b>	<b>16 or 50</b>	<b>100</b>
<b>INVERTER</b>							
Input voltage range (V DC)		9,5 – 17 V		19 – 33 V	38 – 66 V		
Output		Output voltage: 230 VAC ± 2%			Frequency: 50 Hz ± 0,1% (1)		
Cont. output power at 25°C (VA) (3)		800	1200	1600	2000	3000	5000
Cont. output power at 25°C (W)		700	1000	1300	1600	2400	4000
Cont. output power at 40°C (W)		650	900	1200	1400	2200	3700
Cont. output power at 65°C (W)		400	600	800	1000	1700	3000
Peak power (W)		1600	2400	3000	4000	6000	10.000
Maximum efficiency (%)		92 / 94	93 / 94	93 / 94	93 / 94	93 / 94 / 95	94 / 95
Zero load power (W)		8 / 10	8 / 10	8 / 10	9 / 11	20 / 20 / 25	30 / 35
Zero load power in AES mode (W)		5 / 8	5 / 8	5 / 8	7 / 9	15 / 15 / 20	25 / 30
Zero load power in Search mode (W)		2 / 3	2 / 3	2 / 3	3 / 4	8 / 10 / 12	10 / 15
<b>CHARGER</b>							
AC Input		Input voltage range: 187-265 VAC		Input frequency: 45 – 65 Hz	Power factor: 1		
Charge voltage 'absorption' (V DC)		14,4 / 28,8 / 57,6					
Charge voltage 'float' (V DC)		13,8 / 27,6 / 55,2					
Storage mode (V DC)		13,2 / 26,4 / 52,8					
Charge current house battery (A) (4)		35 / 16	50 / 25	70 / 40	80 / 50	120 / 70 / 35	120 / 70
Charge current starter battery (A)		4 (12 V and 24 V models only)					
Battery temperature sensor		yes					
<b>GENERAL</b>							
Auxiliary output (5)		n. a.	n. a.	n. a.	n. a.	Yes (16A)	Yes (25A)
Programmable relay (6)		Yes					
Protection (2)		a - g					
VE.Bus communication port		For parallel and three phase operation, remote monitoring and system integration					
General purpose com. port		n. a.	n. a.	n. a.	n. a.	Yes	Yes
Remote on-off		Yes					
Common Characteristics		Operating temp. range: -40 to +65°C (fan assisted cooling) Humidity (non-condensing): max 95%					
<b>ENCLOSURE</b>							
Common Characteristics		Material & Colour: aluminium (blue RAL 5012)			Protection category: IP 21		
Battery-connection		battery cables of 1.5 meter		M8 bolts	Four M8 bolts (2 plus and 2 minus connections)		
230 V AC-connection		G-ST18i connector		Spring-clamp	Screw terminals 13 mm <sup>2</sup> (6 AWG)		
Weight (kg)		10	10	10	12	18	30
Dimensions (hxxwx d in mm)		375x214x110		520x255x125	362x258x218	444x328x240	
<b>STANDARDS</b>							
Safety		EN-IEC 60335-1, EN-IEC 60335-2-29, IEC 62109-1					
Emission, Immunity		EN 55014-1, EN 55014-2, EN 61000-3-3, EN 61000-6-3, EN 61000-6-2, EN 61000-6-1					
Automotive Directive		2004/104/EC					
Anti-islanding		See our website					

- 1) Can be adjusted to 60 HZ; 120 V 60 Hz on request
- 2) Protection key:
  - a) output short circuit
  - b) overload
  - c) battery voltage too high
  - d) battery voltage too low
  - e) temperature too high
  - f) 230 VAC on inverter output
  - g) input voltage ripple too high
- 3) Non-linear load, crest factor 3:1
- 4) At 25°C ambient
- 5) Switches off when no external AC source available
- 6) Programmable relay that can a.o. be set for general alarm, DC under voltage or genset start/stop function  
AC rating: 230 V/4A  
DC rating: 4 A up to 35 VDC, 1 A up to 60 VDC



**Digital Multi Control Panel**  
A convenient and low cost solution for remote monitoring, with a rotary knob to set PowerControl and PowerAssist levels.



**Blue Power Panel**  
Connects to a Multi or Quattro and all VE.Net devices, in particular the VE.Net Battery Controller.  
Graphic display of currents and voltages.



**Computer controlled operation and monitoring**  
Several interfaces are available:

- **MK2.2 VE.Bus to RS232 converter**  
Connects to the RS232 port of a computer (see 'A guide to VEConfigure')
- **MK2-USB VE.Bus to USB converter**  
Connects to a USB port (see 'A guide to VEConfigure')
- **VE.Net to VE.Bus converter**  
Interface to VE.Net (see VE.Net documentation)
- **VE.Bus to NMEA 2000 converter**
- **Victron Global Remote**  
The Global Remote is a modem which sends alarms, warnings and system status reports to cellular phones via text messages (SMS). It can also log data from Victron Battery Monitors, Multis, Quattros and Inverters to a website through a GPRS connection. Access to this website is free of charge.
- **Victron Ethernet Remote**  
To connect to the Ethernet.
- **Color Control panel (see picture on page 1)**  
Behind the color LCD a Linux microcomputer runs open source software. The Color Control (CCGX) provides intuitive control and monitoring for all products connected to it. The list of Victron products that can be connected is endless: Inverters, Multis, Quattros, all our latest MPPT Solar Chargers, BMV-700, BMV-600, Lynx Ion + Shunt and more. The information can also be forwarded to our free remote monitoring website: the VRM Online Portal.



**BMV-700 Battery Monitor**  
The BMV-700 Battery Monitor features an advanced microprocessor control system combined with high resolution measuring systems for battery voltage and charge/discharge current. Besides this, the software includes complex calculation algorithms, like Peukert's formula, to exactly determine the state of charge of the battery. The BMV-700 selectively displays battery voltage, current, consumed Ah or time to go. The monitor also stores a host of data regarding performance and use of the battery.  
Several models available (see battery monitor documentation).

**Two AC inputs with integrated transfer switch**

The Quattro can be connected to two independent AC sources, for example the public grid and a generator, or two generators. The Quattro will automatically connect to the active source.

**Two AC Outputs**

The main output has no-break functionality. The Quattro takes over the supply to the connected loads in the event of a grid failure or when shore/generator power is disconnected. This happens so fast (less than 20 milliseconds) that computers and other electronic equipment will continue to operate without disruption. The second output is live only when AC is available on one of the inputs of the Quattro. Loads that should not discharge the battery, like a water heater for example, can be connected to this output.

**Virtually unlimited power thanks to parallel operation**

Up to 6 Quattro units can operate in parallel. Six units 48/10000/140, for example, will provide 54kW / 60kVA output power and 840 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 162kW / 180kVA inverter power and more than 2500A charging capacity.

**PowerControl – Dealing with limited generator, shore side or grid power**

The Quattro is a very powerful battery charger. It will therefore draw a lot of current from the generator or shore side supply (16A per 5kVA Quattro at 230VAC). A current limit can be set on each AC input. The Quattro will then take account of other AC loads and use whatever is spare for charging, thus preventing the generator or mains supply from being overloaded.

**PowerAssist – Boosting shore or generator power**

This feature takes the principle of PowerControl to a further dimension allowing the Quattro to supplement the capacity of the alternative source. Where peak power is so often required only for a limited period, the Quattro will make sure that insufficient mains or generator power is immediately compensated for by power from the battery. When the load reduces, the spare power is used to recharge the battery.

**Solar energy: AC power available even during a grid failure**

The Quattro can be used in off grid as well as grid connected PV and other alternative energy systems. Loss of mains detection software is available.

**System configuring**

- In case of a stand-alone application, if settings have to be changed, this can be done in a matter of minutes with a DIP switch setting procedure.
- Parallel and three phase applications can be configured with VE.Bus Quick Configure and VE.Bus System Configurator software.
- Off grid, grid interactive and self-consumption applications, involving grid-tie inverters and/or MPPT Solar Chargers can be configured with Assistants (dedicated software for specific applications).

**On-site Monitoring and control**

Several options are available: Battery Monitor, Multi Control Panel, Ve.Net Blue Power panel, Color Control panel, smartphone or tablet (Bluetooth Smart), laptop or computer (USB or RS232).

**Remote Monitoring and control**

Victron Ethernet Remote, Victron Global Remote and the Color Control Panel.

Data can be stored and displayed on our VRM (Victron Remote Management) website, free of charge.

**Remote configuring**

When connected to the Ethernet, systems with a Color Control panel can be accessed and settings can be changed.



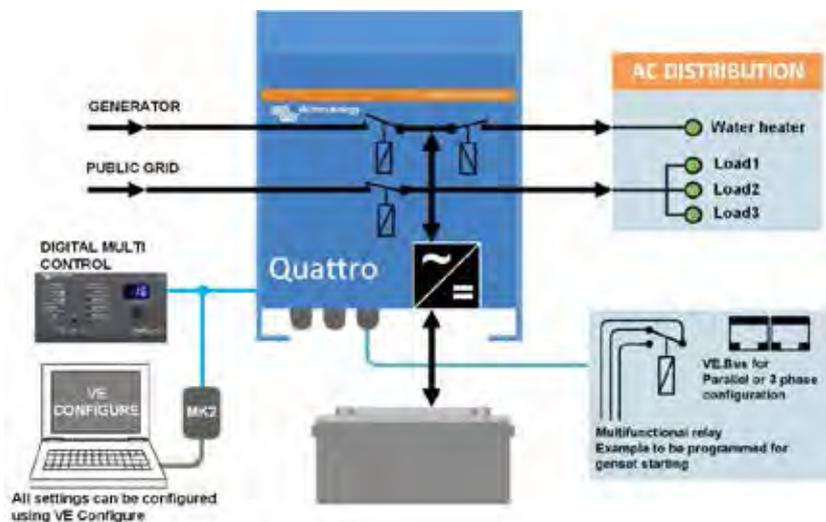
Quattro  
48/5000/70-100/100



Quattro  
24/3000/70-50/50



Color Control panel, showing a PV application



Quattro	12/3000/120-50/50 24/3000/70-50/50	12/5000/220-100/100 24/5000/120-100/100 48/5000/70-100/100	24/8000/200-100/100 48/8000/110-100/100	48/10000/140-100/100	48/15000/210-100/100
PowerControl / PowerAssist	Yes				
Integrated Transfer switch	Yes				
AC inputs (2x)	Input voltage range: 187-265 VAC Input frequency: 45 – 65 Hz Power factor: 1				
Maximum feed through current (A)	2x 50	2x 100	2x 100	2x 100	2x 100
<b>INVERTER</b>					
Input voltage range (V DC)	9,5 – 17V 19 – 33V 38 – 66V				
Output (1)	Output voltage: 230 VAC ± 2% Frequency: 50 Hz ± 0,1%				
Cont. output power at 25°C (VA) (3)	3000	5000	8000	10000	15000
Cont. output power at 25°C (W)	2400	4000	6500	8000	12000
Cont. output power at 40°C (W)	2200	3700	5500	6500	10000
Cont. output power at 65°C (W)	1700	3000	3600	4500	7000
Peak power (W)	6000	10000	16000	20000	25000
Maximum efficiency (%)	93 / 94	94 / 94 / 95	94 / 96	96	96
Zero load power (W)	20 / 20	30 / 30 / 35	45 / 50	55	80
Zero load power in AES mode (W)	15 / 15	20 / 25 / 30	30 / 30	35	50
Zero load power in Search mode (W)	8 / 10	10 / 10 / 15	10 / 20	20	30
<b>CHARGER</b>					
Charge voltage 'absorption' (V DC)	14,4 / 28,8	14,4 / 28,8 / 57,6	28,8 / 57,6	57,6	57,6
Charge voltage 'float' (V DC)	13,8 / 27,6	13,8 / 27,6 / 55,2	27,6 / 55,2	55,2	55,2
Storage mode (V DC)	13,2 / 26,4	13,2 / 26,4 / 52,8	26,4 / 52,8	52,8	52,8
Charge current house battery (A) (4)	120 / 70	220 / 120 / 70	200 / 110	140	210
Charge current starter battery (A)	4 (12V and 24V models only)				
Battery temperature sensor	Yes				
<b>GENERAL</b>					
Auxiliary output (A) (5)	25	50	50	50	50
Programmable relay (6)	3x	3x	3x	3x	3x
Protection (2)	a-g				
VE.Bus communication port	For parallel and three phase operation, remote monitoring and system integration				
General purpose com. port	2x	2x	2x	2x	2x
Remote on-off	Yes				
Common Characteristics	Operating temp.: -40 to +65°C Humidity (non-condensing): max. 95%				
<b>ENCLOSURE</b>					
Common Characteristics	Material & Colour: aluminium (blue RAL 5012) Protection category: IP 21				
Battery-connection	Four M8 bolts (2 plus and 2 minus connections)				
230 V AC-connection	Screw terminals 13 mm <sup>2</sup> (6 AWG)	Bolts M6	Bolts M6	Bolts M6	Bolts M6
Weight (kg)	19	34 / 30 / 30	45 / 41	45	72
Dimensions (hwxwd in mm)	362 x 258 x 218	470 x 350 x 280 444 x 328 x 240 444 x 328 x 240	470 x 350 x 280	470 x 350 x 280	572 x 488 x 344
<b>STANDARDS</b>					
Safety	EN-IEC 60335-1, EN-IEC 60335-2-29, EN-IEC 62109-1				
Emission, Immunity	EN 55014-1, EN 55014-2, EN-IEC 61000-3-2, EN-IEC 61000-3-3, EN-IEC 61000-6-3, EN-IEC 61000-6-2, EN-IEC 61000-6-1				
Vehicles, aftermarket	12V and 24V models: EN 50498				
Anti-islanding	See our website				
1) Can be adjusted to 60 Hz; 120 V 60 Hz on request	3) Non-linear load, crest factor 3:1				
2) Protection key:	4) At 25°C ambient				
a) output short circuit	5) Switches off when no external AC source available				
b) overload	6) Programmable relay that can a.o. be set for general alarm, DC under voltage or genset start/stop function				
c) battery voltage too high	AC rating: 230 V / 4 A				
d) battery voltage too low	DC rating: 4 A up to 35 VDC, 1 A up to 60 VDC				
e) temperature too high					
f) 230 VAC on inverter output					
g) input voltage ripple too high					



### Digital Multi Control Panel

A convenient and low cost solution for remote monitoring, with a rotary knob to set PowerControl and PowerAssist levels.



### Blue Power Panel

Connects to a Multi or Quattro and all VE.Net devices, in particular the VE.Net Battery Controller. Graphical display of currents and voltages.



### Computer controlled operation and monitoring

Several interfaces are available:

- **MK2.2 VE.Bus to RS232 converter**  
Connects to the RS232 port of a computer (see 'A guide to VEConfigure')
- **MK2-USB VE.Bus to USB converter**  
Connects to a USB port (see 'A guide to VEConfigure')
- **VE.Net to VE.Bus converter**  
Interface to VE.Net (see VE.Net documentation)
- **VE.Bus to NMEA 2000 converter**
- **Victron Global Remote**  
The Global Remote is a modem which sends alarms, warnings and system status reports to cellular phones via text messages (SMS). It can also log data from Victron Battery Monitors, Multis, Quattros and Inverters to our VRM website through a GPRS connection. Access to this website is free of charge.
- **Victron Ethernet Remote**  
To connect to the Ethernet.
- **Color Control panel (see picture on page 1)**  
Behind the color LCD a Linux microcomputer runs open source software. The Color Control (CCGX) provides intuitive control and monitoring for all products connected to it. The list of Victron products that can be connected is endless: Inverters, Multis, Quattros, all our latest MPPT solar chargers, BMV-700, BMV-600, Lynx Ion + Shunt and more. The information can also be forwarded to our free remote monitoring website: the VRM Online Portal.



### BMV-700 Battery Monitor

The BMV-700 Battery Monitor features an advanced microprocessor control system combined with high resolution measuring systems for battery voltage and charge/discharge current. Besides this, the software includes complex calculation algorithms, like Peukert's formula, to exactly determine the state of charge of the battery. The BMV-700 selectively displays battery voltage, current, consumed Ah or time to go. The monitor also stores a host of data regarding performance and use of the battery.

Several models available (see battery monitor documentation).



**MultiPlus**  
24/3000/70

**Multifunctional, with intelligent power management**

The MultiPlus is a powerful true sine wave inverter, a sophisticated battery charger that features adaptive charge technology, and a high-speed AC transfer switch in a single compact enclosure. Next to these primary functions, the MultiPlus has several advanced features, as outlined below.

**Two AC Outputs**

The main output has no-break functionality. The MultiPlus takes over the supply to the connected loads in the event of a grid failure or when shore-/generator power is disconnected. This happens so fast (less than 20 milliseconds) that computers and other electronic equipment will continue to operate without disruption.

The second output is live only when AC is available on the input of the MultiPlus. Loads that should not discharge the battery, like a water heater for example, can be connected to this output (second output available on models rated at 3kVA and more).

**Virtually unlimited power thanks to parallel operation**

Up to six Multis can operate in parallel to achieve higher power output. Six 24/3000/70 units, for example, provide 15kW / 18kVA output power with 420 Amps of charging capacity.

**Three phase capability**

In addition to parallel connection, three units can be configured for three-phase output. But that's not all: with three strings of six parallel units a 45 kW / 54 kVA three phase inverter and 1260 A charger can be built.

**Split phase options**

Two units can be stacked to provide 120-0-120 V, and additional units can be paralleled up to a total of 6 units per phase, to supply up to 30 kW / 36 kVA of split phase power.

Alternatively, a split phase AC source can be obtained by connecting our autotransformer (see data sheet on [www.victronenergy.com](http://www.victronenergy.com)) to a 'European' inverter programmed to supply 240 V / 60 Hz.

**PowerControl - Dealing with limited generator, shore side or grid power**

The MultiPlus is a very powerful battery charger. It will therefore draw a lot of current from the generator or shore side supply (nearly 20 A per 3 kVA MultiPlus at 120 VAC). With the 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. It allows the MultiPlus to supplement the capacity of the alternative source. Where peak power is so often required only for a limited period, the MultiPlus will make sure that insufficient shore or generator power is immediately compensated for by power from the battery. When the load reduces, the spare power is used to recharge the battery.

**Four stage adaptive charger and dual bank battery charging**

The main output provides a powerful charge to the battery system by means of advanced 'adaptive charge' software. The software fine-tunes the three stage automatic process to suit the condition of the battery, and adds a fourth stage for long periods of float charging. The adaptive charge process is described in more detail on the Phoenix Charger datasheet and on our website, under Technical Information. In addition to this, the MultiPlus will charge a second battery using an independent trickle charge output intended for a main engine or generator starter battery.

**System configuring has never been easier**

After installation, the MultiPlus is ready to go.

If settings have to be changed, this can be done in a matter of minutes with a DIP switch setting procedure. Even parallel and 3-phase operation can be programmed with DIP switches: no computer needed!

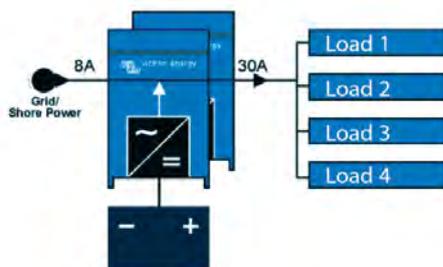
Alternatively, VE.Net can be used instead of the DIP switches.

And sophisticated software (VE.Bus Quick Configure and VE.Bus System Configurator) is available to configure several new, advanced, features.

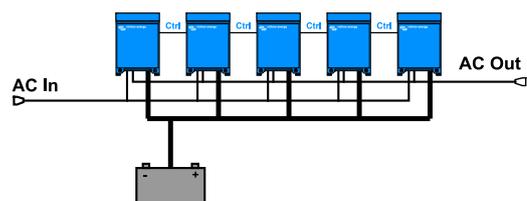


**MultiPlus Compact**  
12/2000/80

**PowerAssist with 2x MultiPlus in parallel**



**Five parallel units: output power 12,5 kW**



MultiPlus	12 Volt 24 Volt	12/2000/80 24/2000/50	12/3000/120 24/3000/70
<b>PowerControl</b>			<b>Yes</b>
<b>PowerAssist</b>			<b>Yes</b>
<b>Transfer switch (A)</b>			<b>50</b>
<b>Parallel and 3-phase operation</b>			<b>Yes</b>
<b>INVERTER</b>			
Input voltage range (V DC)		9,5 – 17 V	19 – 33 V
Output		Output voltage: 120 VAC ± 2%	Frequency: 60 Hz ± 0,1% (1)
Cont. output power at 25°C / 77°F (VA) (3)	2000		3000
Cont. output power at 25°C / 77°F (W)	1600		2400
Cont. output power at 40°C / 104°F (W)	1450		2200
Cont. output power at 65°C / 150°F (W)	1100		1700
Peak power (W)	4000		6000
Maximum efficiency (%)	92 / 94		93 / 94
Zero load power (W)	9 / 11		20 / 20
Zero load power in AES mode (W)	7 / 8		15 / 15
Zero load power in Search mode (W)	3 / 4		8 / 10
<b>CHARGER</b>			
AC Input		Input voltage range: 95-140 VAC	Input frequency: 45 – 65 Hz Power factor: 1
Charge voltage 'absorption' (V DC)			14,4 / 28,8
Charge voltage 'float' (V DC)			13,8 / 27,6
Storage mode (V DC)			13,2 / 26,4
Charge current house battery (A) (4)	80 / 50		120 / 70
Charge current starter battery (A)			4
Battery temperature sensor			yes
<b>GENERAL</b>			
Auxiliary output (5)	n. a.		Yes (32A)
Programmable relay (6)	Yes (1x)		Yes (3x)
Protection (2)		a - g	
VE.Bus communication port		For parallel and three phase operation, remote monitoring and system integration	
General purpose com. port (7)	n. a.		Yes (2x)
Remote on-off		Yes	
Common Characteristics		Operating temp. range: -40 - +65°C / -40 to 150°F (fan assisted cooling)	Humidity (non-condensing): max 95%
<b>ENCLOSURE</b>			
Common Characteristics		Material & Colour: aluminium (blue RAL 5012)	Protection category: IP 21
Battery-connection	M8 bolts		M8 bolts (2 plus and 2 minus connections)
120 V AC-connection	Screw-terminal 6 AWG (13 mm <sup>2</sup> )		Screw-terminal 6 AWG (13mm <sup>2</sup> )
Weight	13 kg 25 lbs.		19kg 40 lbs.
Dimensions (hwxwd in mm and inches)	520x255x125 mm 20.5x10.0x5.0 inch		362x258x218 mm 14.3x10.2x8.6 inch
<b>STANDARDS</b>			
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 60 HZ; 120 V 60 Hz on request 2) Protection key: a) output short circuit b) overload c) battery voltage too high d) battery voltage too low e) temperature too high f) 230 VAC on inverter output g) input voltage ripple too high 3) Non-linear load, crest factor 3:1 4) At 75°F ambient 5) Switches off when no external AC source available 6) Programmable relay that can a.o. be set for general alarm, DC under voltage or genset start/stop function AC rating: 230 V/4 A DC rating: 4 A up to 35 VDC, 1 A up to 60 VDC 7) A.o. to communicate with a Lithium Ion battery BMS			



### Digital Multi Control

A convenient and low cost solution for remote monitoring, with a rotary knob to set PowerControl and PowerAssist levels.



### Blue Power Panel

Connects to a Multi or Quattro and all VE.Net devices, in particular the VE.Net Battery Controller.  
Graphic display of currents and voltages.



### Computer controlled operation and monitoring

Several interfaces are available:

- **MK2.2 VE.Bus to RS232 converter**  
Connects to the RS232 port of a computer (see 'A guide to VEConfigure')
- **MK2-USB VE.Bus to USB converter**  
Connects to a USB port (see 'A guide to VEConfigure')
- **VE.Net to VE.Bus converter**  
Interface to VE.Net (see VE.Net documentation)
- **VE.Bus to NMEA 2000 converter**
- **Victron Global Remote**  
The Global Remote is a modem which sends alarms, warnings and system status reports to cellular phones via text messages (SMS). It can also log data from Victron Battery Monitors, Multis, Quattros and Inverters to a website through a GPRS connection. Access to this website is free of charge.
- **Victron Ethernet Remote**  
To connect to Ethernet.



### BMV-700 Battery Monitor

The BMV-700 Battery Monitor features an advanced microprocessor control system combined with high resolution measuring systems for battery voltage and charge/discharge current. Besides this, the software includes complex calculation algorithms, like Peukert's formula, to exactly determine the state of charge of the battery. The BMV-700 selectively displays battery voltage, current, consumed Ah or time to go. The monitor also stores a host of data regarding performance and use of the battery.

### Two AC inputs with integrated transfer switch

The Quattro can be connected to two independent AC sources, for example shore-side power and a generator, or two generators. The Quattro will automatically connect to the active source.

### Two AC Outputs

The main output has no-break functionality. The Quattro takes over the supply to the connected loads in the event of a grid failure or when shore/generator power is disconnected. This happens so fast (less than 20 milliseconds) that computers and other electronic equipment will continue to operate without disruption.

The second output is live only when AC is available on one of the inputs of the Quattro. Loads that should not discharge the battery, like a water heater for example, can be connected to this output.

### Virtually unlimited power thanks to parallel operation

Up to 6 Quattro units can operate in parallel. Six units 48/5000/70, for example, will provide 27 kW / 30 kVA 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 81 kW / 90 kVA inverter power and 1260 A charging capacity.

### Split phase options

Two units can be stacked to provide 120-0-120 V, and additional units can be paralleled up to a total of 6 units per phase, to supply up to 30 kW / 36 kVA of split phase power.

Alternatively, a split phase AC source can be obtained by connecting our autotransformer (see data sheet on [www.victronenergy.com](http://www.victronenergy.com)) to a 'European' inverter programmed to supply 240 V / 60Hz.

### PowerControl – Dealing with limited generator, shore-side or grid power

The Quattro is a very powerful battery charger. It will therefore draw a lot of current from the generator or shore side supply (Up to 40 A per 5 kVA Quattro at 120 VAC). A current limit can be set on each AC input. The Quattro will then take account of other AC loads and use whatever is spare for charging, thus preventing the generator or shore supply from being overloaded.

### PowerAssist – Boosting shore or generator power

This feature takes the principle of PowerControl to a further dimension allowing the Quattro to supplement the capacity of the alternative source. Where peak power is so often required only for a limited period, the Quattro will make sure that insufficient shore or generator power is immediately compensated for by power from the battery. When the load reduces, the spare power is used to recharge the battery.

### Solar energy: AC power available even during a grid failure

The Quattro can be used in off grid as well as grid connected PV and other alternative energy systems.

### System configuring

- In case of a stand-alone application, if settings have to be changed, this can be done in a matter of minutes with a DIP switch setting procedure.
- Parallel and three phase applications can be configured with VE.Bus Quick Configure and VE.Bus System Configurator software.
- Off grid, grid interactive and self-consumption applications, involving grid-tie inverters and/or MPPT Solar Chargers can be configured with Assistants (dedicated software for specific applications).

### On-site Monitoring and control

Several options are available: Battery Monitor, Multi Control Panel, Ve.Net Blue Power panel, Color Control panel, smartphone or tablet (Bluetooth Smart), laptop or computer (USB or RS232).

### Remote Monitoring and control

Victron Ethernet Remote, Victron Global Remote and the Color Control Panel.

Data can be stored and displayed on our VRM (Victron Remote Management) website, free of charge.

### Remote configuring

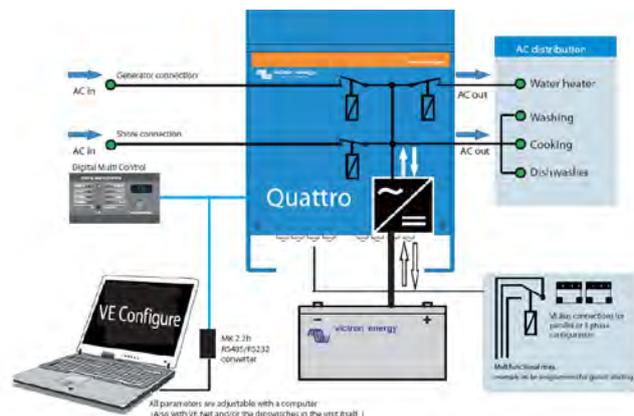
When connected to the Ethernet, systems with a Color Control panel can be accessed and settings can be changed.



**Quattro**  
24/5000/120-100/100



**Color Control panel, showing a PV application**



Quattro	12/5000/200-100/100 120V	24/5000/120-100/100 120V	48/3000/35-50/50 120V	48/5000/70-100/100 120V
PowerControl / PowerAssist	Yes			
Integrated Transfer switch	Yes			
AC inputs (2x)	Input voltage range: 90-140 VAC Input frequency: 45 – 65 Hz Power factor: 1			
Maximum feed through current (A)	2x100	2x100	2x50	2x100
<b>INVERTER</b>				
Input voltage range (V DC)	9,5 - 17	19 – 33	37,2 – 64,4	37,2 – 64,4
Output (1)	Output voltage: 120 VAC ± 2%		Frequency: 60 Hz ± 0,1%	
Cont. output power at 25°C / 77°F (VA) (3)	5000	5000	3000	5000
Cont. output power at 25°C / 77°F (W)	4000	4000	2400	4000
Cont. output power at 40°C / 104°F (W)	3700	3700	2200	3700
Cont. output power at 65°C / 150°F (W)	3000	3000	1700	3000
Peak power (W)	10000	10000	6000	10000
Maximum efficiency (%)	94	94	94	95
Zero load power (W)	30	30	25	35
Zero load power in AES mode (W)	20	25	20	30
Zero load power in Search mode (W)	10	10	12	15
<b>CHARGER</b>				
Charge voltage 'absorption' (V DC)	14,4	28,8	57,6	57,6
Charge voltage 'float' (V DC)	13,8	27,6	55,2	55,2
Storage mode (V DC)	13,2	26,4	52,8	52,8
Charge current house battery (A) (4)	200	120	35	70
Charge current starter battery (A)	4	4	n. a.	n. a.
Battery temperature sensor	Yes			
<b>GENERAL</b>				
Auxiliary output (A) (5)	50	50	32	50
Programmable relay (6)	3x	3x	3x	3x
Protection (2)	a-g			
VE.Bus communication port	For parallel and three phase operation, remote monitoring and system integration			
General purpose com. port (7)	Yes, 2x			
Remote on-off	Yes			
Common Characteristics	Operating temp.: -40 - +65°C (-40 - 150°F) Humidity (non-condensing): max. 95%			
<b>ENCLOSURE</b>				
Common Characteristics	Material & Colour: aluminium (blue RAL 5012) Protection category: IP 21			
Battery-connection	Four M8 bolts (2 plus and 2 minus connections)			
230 V AC-connection	M6 bolts	M6 bolts	Screw terminals 13 mm <sup>2</sup> (6 AWG)	M6 bolts
Weight (kg)	75 lb 34 kg	66 lb 30 kg	42 lb 19 kg	66 lb 30 kg
Dimensions (hwxwd)	18,5 x 14,0 x 11,2 inch 470 x 350 x 280 mm	17,5 x 13,0 x 9,6 inch 444 x 328 x 240 mm	14,3 x 10,2 x 8,6 inch 362 x 258 x 218 mm	17,5 x 13,0 x 9,6 inch 444 x 328 x 240 mm
<b>STANDARDS</b>				
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 50 Hz	3) Non-linear load, crest factor 3:1			
2) Protection key:	4) At 25°C ambient			
a) output short circuit	5) Switches off when no external AC source available			
b) overload	6) Programmable relay that can be set for general alarm, DC under voltage or genset start/stop function			
c) battery voltage too high	AC rating: 120 V / 4 A			
d) battery voltage too low	DC rating: 4 A up to 35 VDC, 1 A up to 60 VDC			
e) temperature too high	7) A.o. to communicate with a Lithium-Ion battery BMS			
f) 120 VAC on inverter output				
g) input voltage ripple too high				



### Digital Multi Control

A convenient and low cost solution for remote monitoring, with a rotary knob to set PowerControl and PowerAssist levels.



### Blue Power Panel

Connects to a Multi or Quattro and all VE.Net devices, in particular the VE.Net Battery Controller.

Graphic display of currents and voltages.



### Computer controlled operation and monitoring

Several interfaces are available:

- **MK2.2 VE.Bus to RS232 converter**  
Connects to the RS232 port of a computer (see 'A guide to VEConfigure')

- **MK2-USB VE.Bus to USB converter**  
Connects to a USB port (see 'A guide to VEConfigure')

- **VE.Net to VE.Bus converter**  
Interface to VE.Net (see VE.Net documentation)

- **VE.Bus to NMEA 2000 converter**

- **Victron Global Remote**

The Global Remote is a modem which sends alarms, warnings and system status reports to cellular phones via text messages (SMS). It can also log data from Victron Battery Monitors, Multis, Quattros and Inverters to a website through a GPRS connection. Access to this website is free of charge.

- **Victron Ethernet Remote**

To connect to Ethernet.

- **Color Control panel (see picture on page 1)**

Behind the color LCD a Linux microcomputer runs open source software. The Color Control (CCGX) provides intuitive control and monitoring for all products connected to it. The list of Victron products that can be connected is endless: Inverters, Multis, Quattros, all our latest MPPT solar chargers, BMV-700, BMV-600, Lynx Ion + Shunt and more. The information can also be forwarded to our free remote monitoring website: the VRM Online Portal.



### BMV-700 Battery Monitor

The BMV-700 Battery Monitor features an advanced microprocessor control system combined with high resolution measuring systems for battery voltage and charge/discharge current. Besides this, the software includes complex calculation algorithms, like Peukert's formula, to exactly determine the state of charge of the battery. The BMV-700 selectively displays battery voltage, current, consumed Ah or time to go. The monitor also stores a host of data regarding performance and use of the battery.

## Color Control GX



### Color Control GX

The Color Control (CCGX) provides intuitive control and monitoring for all products connected to it. The list of Victron products that can be connected is endless: Inverters, Multis, Quattros, all our latest MPPT solar chargers, BMV-700, BMV-600, Lynx Ion + Shunt and more.

### VRM Online Portal

Besides monitoring and controlling products on the CCGX, the information is also forwarded to our free remote monitoring website: the VRM Online Portal. To get an impression of the VRM Online Portal, visit <https://vrm.victronenergy.com>, and try our demo. See also the screenshots further down in this datasheet.

### Future functionality

The CCGX has endless possibilities. To implement all our ideas and wishes will take years. There are therefore many features that are not yet available. Functions marked with 'Future function' will become available later on, as a firmware update. Firmware updates are free of charge, as with all updates of Victron products. Updating the product is easy: the CCGX will update itself automatically, as long as it is connected to the internet. Manual updates can be done with a USB stick and microSD cards.

### Supported products

- Multis and Quattros, including split-phase and three-phase systems. Monitoring and control (on/off and current limiter). Changing settings is not yet available.
- BlueSolar MPPT 150/70 and the MPPT 150/85. Current solar output is visible on the overview screen, and all parameters are logged to the VRM online portal. Note that the VRM App has a nice overview showing data of the BlueSolar MPPT 150/70 as well. When multiple BlueSolar MPPTs with VE.Can are used in parallel, the Color Control will show all information as one. See also our blog-post about [synchronizing multiple MPPT 150/70 solar chargers](#).
- BlueSolar MPPT Solar Chargers with a VE.Direct port (70/15, 75/15, 100/15, 100/30, 75/50, 100/50, 150/35) can be connected to the VE.Direct ports on the CCGX. Connecting multiple at the same time is possible. They will all appear as a separate Solar Charger in the device list.
- BMV-700 family can be connected directly to the VE.Direct ports on the CCGX. Use the VE.Direct Cable for this. [See our pricelist](#).
- BMV-600 family can be connected to the VE.Direct ports on the CCGX. Use the VE.Direct to BMV60xS cable for that. [See our pricelist](#).
- Lynx Ion + Shunt
- Lynx Shunt VE.Can
- Skylla-i
- NMEA2000 tank sensors
- A USB GPS can be connected to the USB port. Location and speed will be visible on the display, and the data is sent to the VRM Portal for tracking purposes. The map on VRM will show the latest position.
- WiFi USB. [See our pricelist](#).

Note that there are more options for products which use the VE.Direct ports, such as BMVs and small MPPTs. They can also be connected through USB, useful when more than two products need to be connected. Use an off-the-shelf USB-hub and the VE.Direct to USB interface, ASS030530000.

### Other highlights

- When connected to the internet, the CCGX will update itself automatically when there is a new software version available.
- Multiple languages: English, Chinese, German, Italian, Spanish, French, Swedish and Dutch.
- Use the CCGX as a Modbus-TCP gateway to all connected Victron products. See our [Modbus-TCP FAQ](#) for more information.

### Notes for existing VGR2 and VER users

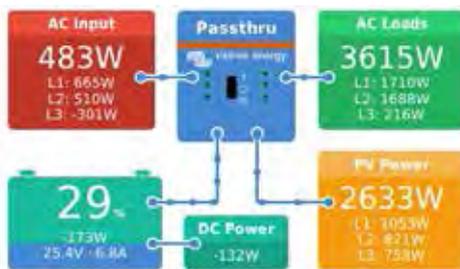
- Opposite to the Victron Global Remote 2 (VGR2) and Victron Ethernet Remote (VER), the CCGX stores all data locally during network interruptions. As soon as the connection to the VRM Online Portal is restored, it will automatically send all backlogged data to the portal. Data can then be analysed on <https://vrm.victronenergy.com>.
- The local website, as present on the VER, is not yet supported.
- The CCGX has no internal GPRS modem: you cannot insert a sim-card into the CCGX. Use an off-the-shelf GPRS or 3G router instead. See the [blog post about 3G routers](#).

### More information

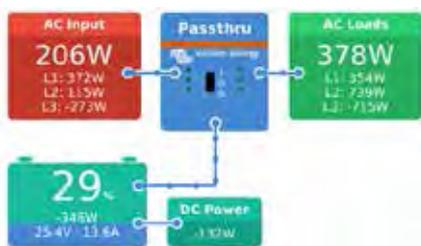
For help with installation please read the [Color Control GX Manual](#) and visit the [Frequently Asked Questions page](#).

Color Control GX			
Power supply voltage range	9 – 70V DC		
<b>Current draw</b>	12V DC	24V DC	48V DC
Switched off	0mA	0mA	0mA
Display off	140mA	80mA	40mA
Display at minimum intensity	160mA	90mA	45mA
Display at maximum intensity	245mA	125mA	65mA
Potential free contact	3A / 30V DC / 250V AC (Normally open)		
Communication ports			
VE.Direct	2 separate VE.Direct ports – isolated		
VE.Can	2 paralleled RJ45 sockets – isolated		
VE.Bus	2 paralleled RJ45 sockets – isolated		
USB	2 USB Host ports – not isolated		
Ethernet	10/100/1000MB RJ45 socket – isolated except shield		
3rd party interfacing			
Modbus-TCP	Use Modbus-TCP to monitor and control all products connected to the Color Control GX		
JSON	Use the VRM JSON API to retrieve data from the <a href="#">VRM Portal</a>		
Other			
Outer dimensions (h x w x d)	130 x 120 x 28mm		
Operating temperature range	-20 to +50°C		
Standards			
Safety	EN 60950		
EMC	EN 61000-6-3, EN 55014-1, EN 61000-6-2, EN 61000-6-1, EN 55014-2		
Automotive	E4-10R-053535		

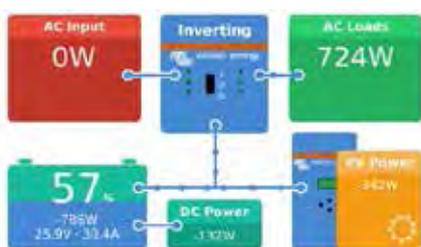
Overview - Multi with PV Inverter on output (Hub-2)



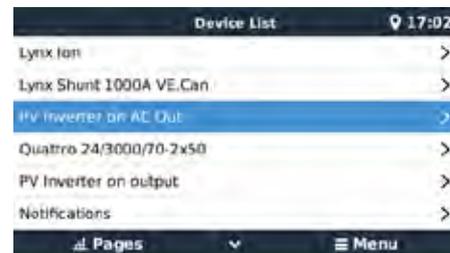
Overview - Multi



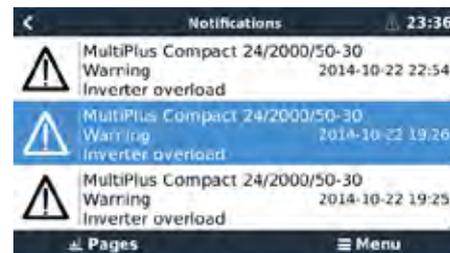
Overview - Multi with MPPT 150/70



Main menu

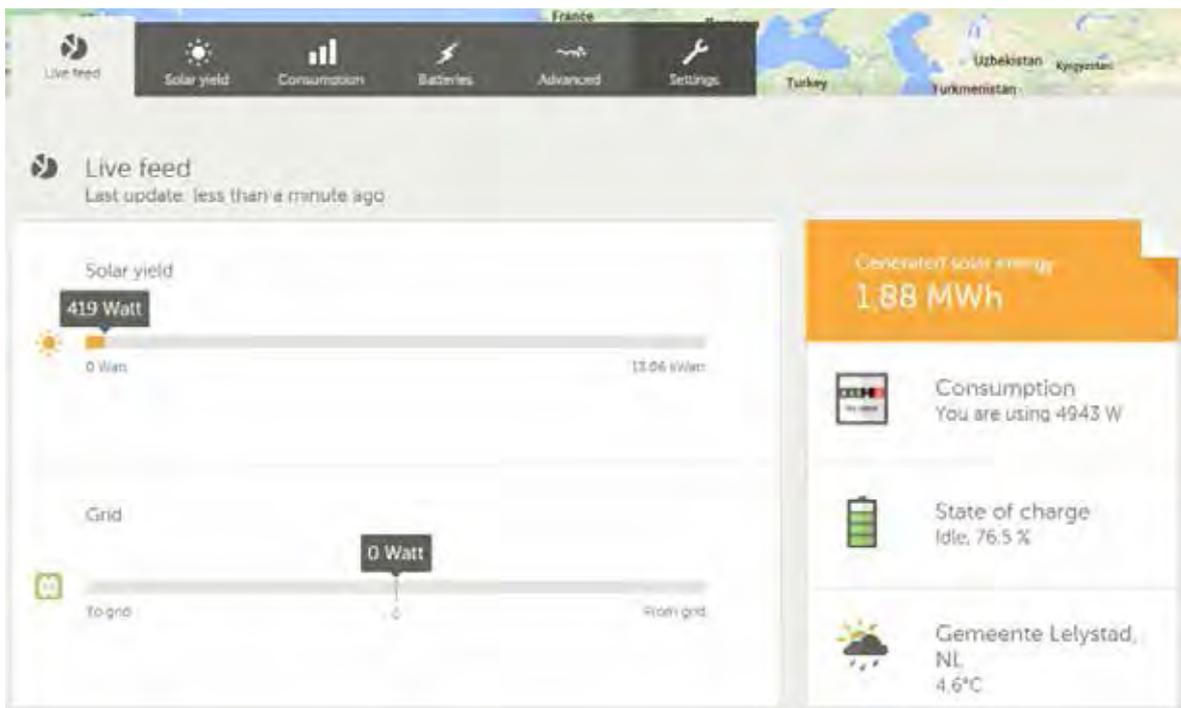
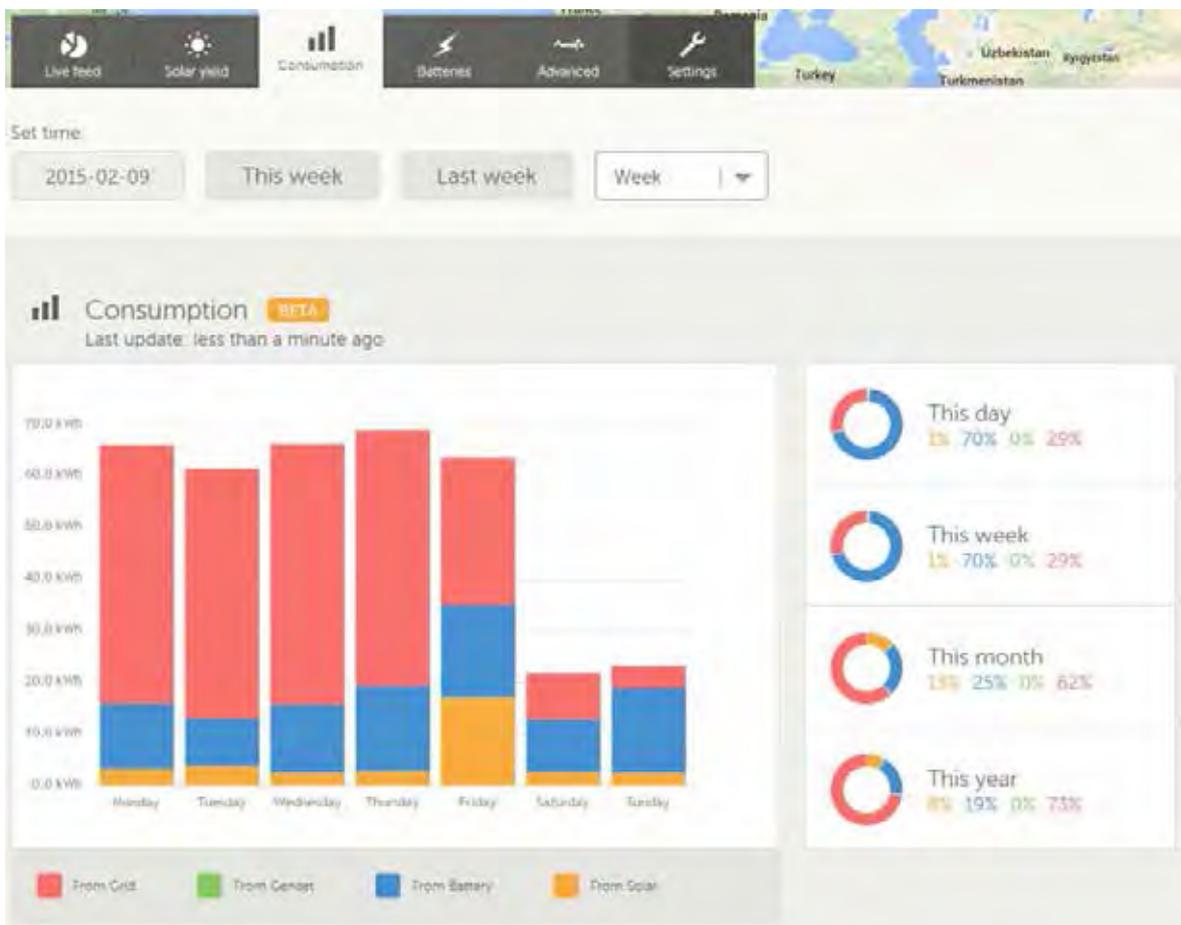


Alarm notifications

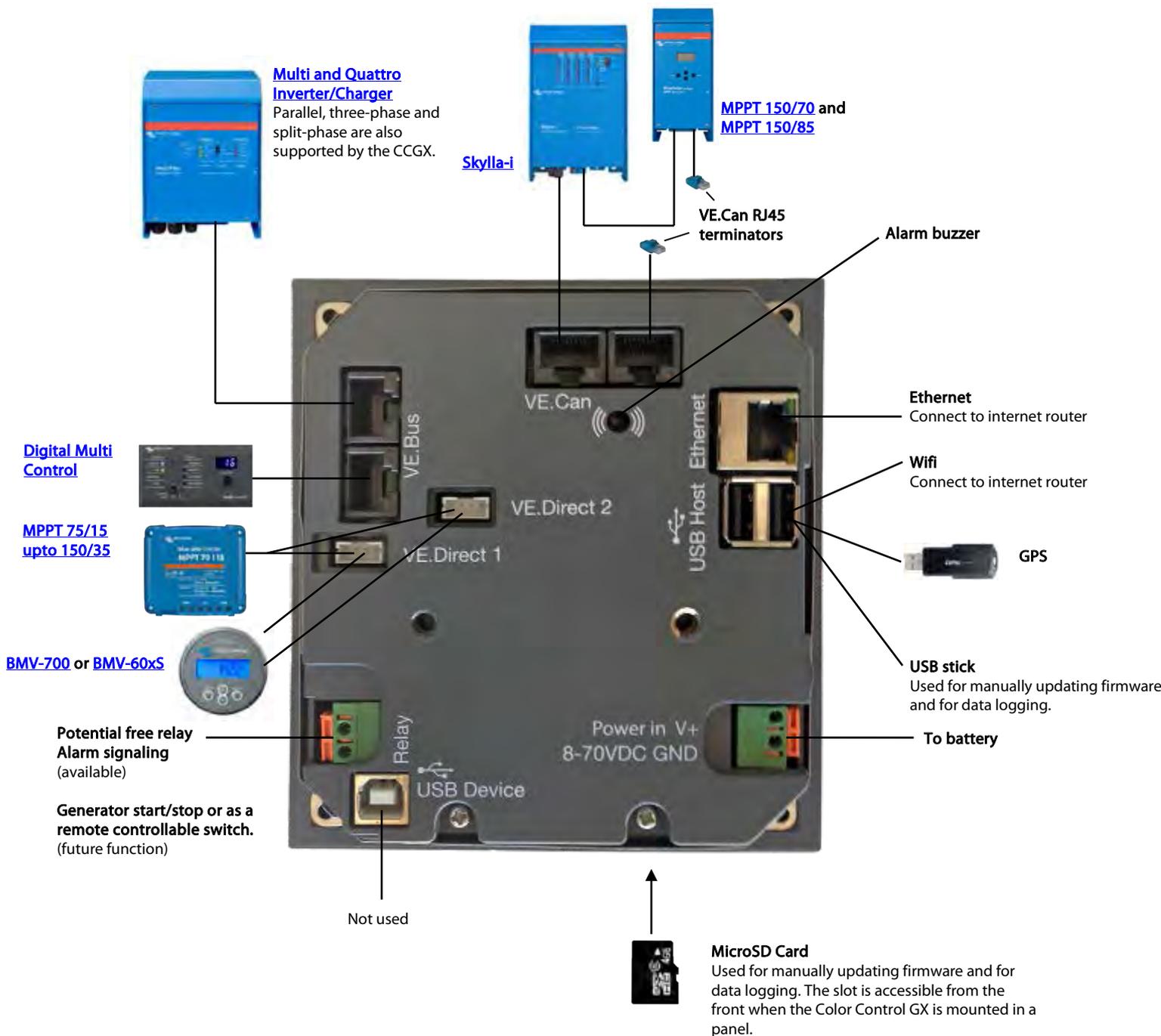


Tiles overview – Hub-2 system



**VRM Portal – Live feed**

**VRM Portal – Consumption**


## Color Control GX schematic diagram



## BMV 700 series: Precision battery monitoring



**BMV-700**



**BMV bezel square**



**BMV shunt 500A/50mV**  
With quick connect pcb



**BMV-702 Black**



**BMV-700H**

### Battery 'fuel gauge', time-to-go indicator, and much more

The remaining battery capacity depends on the ampere-hours consumed, discharge current, temperature and the age of the battery. Complex software algorithms are needed to take all these variables into account.

Next to the basic display options, such as voltage, current and ampere-hours consumed, the BMV-700 series also displays state of charge, time to go, and power consumption in Watts.

The BMV-702 features an additional input which can be programmed to measure the voltage (of a second battery), battery temperature or midpoint voltage (see below).

### Bluetooth Smart

Use the Bluetooth Smart dongle to monitor your batteries on Apple or Android smartphones, tablets, macbooks and other devices.

### Easy to install

All electrical connections are to the quick connect PCB on the current shunt. The shunt connects to the monitor with a standard RJ12 telephone cable. Included: RJ 12 cable (10 m) and battery cable with fuse (2 m); no other components needed.

Also included are a separate front bezel for a square or round display appearance, a securing ring for the rear mounting and screws for the front mounting.

### Easy to program (with your smartphone!)

A quick install menu and a detailed setup menu with scrolling texts assist the user when going through the various settings.

Alternatively, choose the fast and easy solution: download the smartphone app (Bluetooth Smart dongle needed)

### Midpoint voltage monitoring (BMV-702 only)

This feature, which is often used in industry to monitor large and expensive battery banks, is now for the first time made available at a low cost, to monitor any battery bank.

A battery bank consists of a string of series connected cells. The midpoint voltage is the voltage halfway along the string. Ideally, the midpoint voltage would be exactly half of the total voltage. In practice, however, deviations will be seen, that depend on many factors such as a different state of charge for new batteries or cells, different temperatures, internal leakage currents, capacities and much more.

Large or increasing deviation of the midpoint voltage, points to improper battery care or a failed battery or cell. Corrective action following a midpoint voltage alarm can prevent severe damage to an expensive battery. Please consult the BMV manual for more information.

### Standard features

- Battery voltage, current, power, ampere-hours consumed and state of charge
- Remaining time at the current rate of discharge
- Programmable visual and audible alarm
- Programmable relay, to turn off non critical loads or to run a generator when needed
- 500 Amp quick connect shunt and connection kit
- Shunt selection capability up to 10.000 Amps
- VE.Direct communication port
- Stores a wide range of historical events, which can be used to evaluate usage patterns and battery health
- Wide input voltage range: 9,5 – 95V
- High current measurement resolution: 10 mA (0,01A)
- Low current consumption: 2,9Ah per month (4mA) @12V and 2,2Ah per month (3mA) @ 24V

### BMV-702 additional features

Additional input to measure voltage (of a second battery), temperature or midpoint voltage, and corresponding alarm and relay settings.

### BMV-700HS: 60 to 385 VDC voltage range

No additional parts needed. Note: suitable for systems with grounded minus only (battery monitor is not isolated from shunt).

### Other battery monitoring options

- VE.Net Battery Controller
- Lynx Shunt VE.Net
- Lynx Shunt VE.Can

### More about midpoint voltage

One bad cell or one bad battery can destroy a large, expensive battery bank. When batteries are connected in series, a timely warning can be generated by measuring the midpoint voltage. Please see the BMV manual, section 5.2, for more information.

We recommend our [Battery Balancer](#) (BMS012201000) to maximize service life of series-connected batteries.

Battery Monitor	BMV-700	BMV-702 BMV-702 BLACK	BMV-700HS
Supply voltage range	6,5 - 95 VDC	6,5 - 95 VDC	60 – 385 VDC
Current draw, back light off	< 4mA	< 4mA	< 4mA
Input voltage range, auxiliary battery	n. a.	6,5 - 95 VDC	n. a.
Battery capacity (Ah)	20 - 9999 Ah		
Operating temperature range	-40 +50°C (-40 - 120°F)		
Measures voltage of second battery, or temperature, or midpoint	No	Yes	No
Temperature measurement range	-20 +50°C		n. a.
VE.Direct communication port	Yes	Yes	Yes
Relay	60V / 1A normally open (function can be inverted)		
<b>RESOLUTION &amp; ACCURACY (with a 500 A shunt)</b>			
Current	± 0,01A		
Voltage	± 0,01V		
Amp hours	± 0,1 Ah		
State of charge (0 - 100%)	± 0,1%		
Time to go	± 1 min		
Temperature (0 - 50°C or 30 - 120°F)	n. a.	± 1°C/°F	n. a.
Accuracy of current measurement	± 0,4%		
Accuracy of voltage measurement	± 0,3%		
<b>INSTALLATION &amp; DIMENSIONS</b>			
Installation	Flush mount		
Front	63mm diameter		
Front bezel	69 x 69mm (2.7 x 2.7 inch)		
Body diameter	52mm (2.0 inch)		
Body depth	31mm (1.2 inch)		
<b>STANDARDS</b>			
Safety	EN 60335-1		
Emission / Immunity	EN 55014-1 / EN 55014-2		
Automotive	ECE R10-4 / EN 50498		
<b>ACCESSORIES</b>			
Shunt (included)	500A / 50mV		
Cables (included)	10 meter 6 core UTP with RJ12 connectors, and cable with fuse for '+' connection		
Temperature sensor	Optional (ASS000100000)		



**Victron Global Remote**

The Global Remote is a modem which sends alarms, warnings and system status reports to cellular phones via text messages (SMS). It can also log data from Victron Battery Monitors, MultiPlus units, Quattros and Inverters to a website through a GPRS connection to the [VRM Portal](#). Access to this website is free of charge. VE.Direct to Global remote Interface cable needed (ASS030534000).



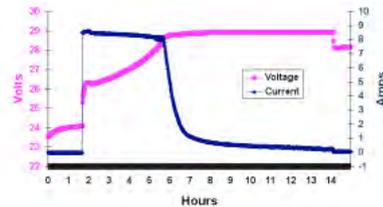
**1000A/50mV, 2000A/50mV and 600A/50mV shunt**

The quick connect PCB on the standard 500A/50mV shunt can also be mounted on these shunts.



**Interface cables**

- VE.Direct cables to connect a BMV 70x to the Color Control (ASS030530xxx)
- VE.Direct to USB interface (ASS030530000) to connect several BMV 70x to the Color Control or to a computer.
- VE.Direct to Global remote interface to connect a BMV 70x to a Global Remote. (ASS030534000)



The PC application software **BMV-Reader** will show all current readings on a computer, including history data. It can also log the data to a CSV formatted file. It is available for free, and can be downloaded from our website at the [Support and downloads section](#). Connect the BMV to the computer with the VE.Direct to USB interface, ASS030530000.



**Color Control**

The powerful Linux computer, hidden behind the colour display and buttons, collects data from all Victron equipment and shows it on the display. Besides communicating with Victron equipment, the Color Control communicates through CAN bus (NMEA2000), Ethernet and USB. Data can be stored and analysed on the VRM Portal.



A maximum of four BMVs can be connected directly to the Color Control. Even more BMVs can be connected to a USB Hub for central monitoring.



**Battery Balancer (BMS012201000)**

The Battery Balancer equalizes the state of charge of two series connected 12V batteries, or of several parallel strings of series connected batteries.

When the charge voltage of a 24V battery system increases to more than 27V, the Battery Balancer will turn on and compare the voltage over the two series connected batteries. The Battery Balancer will draw a current of up to 1A from the battery (or parallel connected batteries) with the highest voltage. The resulting charge current differential will ensure that all batteries will converge to the same state of charge.

If needed, several balancers can be paralleled.

A 48V battery bank can be balanced with three Battery Balancers.



With the VE.Direct to Bluetooth Smart dongle real time data and alarms can be displayed on Apple and Android smartphones, tablets, macbooks and other devices.

Also use your smartphone to adjust settings!

(the VE.Direct to Bluetooth Smart dongle must be ordered separately)



See the [VictronConnect BMV app Discovery Sheet](#) for more screenshots







Solar Charge Controller MPPT 75/15



**Ultra-fast Maximum Power Point Tracking (MPPT)**

Especially in case of a cloudy sky, when light intensity is changing continuously, an ultra-fast MPPT controller will improve energy harvest by up to 30% compared to PWM charge controllers and by up to 10% compared to slower MPPT controllers.

**Load output**

Over-discharge of the battery can be prevented by connecting all loads to the load output. The load output will disconnect the load when the battery has been discharged to a pre-set voltage.

Alternatively, an intelligent battery management algorithm can be chosen: see Battery Life.

The load output is short circuit proof.

Some loads (especially inverters) can best be connected directly to the battery, and the inverter remote control connected to the load output. A special interface cable may be needed, please see the manual.

**Battery Life: intelligent battery management**

When a solar charge controller is not able to recharge the battery to its full capacity within one day, the result is often that the battery will continually be cycled between a 'partially charged' state and the 'end of discharge' state. This mode of operation (no regular full recharge) will destroy a lead-acid battery within weeks or months.

The Battery Life algorithm will monitor the state of charge of the battery and, if needed, day by day slightly increase the load disconnect level (i.e. disconnect the load earlier) until the harvested solar energy is sufficient to recharge the battery to nearly the full 100%. From that point onwards the load disconnect level will be modulated so that a nearly 100% recharge is achieved about once every week.

**Programmable battery charge algorithm**

See the software section on our website for details

**Day/night timing and light dimming option**

See the software section on our website for details

**Programming, real-time data and history display options**

- Modern Apple and Android smartphones, tablets, macbooks and other devices: see the VE.Direct Bluetooth Smart dongle and the MPPT app discovery sheet for screenshots.
- ColorControl panel

BlueSolar Charge Controller	MPPT 75/10	MPPT 75/15	MPPT 100/15
Battery voltage	12/24V Auto Select		
Rated charge current	10A	15A	15A
Maximum PV power, 12V 1a,b)	135W	200W	200W
Maximum PV power, 24V 1a,b)	270W	400W	400W
Max. PV short circuit current 2)	10A	15A	15A
Automatic load disconnect	Yes, maximum load 15A		
Maximum PV open circuit voltage	75V		100V
Peak efficiency	98%		
Self-consumption	10 mA		
Charge voltage 'absorption'	14,4V / 28,8V (adjustable)		
Charge voltage 'float'	13,8V / 27,6V (adjustable)		
Charge algorithm	multi-stage adaptive		
Temperature compensation	-16 mV / °C resp. -32 mV / °C		
Continuous/peak load current	15A / 50A		
Low voltage load disconnect	11,1V / 22,2V or 11,8V / 23,6V or Battery Life algorithm		
Low voltage load reconnect	13,1V / 26,2V or 14V / 28V or Battery Life algorithm		
Protection	Battery reverse polarity (fuse) Output short circuit / Over temperature		
Operating temperature	-30 to +60°C (full rated output up to 40°C)		
Humidity	95%, non-condensing		
Data communication port	VE.Direct See the data communication white paper on our website		
<b>ENCLOSURE</b>			
Colour	Blue (RAL 5012)		
Power terminals	6 mm <sup>2</sup> / AWG10		
Protection category	IP43 (electronic components), IP22 (connection area)		
Weight	0,5 kg		
Dimensions (h x w x d)	100 x 113 x 40 mm		
<b>STANDARDS</b>			
Safety	EN/IEC 62109		
1a) If more PV power is connected, the controller will limit input power to the stated maximum.			
1b) PV voltage must exceed Vbat + 5V for the controller to start. Thereafter minimum PV voltage is Vbat + 1V			
2) A PV array with a higher short circuit current may damage the controller.			



Solar Charge Controller  
MPPT 100/30

#### Ultra-fast Maximum Power Point Tracking (MPPT)

Especially in case of a clouded sky, when light intensity is changing continuously, an ultra-fast MPPT controller will improve energy harvest by up to 30% compared to PWM charge controllers and by up to 10% compared to slower MPPT controllers.

#### Advanced Maximum Power Point Detection in case of partial shading conditions

If partial shading occurs, two or more maximum power points may be present on the power-voltage curve.

Conventional MPPT's tend to lock to a local MPP, which may not be the optimum MPP.

The innovative BlueSolar algorithm will always maximize energy harvest by locking to the optimum MPP.

#### Outstanding conversion efficiency

No cooling fan. Maximum efficiency exceeds 98%. Full output current up to 40°C (104°F).

#### Flexible charge algorithm

Fully programmable charge algorithm (see the software page on our website), and eight pre-programmed algorithms, selectable with a rotary switch (see manual for details).

#### Extensive electronic protection

Over-temperature protection and power derating when temperature is high.

PV short circuit and PV reverse polarity protection.

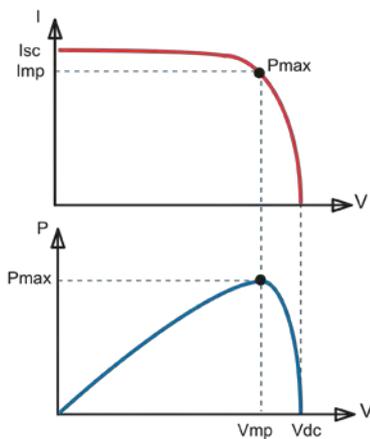
PV reverse current protection.

#### Internal temperature sensor

Compensates absorption and float charge voltage for temperature.

#### Real-time data display options

- Apple and Android smartphones, tablets and other devices: see the VE.Direct to Bluetooth low energy dongle
- ColorControl panel



#### Maximum Power Point Tracking

##### Upper curve:

Output current (I) of a solar panel as function of output voltage (V).

The Maximum Power Point (MPP) is the point Pmax along the curve where the product  $I \times V$  reaches its peak.

##### Lower curve:

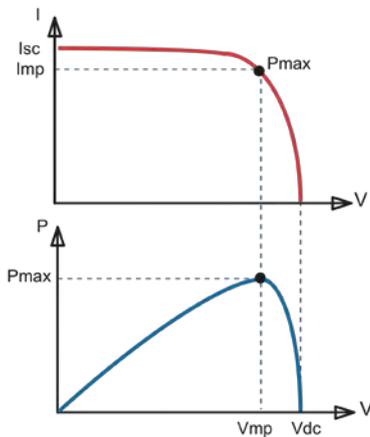
Output power  $P = I \times V$  as function of output voltage.

When using a PWM (not MPPT) controller the output voltage of the solar panel will be nearly equal to the voltage of the battery, and will be lower than  $V_{mp}$ .

BlueSolar Charge Controller	MPPT 100/30
Battery voltage	12/24V Auto Select
Maximum output current	30A
Maximum PV power, 12V 1a,b)	440W (MPPT range 15V to 80V)
Maximum PV power, 24V 1a,b)	880W (MPPT range 30V to 80V)
Maximum PV open circuit voltage	100V
Maximum efficiency	98%
Self-consumption	10 mA
Charge voltage 'absorption'	Default setting: 14,4V / 28,8V (adjustable)
Charge voltage 'float'	Default setting: 13,8V / 27,6V (adjustable)
Charge algorithm	multi-stage adaptive
Temperature compensation	-16 mV / °C resp. -32 mV / °C
Protection	Battery reverse polarity (fuse, not user accessible) Output short circuit Over temperature
Operating temperature	-30 to +60°C (full rated output up to 40°C)
Humidity	95%, non-condensing
Data communication port	VE.Direct See the data communication white paper on our website
ENCLOSURE	
Colour	Blue (RAL 5012)
Power terminals	13 mm <sup>2</sup> / AWG6
Protection category	IP43 (electronic components), IP22 (connection area)
Weight	1,25kg
Dimensions (h x w x d)	130 x 186 x 70mm
STANDARDS	
Safety	EN/IEC 62109
1a) If more PV power is connected, the controller will limit input power to 440W resp. 880W 1b) PV voltage must exceed $V_{bat} + 5V$ for the controller to start. Thereafter minimum PV voltage is $V_{bat} + 1V$	



Solar Charge Controller  
MPPT 100/50



### Maximum Power Point Tracking

#### Upper curve:

Output current (I) of a solar panel as function of output voltage (V). The Maximum Power Point (MPP) is the point Pmax along the curve where the product  $I \times V$  reaches its peak.

#### Lower curve:

Output power  $P = I \times V$  as function of output voltage. When using a PWM (not MPPT) controller the output voltage of the solar panel will be nearly equal to the voltage of the battery, and will be lower than Vmp.

### Ultra-fast Maximum Power Point Tracking (MPPT)

Especially in case of a clouded sky, when light intensity is changing continuously, an ultra-fast MPPT controller will improve energy harvest by up to 30% compared to PWM charge controllers and by up to 10% compared to slower MPPT controllers.

### Advanced Maximum Power Point Detection in case of partial shading conditions

If partial shading occurs, two or more maximum power points may be present on the power-voltage curve.

Conventional MPPTs tend to lock to a local MPP, which may not be the optimum MPP.

The innovative BlueSolar algorithm will always maximize energy harvest by locking to the optimum MPP.

### Outstanding conversion efficiency

No cooling fan. Maximum efficiency exceeds 98%.

The full output current up to 40°C (104°F).

### Flexible charge algorithm

Fully programmable charge algorithm (see the software page on our website), and eight pre-programmed algorithms, selectable with a rotary switch (see manual for details).

### Extensive electronic protection

Over-temperature protection and power derating when temperature is high.

PV short circuit and PV reverse polarity protection.

PV reverse current protection.

### Internal temperature sensor

Compensates absorption and float charge voltage for temperature.

### Real-time data display options

- Apple and Android smartphones, tablets and other devices: see the VE.Direct to Bluetooth Smart dongle
- ColorControl panel



BlueSolar Charge Controller	MPPT 100/30	MPPT 100/50
Battery voltage	12/24V Auto Select	
Rated charge current	30A	50A
Maximum PV power, 12V 1a,b)	440W	700W
Maximum PV power, 24V 1a,b)	880W	1400W
Maximum PV open circuit voltage	100V	100V
Max. PV short circuit current 2)	30A	50A
Maximum efficiency	98%	98%
Self-consumption	10 mA	
Charge voltage 'absorption'	Default setting: 14,4V / 28,8V (adjustable)	
Charge voltage 'float'	Default setting: 13,8V / 27,6V (adjustable)	
Charge algorithm	multi-stage adaptive	
Temperature compensation	-16 mV / °C resp. -32 mV / °C	
Protection	Battery reverse polarity (fuse, not user accessible) PV reverse polarity Output short circuit Over temperature	
Operating temperature	-30 to +60°C (full rated output up to 40°C)	
Humidity	95%, non-condensing	
Data communication port	VE.Direct See the data communication white paper on our website	
<b>ENCLOSURE</b>		
Colour	Blue (RAL 5012)	
Power terminals	13 mm <sup>2</sup> / AWG6	
Protection category	IP43 (electronic components), IP22 (connection area)	
Weight	1,3 kg	1,3 kg
Dimensions (h x w x d)	130 x 186 x 70 mm	130 x 186 x 70 mm
<b>STANDARDS</b>		
Safety	EN/IEC 62109	
1a) If more PV power is connected, the controller will limit input power to 700W resp. 1400W		
1b) PV voltage must exceed Vbat + 5V for the controller to start. Thereafter minimum PV voltage is Vbat + 1V.		
2) A PV array with a higher sort circuit current may damage the controller.		



Solar Charge Controller  
MPPT 150/35

### Ultra-fast Maximum Power Point Tracking (MPPT)

Especially in case of a cloudy sky, when light intensity is changing continuously, an ultra-fast MPPT controller will improve energy harvest by up to 30% compared to PWM charge controllers and by up to 10% compared to slower MPPT controllers.

### Advanced Maximum Power Point Detection in case of partial shading conditions

If partial shading occurs, two or more maximum power points may be present on the power-voltage curve.

Conventional MPPTs tend to lock to a local MPP, which may not be the optimum MPP.

The innovative BlueSolar algorithm will always maximize energy harvest by locking to the optimum MPP.

### Outstanding conversion efficiency

No cooling fan. Maximum efficiency exceeds 98%. Full output current up to 40°C (104°F).

### Flexible charge algorithm

Fully programmable charge algorithm (see the software page on our website), and eight preprogrammed algorithms, selectable with a rotary switch (see manual for details).

### Extensive electronic protection

Over-temperature protection and power derating when temperature is high.

PV short circuit and PV reverse polarity protection.

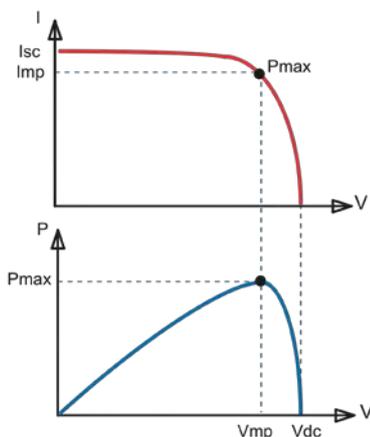
PV reverse current protection.

### Internal temperature sensor

Compensates absorption and float charge voltage for temperature.

### Real-time data display options

- Apple and Android smartphones, tablets and other devices: see the VE.Direct to Bluetooth low energy dongle
- ColorControl panel



### Maximum Power Point Tracking

#### Upper curve:

Output current (I) of a solar panel as function of output voltage (V).

The Maximum Power Point (MPP) is the point Pmax along the curve where the product  $I \times V$  reaches its peak.

#### Lower curve:

Output power  $P = I \times V$  as function of output voltage.

When using a PWM (not MPPT) controller the output voltage of the solar panel will be nearly equal to the voltage of the battery, and will be lower than Vmp.

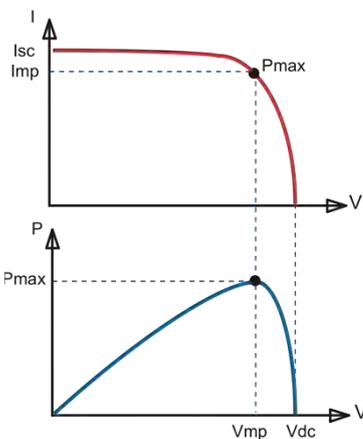
BlueSolar Charge Controller	MPPT 150/35
Battery voltage	12 / 24 / 48V Auto Select (software tool needed to select 36V)
Rated charge current	35A
Maximum PV power 1a, b)	12V: 500W / 24V: 1000W / 36V: 1500W / 48V: 2000W
Maximum PV open circuit voltage	150V absolute maximum coldest conditions 145V start-up and operating maximum
Maximum efficiency	98%
Self-consumption	0,0o1 mA (1 $\mu$ A)
Charge voltage 'absorption'	Default setting: 14,4 / 28,8 / 43,2 / 57,6V (adjustable)
Charge voltage 'float'	Default setting: 13,8 / 27,6 / 41,4 / 55,2V (adjustable)
Charge algorithm	multi-stage adaptive
Temperature compensation	-16 mV / -32 mV / -68 mV / °C
Protection	Battery reverse polarity (fuse, not user accessible) PV reverse polarity Output short circuit Over-temperature
Operating temperature	-30 to +60°C (full rated output up to 40°C)
Humidity	95%, non-condensing
Data communication port	VE.Direct See the data communication white paper on our website
<b>ENCLOSURE</b>	
Colour	Blue (RAL 5012)
Power terminals	13 mm <sup>2</sup> / AWG6
Protection category	IP43 (electronic components), IP22 (connection area)
Weight	1,25 kg
Dimensions (h x w x d)	130 x 186 x 70 mm
<b>STANDARDS</b>	
Safety	EN/IEC 62109
1a) If more PV power is connected, the controller will limit input power to the stated maximum. 1b) PV voltage must exceed Vbat + 5V for the controller to start. Thereafter minimum PV voltage is Vbat + 1V.	



Solar Charge Controller  
MPPT 150/70-Tr



Solar Charge Controller  
MPPT 150/70-MC4



Maximum Power Point Tracking

**Upper curve:**

Output current (I) of a solar panel as function of output voltage (V).

The Maximum Power Point (MPP) is the point Pmax along the curve where the product I x V reaches its peak.

**Lower curve:**

Output power P = I x V as function of output voltage.

When using a PWM (not MPPT) controller the output voltage of the solar panel will be nearly equal to the voltage of the battery, and will be lower than Vmp.

**Ultra-fast Maximum Power Point Tracking (MPPT)**

Especially in case of a clouded sky, when light intensity is changing continuously, an ultra-fast MPPT controller will improve energy harvest by up to 30% compared to PWM charge controllers and by up to 10% compared to slower MPPT controllers.

**Advanced Maximum Power Point Detection in case of partial shading conditions**

If partial shading occurs, two or more maximum power points may be present on the power-voltage curve. Conventional MPPTs tend to lock to a local MPP, which may not be the optimum MPP.

The innovative BlueSolar algorithm will always maximize energy harvest by locking to the optimum MPP.

**Outstanding conversion efficiency**

No cooling fan. Maximum efficiency exceeds 98%.

**Flexible charge algorithm**

Fully programmable charge algorithm (see the software page on our website), and eight pre-programmed algorithms, selectable with a rotary switch (see manual for details).

**Extensive electronic protection**

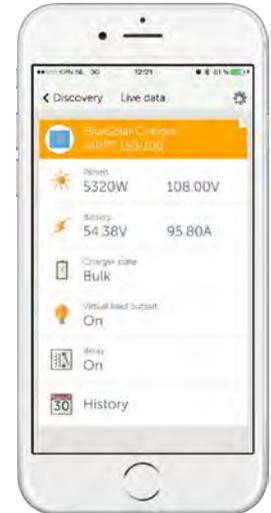
Over-temperature protection and power derating when temperature is high. PV short circuit and PV reverse polarity protection. PV reverse current protection.

**Internal temperature sensor**

Compensates absorption and float charge voltage for temperature.

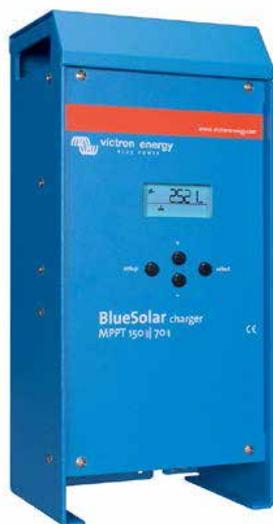
**Real-time data display options**

- Apple and Android smartphones, tablets and other devices: see the VE.Direct to Bluetooth Smart dongle
- ColorControl panel



BlueSolar Charge Controller	MPPT 150/45	MPPT 150/60	MPPT 150/70	MPPT 150/85	MPPT 150/100
Battery voltage	12 / 24 / 48V Auto Select (software tool needed to select 36V)				
Rated charge current	45A	60A	70A	85A	100A
Maximum PV power, 12V 1a,b)	650W	860W	1000W	1200W	1450W
Maximum PV power, 24V 1a,b)	1300W	1720W	2000W	2400W	2900W
Maximum PV power, 48V 1a,b)	2600W	3440W	4000W	4900W	5800W
Max. PV short circuit current 2)	50A	50A	50A	70A	70A
Maximum PV open circuit voltage	150V absolute maximum coldest conditions 145V start-up and operating maximum				
Maximum efficiency	98%				
Self-consumption	10 mA				
Charge voltage 'absorption'	Default setting: 14,4 / 28,8 / 43,2 / 57,6V (adjustable)				
Charge voltage 'float'	Default setting: 13,8 / 27,6 / 41,4 / 55,2V (adjustable)				
Charge algorithm	multi-stage adaptive				
Temperature compensation	-16 mV / -32 mV / -68 mV / °C				
Protection	Battery reverse polarity (fuse, not user accessible) PV reverse polarity / Output short circuit / Over temperature				
Operating temperature	-30 to +60°C (full rated output up to 40°C)				
Humidity	95%, non-condensing				
Data communication port and remote on-off	VE.Direct (see the data communication whitepaper on our website)				
Parallel operation	Yes (not synchronized)				
<b>ENCLOSURE</b>					
Colour	Blue (RAL 5012)				
PV terminals 3)	35 mm² / AWG2 (Tr models) Two sets of MC4 connectors (MC4 models up to 150/70) Three sets of MC4 connectors (MC4 models 150/85 and 150/100)				
Battery terminals	35 mm² / AWG2				
Protection category	IP43 (electronic components), IP22 (connection area)				
Weight	3kg			4,5kg	
Dimensions (h x w x d) in mm	Tr models: 185 x 250 x 95 MC4 models: 215 x 250 x 95			Tr models: 216 x 295 x 103 MC4 models: 246 x 295 x 103	
<b>STANDARDS</b>					
Safety	EN/IEC 62109				
1a) If more PV power is connected, the controller will limit input power to the stated maximum. 1b) PV voltage must exceed Vbat + 5V for the controller to start. Thereafter minimum PV voltage is Vbat + 1V. 2) A PV array with a higher short circuit current may damage the controller. 3) MC4 models: several splitter pairs may be needed to parallel the strings of solar panels. Maximum current per MC4 connector: 30A					

## BlueSolar charge controller MPPT 150/70 &amp; MPPT 150/85 - VE.Can



**Solar Charge Controllers  
MPPT 150/70 and 150/85**

#### PV voltage up to 150 V

The BlueSolar MPPT 150/70 and 150/85 charge controllers will charge a lower nominal-voltage battery from a higher nominal voltage PV array.

The controller will automatically adjust to a 12, 24, 36, or 48V nominal battery voltage.

#### Ultra-fast Maximum Power Point Tracking (MPPT)

Especially in case of a cloudy sky, when light intensity is changing continuously, an ultra-fast MPPT controller will improve energy harvest by up to 30% compared to PWM charge controllers and by up to 10% compared to slower MPPT controllers.

#### Advanced Maximum Power Point Detection in case of partial shading conditions

If partial shading occurs, two or more maximum power points may be present on the power-voltage curve. Conventional MPPT's tend to lock to a local MPP, which may not be the optimum MPP.

The innovative BlueSolar algorithm will always maximize energy harvest by locking to the optimum MPP.

#### Outstanding conversion efficiency

Maximum efficiency exceeds 98%. Full output current up to 40°C (104°F).

#### Flexible charge algorithm

Several preconfigured algorithms. One user programmable algorithm.

Manual or automatic equalisation.

Battery temperature sensor. Battery voltage sense option.

#### Programmable auxiliary relay

For alarm or generator start purposes

#### Extensive electronic protection

Over-temperature protection and power derating when temperature is high.

PV short circuit and PV reverse polarity protection.

Reverse current protection.

#### CAN bus

To parallel up to 25 units, to connect to a ColorControl panel or to connect to a CAN bus network

BlueSolar Charge Controller	MPPT 150/70	MPPT 150/85
Nominal battery voltage	12 / 24 / 36 / 48V Auto Select	
Rated charge current	70A @ 40°C (104°F)	85A @ 40°C (104°F)
Maximum solar array input power 1)	12V: 1000W / 24V: 2000W / 36V: 3000W / 48V: 4000W	12V: 1200W / 24V: 2400W / 36V: 3600W / 48V: 4850W
Maximum PV open circuit voltage	150V absolute maximum coldest conditions 145V start-up and operating maximum	
Minimum PV voltage	Battery voltage plus 7 Volt to start	Battery voltage plus 2 Volt operating
Standby power consumption	12V: 0,55W / 24V: 0,75W / 36V: 0,90W / 48V: 1,00W	
Efficiency at full load	12V: 95% / 24V: 96,5% / 36V: 97% / 48V: 97,5%	
Absorption charge	14.4 / 28.8 / 43.2 / 57.6V	
Float charge	13.7 / 27.4 / 41.1 / 54.8V	
Equalization charge	15.0 / 30.0 / 45 / 60V	
Remote battery temperature sensor	Yes	
Default temperature compensation setting	-2,7 mV/°C per 2V battery cell	
Remote on/off	Yes	
Programmable relay	DPST AC rating: 240VAC / 4A	DC rating: 4A up to 35VDC, 1A up to 60VDC
Communication port	VE.Can: two paralleled RJ45 connectors, NMEA2000 protocol	
Parallel operation	Yes, through VE.Can. Max 25 units in parallel	
Operating temperature	-40°C to 60°C with output current derating above 40°C	
Cooling	Low noise fan assisted	
Humidity (non condensing)	Max. 95%	
Terminal size	35mm <sup>2</sup> / AWG2	
Material & color	Aluminium, blue RAL 5012	
Protection class	IP20	
Weight	4,2kg	
Dimensions (h x w x d)	350 x 160 x 135mm	
Mounting	Vertical wall mount	Indoor only
Safety	EN/IEC 62109-1	
EMC	EN 61000-6-1, EN 61000-6-3	

1) If more solar power is connected, the controller will limit input power to the stated maximum

## SmartSolar charge controller MPPT 150/85 & MPPT 150/100

### Ultra-fast Maximum Power Point Tracking (MPPT)

Especially in case of a clouded sky, when light intensity is changing continuously, an ultra-fast MPPT controller will improve energy harvest by up to 30% compared to PWM charge controllers and by up to 10% compared to slower MPPT controllers.

### Advanced Maximum Power Point Detection in case of partial shading conditions

If partial shading occurs, two or more maximum power points may be present on the power-voltage curve. Conventional MPPTs tend to lock to a local MPP, which may not be the optimum MPP. The innovative SmartSolar algorithm will always maximize energy harvest by locking to the optimum MPP.

### Outstanding conversion efficiency

No cooling fan. Maximum efficiency exceeds 98%.

### Flexible charge algorithm

Fully programmable charge algorithm (see the software page on our website), and eight pre-programmed algorithms, selectable with a rotary switch (see manual for details).

### Extensive electronic protection

Over-temperature protection and power derating when temperature is high. PV short circuit and PV reverse polarity protection. PV reverse current protection.

### Internal temperature sensor

Compensates absorption and float charge voltage for temperature.

### Bluetooth Smart built-in: dongle not needed

The wireless solution to set-up, monitor and update the controller using Apple and Android smartphones, tablets or other devices.

### VE.Direct

For a wired data connection to a Color Control panel, PC or other devices

### Remote on-off

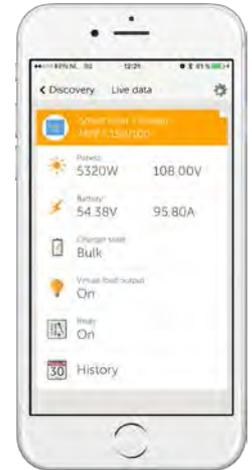
To connect for example to a VE.BUS BMS.

### Programmable relay

Can be programmed (a.o. with a smartphone) to trip on an alarm, or other events.

### Optional: pluggable LCD display

Simply remove the rubber seal that protects the plug on the front of the controller, and plug-in the display.



**Solar Charge Controller  
MPPT 150/100-Tr  
with pluggable display**



**Solar Charge Controller  
MPPT 150/100-MC4  
without display**

SmartSolar Charge Controller	MPPT 150/85	MPPT 150/100
Battery voltage	12 / 24 / 48V Auto Select (software tool needed to select 36V)	
Rated charge current	85A	100A
Maximum PV power, 12V 1a,b)	1200W	1450W
Maximum PV power, 24V 1a,b)	2400W	2900W
Maximum PV power, 48V 1a,b)	4900W	5800W
Max. PV short circuit current 2)	70A	70A
Maximum PV open circuit voltage	150V absolute maximum coldest conditions 145V start-up and operating maximum	
Maximum efficiency	98%	
Self-consumption	Less than 35mA @ 12V / 20mA @ 48V	
Charge voltage 'absorption'	Default setting: 14,4 / 28,8 / 43,2 / 57,6V (adjustable with: rotary switch, display, VE.Direct or Bluetooth)	
Charge voltage 'float'	Default setting: 13,8 / 27,6 / 41,4 / 55,2V (adjustable: rotary switch, display, VE.Direct or Bluetooth)	
Charge algorithm	multi-stage adaptive	
Temperature compensation	-16 mV / -32 mV / -68 mV / °C	
Protection	Battery reverse polarity (fuse, not user accessible) PV reverse polarity / Output short circuit / Over temperature	
Operating temperature	-30 to +60°C (full rated output up to 40°C)	
Humidity	95%, non-condensing	
Data communication port	VE.Direct or Bluetooth	
Remote on/off	Yes (2 pole connector)	
Programmable relay	DPST AC rating: 240VAC / 4A DC rating: 4A up to 35VDC, 1A up to 60VDC	
Parallel operation	Yes (not synchronized)	
<b>ENCLOSURE</b>		
Colour	Blue (RAL 5012)	
PV terminals 3)	35 mm <sup>2</sup> / AWG2 (Tr models)	Three sets of MC4 connectors (MC4 models)
Battery terminals	35 mm <sup>2</sup> / AWG2	
Protection category	IP43 (electronic components), IP22 (connection area)	
Weight	4,5kg	
Dimensions (h x w x d) in mm	Tr models: 216 x 295 x 103 MC4 models: 246 x 295 x 103	
<b>STANDARDS</b>		
Safety	EN/IEC 62109	
1a) If more PV power is connected, the controller will limit input power to the stated maximum.		
1b) PV voltage must exceed Vbat + 5V for the controller to start. Thereafter minimum PV voltage is Vbat + 1V.		
2) A PV array with a higher short circuit current may damage the controller.		
3) MC4 models: several splitter pairs may be needed to parallel the strings of solar panels. Maximum current per MC4 connector: 30A		



### The problem: the service life of an expensive battery bank can be substantially shortened due to state of charge unbalance

One battery with a slightly higher internal leakage current in a 24V or 48V bank of several series/parallel connected batteries will cause undercharge of that battery and parallel connected batteries, and overcharge of the series connected batteries. Moreover, when new cells or batteries are connected in series, they should all have the same initial state of charge. Small differences will be ironed out during absorption or equalize charging, but large differences will result in damage due to excessive gassing (caused by overcharging) of the batteries with the higher initial state of charge and sulphation (caused by undercharging) of the batteries with the lower initial state of charge.

### The Solution: battery balancing

The Battery Balancer equalizes the state of charge of two series connected 12V batteries, or of several parallel strings of series connected batteries.

When the charge voltage of a 24V battery system increases to more than 27,3V, the Battery Balancer will turn on and compare the voltage over the two series connected batteries. The Battery Balancer will draw a current of up to 0,7A from the battery (or parallel connected batteries) with the highest voltage. The resulting charge current differential will ensure that all batteries will converge to the same state of charge.

If needed, several balancers can be paralleled.

A 48V battery bank can be balanced with three Battery Balancers.

### LED indicators

**Green:** on (battery voltage > 27,3V)

**Orange:** lower battery leg active (deviation > 0,1V)

**Orange:** upper battery leg active (deviation > 0,1V)

**Red:** alarm (deviation > 0,2V). Remains on until the deviation has reduced to less than 0,14V, or until system voltage drops to less than 26,6V.

### Alarm relay

Normally open. The alarm relay closes when the red LED switches on and opens when the red LED switches off.

### Alarm reset

Two terminals are available to connect a push button. Interconnecting the two terminals resets the relay.

The reset condition will remain active until the alarm is over. Thereafter the relay will close again when a new alarm occurs.

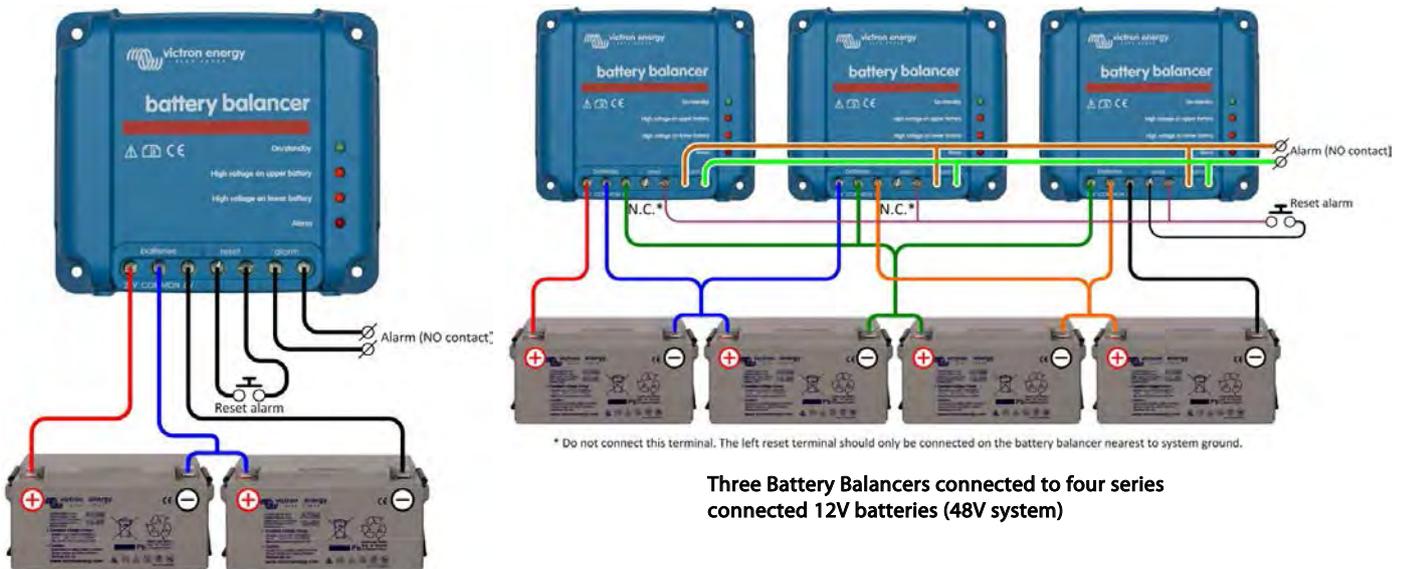
### Even more insight and control with the midpoint monitoring function of the BMV-702 Battery Monitor

The BMV-702 measures the midpoint of a string of cells or batteries. It displays the deviation from the ideal midpoint in volts or percent. Separate deviation percentages can be set to trigger a visual/audible alarm and to close a potential free relay contact for remote alarm purposes.

Please see the manual of the BMV-702 for more information about battery balancing.

### Learn more about batteries and battery charging

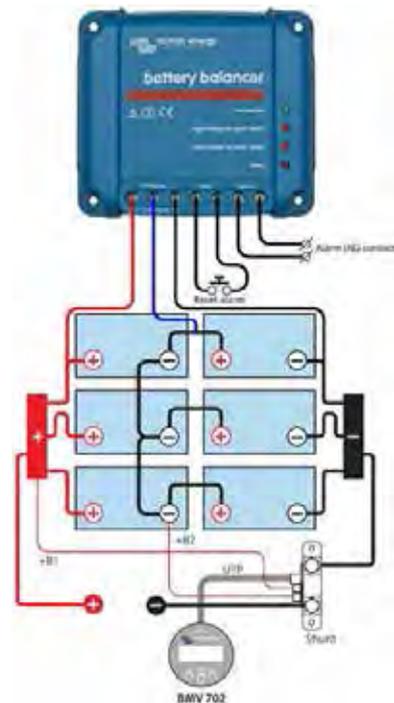
To learn more about batteries and charging batteries, please refer to our book 'Energy Unlimited' (available free of charge from Victron Energy and downloadable from [www.victronenergy.com](http://www.victronenergy.com)).



**Battery Balancer connected to two series connected 12V batteries (24V system)**

**Three Battery Balancers connected to four series connected 12V batteries (48V system)**

Victron Battery Balancer	
Input voltage range	Up to 18V per battery, 36V total
Turn on level	27,3V +/- 1%
Turn off level	26,6V +/- 1%
Current draw when off	0,7 mA
Midpoint deviation to start balancing	50 mV
Maximum balancing current	0,7A (when deviation > 100 mV)
Alarm trigger level	200 mV
Alarm reset level	140 mV
Alarm relay	60V / 1A normally open
Alarm relay reset	Two terminals to connect a push button
Over temperature protection	yes
Operating temperature	-30 to +50°C
Humidity (non-condensing)	95%
ENCLOSURE	
Colour	Blue (RAL 5012)
Connection terminals	Screw terminals 6 mm <sup>2</sup> / AWG10
Protection category	IP22
Weight	0,4 kg
Dimensions (h x w x d)	100 x 113 x 47 mm
STANDARDS	
Safety	EN 60950
Emission	EN 61000-6-3, EN 55014-1
Immunity	EN 61000-6-2, EN 61000-6-1, EN 55014-2
Automotive Directive	EN 50498



Battery Balancer connected to six series-parallel connected 12V batteries (24V system)

### Installation

- The Battery Balancer(s) must be installed on a well-ventilated vertical surface close to the batteries (but, due to possible corrosive gasses, not above the batteries!)
- In case of series-parallel connection, the midpoint interconnecting cables must be sized to at least carry the current that arises when one battery becomes open-circuited.**
  - In case of 2 parallel strings: cross section 50% of the series interconnecting cables.
  - In case of 3 parallel strings: cross section 33% of the series interconnecting cables, etc.
- If required: first wire the alarm contact and the alarm reset.
- Use at least 0,75 mm<sup>2</sup> to wire the negative, positive and midpoint connections (in this order).
- The balancer is operational.
  - When the voltage over a string of two batteries is less than 26,6V the balancer switches to standby and all LEDs will be off.
  - When the voltage over a string of two batteries increases to more than 27,3V (during charging) the green LED will turn on, indicating that the balancer is on.
  - When on, a voltage deviation of more than 50 mV will start the balancing process and at 100 mV one of the two orange LEDs will turn on. A deviation of more than 200 mV will trigger the alarm relay.

### What to do in case of an alarm during charging

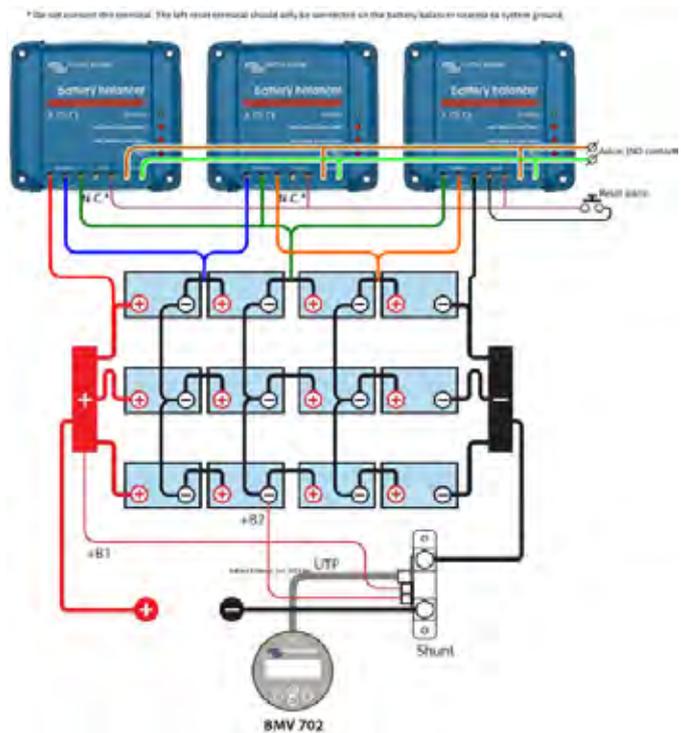
In case of a new battery bank the alarm is probably due to differences in initial state-of-charge. If the difference between the lowest and highest battery voltage reading is more than 0,9V: stop charging and charge the individual batteries or cells separately first, or reduce charge current substantially and allow the batteries to equalize over time.

If the problem persists after several charge-discharge cycles:

- In case of series-parallel connection disconnect the midpoint parallel connection wiring and measure the individual midpoint voltages during absorption charge to isolate batteries or cells which need additional charging, or:
- Charge and then test all batteries or cells individually or:
- Connect two or more battery balancers in parallel (on average one balancer will take care of up to three parallel 200 Ah strings).

In case of an older battery bank which has performed well in the past, the problem may be due to:

- Systematic undercharge: more frequent charging needed (VRLA batteries), or equalization charge needed (flooded deep cycle flat plate or OPzS batteries). Better and regular charging will solve the problem.
- One or more faulty cells: replace all batteries.



Three Battery Balancers connected to 12 series-parallel connected 12V batteries (48V system)

### Why lithium-iron-phosphate?

Lithium-iron-phosphate (LiFePO<sub>4</sub> or LFP) is the safest of the mainstream li-ion battery types. The nominal voltage of a LFP cell is 3,2V (lead-acid: 2V/cell). A 12,8V LFP battery therefore consists of 4 cells connected in series; and a 25,6V battery consists of 8 cells connected in series.



12,8V 90Ah LiFePO<sub>4</sub> Battery

#### Rugged

A lead-acid battery will fail prematurely due to sulfation:

- If it operates in deficit mode during long periods of time (i.e. if the battery is rarely, or never at all, fully charged).
- If it is left partially charged or worse, fully discharged (yacht or mobile home during wintertime).

A LFP battery does not need to be fully charged. Service life even slightly improves in case of partial charge instead of a full charge. This is a major advantage of LFP compared to lead-acid.

Other advantages are the wide operating temperature range, excellent cycling performance, low internal resistance and high efficiency (see below).

LFP is therefore the chemistry of choice for very demanding applications.

#### Efficient

In several applications (especially off-grid solar and/or wind), energy efficiency can be of crucial importance. The round trip energy efficiency (discharge from 100% to 0% and back to 100% charged) of the average lead-acid battery is 80%.

The round trip energy efficiency of a LFP battery is 92%.

The charge process of lead-acid batteries becomes particularly inefficient when the 80% state of charge has been reached, resulting in efficiencies of 50% or even less in solar systems where several days of reserve energy is required (battery operating in 70% to 100% charged state).

In contrast, a LFP battery will still achieve 90% efficiency under shallow discharge conditions.



12,8V 300Ah LiFePO<sub>4</sub> Battery  
(only one data cable shown)

#### Size and weight

Saves up to 70% in space

Saves up to 70% in weight

#### Expensive?

LFP batteries are expensive when compared to lead-acid. But in demanding applications, the high initial cost will be more than compensated by longer service life, superior reliability and excellent efficiency.

#### Endless flexibility

LFP batteries are easier to charge than lead-acid batteries. The charge voltage may vary from 14 V to 16 V (as long as no cell is subjected to more than 4,2 V), and they do not need to be fully charged. Therefore several batteries can be connected in parallel and no damage will occur if some batteries are less charged than others.

#### With or without Battery Management System (BMS)?

Important facts:

1. A LFP cell will fail if the voltage over the cell falls to less than 2,5V (note: recovery by charging with a low current, less than 0,1C, is sometimes possible).

2. A LFP cell will fail if the voltage over the cell increases to more than 4,2V.

Lead-acid batteries will eventually also be damaged when discharged too deeply or overcharged, but not immediately. A lead-acid battery will recover from total discharge even after it has been left in discharged state during days or weeks (depending on battery type and brand).

3. The cells of a LFP battery do not auto-balance at the end of the charge cycle.

The cells in a battery are not 100% identical. Therefore, when cycled, some cells will be fully charged or discharged earlier than others. The differences will increase if the cells are not balanced/equalized from time to time.

In a lead-acid battery a small current will continue to flow even after one or more cells are fully charged (the main effect of this current is decomposition of water into hydrogen and oxygen). This current helps to fully charge other cells that are lagging behind, thus equalizing the charge state of all cells.

The current which flows through a fully-charged LFP cell however, is nearly zero, and lagging cells will therefore not be fully charged. Over time the differences between cells may become so extreme that, even though the overall battery voltage is within limits, some cells will fail due to over- or under voltage. Cell balancing is therefore highly recommended.

In addition to cell balancing, a BMS will:

- Prevent cell under voltage by timely disconnecting the load.
- Prevent cell overvoltage by reducing charge current or stopping the charge process.
- Shut down the system in case of over temperature.

A BMS is therefore indispensable to prevent damage to Li-ion batteries.

Our LFP batteries have integrated cell balancing and cell monitoring. Up to ten batteries can be paralleled and up to four batteries can be series connected, so that a 48V battery bank of up to 3000Ah can be assembled. The cell balancing/monitoring cables can be daisy-chained and must be connected to a Battery Management System (BMS).

### Battery Management System (BMS)

The BMS will:

1. Disconnect or shut down the load whenever the voltage of a battery cell falls to less than 2,5V.
2. Stop the charging process whenever the voltage of a battery cell increases to more than 4,2V.
3. Shut down the system whenever the temperature of a cell exceeds 50°C.

More features may be included: see the individual BMS datasheets.

Battery specification					
VOLTAGE AND CAPACITY	LFP-BMS 12,8/60	LFP-BMS 12,8/90	LFP-BMS 12,8/160	LFP-BMS 12,8/200	LFP-BMS 12,8/300
Nominal voltage	12,8V	12,8V	12,8V	12,8V	12,8V
Nominal capacity @ 25°C*	60Ah	90Ah	160Ah	200Ah	300Ah
Nominal capacity @ 0°C*	48Ah	72Ah	130Ah	160Ah	240Ah
Nominal capacity @ -20°C*	30Ah	45Ah	80Ah	100Ah	150Ah
Nominal energy @ 25°C*	768Wh	1152Wh	2048Wh	2560Wh	3840Wh
*Discharge current ≤1C					
CYCLE LIFE (capacity ≥ 80% of nominal)					
80% DoD	2500 cycles				
70% DoD	3000 cycles				
50% DoD	5000 cycles				
DISCHARGE					
Maximum continuous discharge current	180A	270A	400A	500A	750A
Recommended continuous discharge current	≤60A	≤90A	≤160A	≤200A	≤300A
Maximum 10 s pulse current	600A	900A	1200A	1500A	2000A
End of discharge voltage	11V	11V	11V	11V	11V
OPERATING CONDITIONS					
Operating temperature	-20°C to +50°C (maximum charge current when battery temperature < 0°C: 0,05C, i.e. 10A in case of a 200Ah battery)				
Storage temperature	-45°C to +70°C				
Humidity (non-condensing)	Max. 95%				
Protection class	IP 54				
CHARGE					
Charge voltage	Between 14V and 15V (<14,5V recommended)				
Float voltage	13,6V				
Maximum charge current	180A	270A	400A	500A	750A
Recommended charge current	≤30A	≤45A	≤80A	≤100A	≤150A
OTHER					
Max storage time @ 25°C*	1 year				
BMS connection	Male + female cable with M8 circular connector, length 50cm				
Power connection (threaded inserts)	M8	M8	M10	M10	M10
Dimensions (h×w×d) mm	235x293x139	249x293x168	320x338x233	295x425x274	345x425x274
Weight	12kg	16kg	33kg	42kg	51kg
*When fully charged					


**VE.Bus BMS**

### Protects each individual cell of a Victron lithium iron phosphate (LiFePO<sub>4</sub> or LFP) battery

Each individual cell of a LiFePO<sub>4</sub> battery must be protected against over voltage, under voltage and over temperature.

Victron LiFePO<sub>4</sub> batteries have integrated Balancing, Temperature and Voltage control (acronym: BTV) and connect to the VE.Bus BMS with two M8 circular connector cord sets.

The BTVs of several batteries can be daisy chained. Up to ten batteries can be paralleled and up to four batteries can be series connected (BTVs are simply daisy-chained) so that a 48V battery bank of up to 2000Ah can be assembled. Please see our LiFePO<sub>4</sub> battery documentation for details.

The BMS will:

- shut down or disconnect loads in case of imminent cell under voltage,
- reduce charge current in case of imminent cell overvoltage or over temperature (VE.Bus products only, see below), and
- shut down or disconnect battery chargers in case of imminent cell overvoltage or over temperature.

### Protects 12V, 24V and 48V systems

The operating voltage range of the BMS: 9 to 70V DC.

### Communicates with all VE.Bus products

The VE.Bus BMS connects to a MultiPlus, Quattro or Phoenix inverter with a standard RJ45 UTP cable.

Other products, without VE.Bus can be controlled as shown below:

#### Load Disconnect

The Load Disconnect output is normally high and becomes free floating in case of imminent cell under voltage. Maximum current: 2A.

The Load Disconnect output can be used to control

- the remote on/off of a load, and/or
- the remote on/off of an electronic load switch (Battery Protect)

#### Charge Disconnect

The Charge Disconnect output is normally high and becomes free floating in case of imminent cell over voltage or over temperature. Maximum current: 10mA.

The Charge Disconnect output can be used to control

- the remote on/off of a charger and/or
- a Cyrix-Li-Charge relay and/or
- a Cyrix-Li-ct Battery Combiner

#### LED indicators

- **Enabled (blue):** VE.Bus products are enabled.
- **Cell>4V or temperature (red):** charge disconnect output low because of imminent cell over voltage or over temperature.
- **Cell>2,8V (blue):** load disconnect output high.

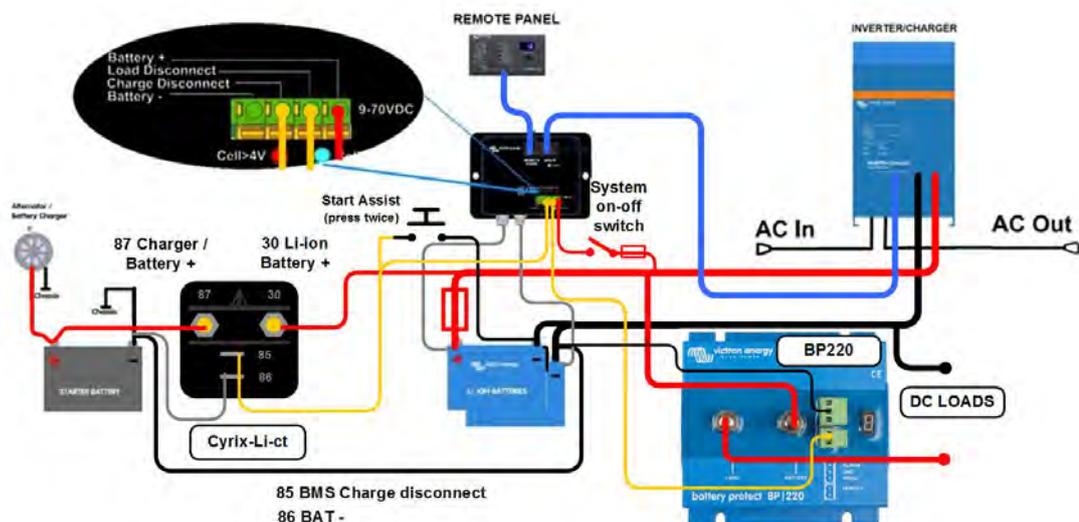


Figure 1: Application example for a vehicle or boat.

A Cyrix Li-ion Battery Combiner is used to connect to the starter battery and alternator. The UTP cable to the inverter/charger also provides the minus connection to the BMS.

VE.Bus BMS	
Input voltage range	9 – 70V DC
Current draw, normal operation	10 mA (excluding Load Disconnect current)
Current draw, low cell voltage	2mA
Load Disconnect output	Normally high Source current limit: 2A Sink current: 0 A (output free floating)
Charge Disconnect output	Normally high Source current limit: 10mA Sink current: 0 A (output free floating)
GENERAL	
VE.Bus communication port	Two RJ45 sockets to connect to all VE.Bus products
Operating temperature	-20 to +50°C 0 - 120°F
Humidity	Max. 95% (non-condensing)
Protection grade	IP20
ENCLOSURE	
Material and colour	ABS, matt black
Weight	0,1kg
Dimensions (h x w x d)	105 x 78 x 32mm
STANDARDS	
Standards: Safety	EN 60950
Emission	EN 61000-6-3, EN 55014-1
Immunity	EN 61000-6-2, EN 61000-6-1, EN 55014-2
Automotive	Regulation UN/ECE-R10 Rev.4

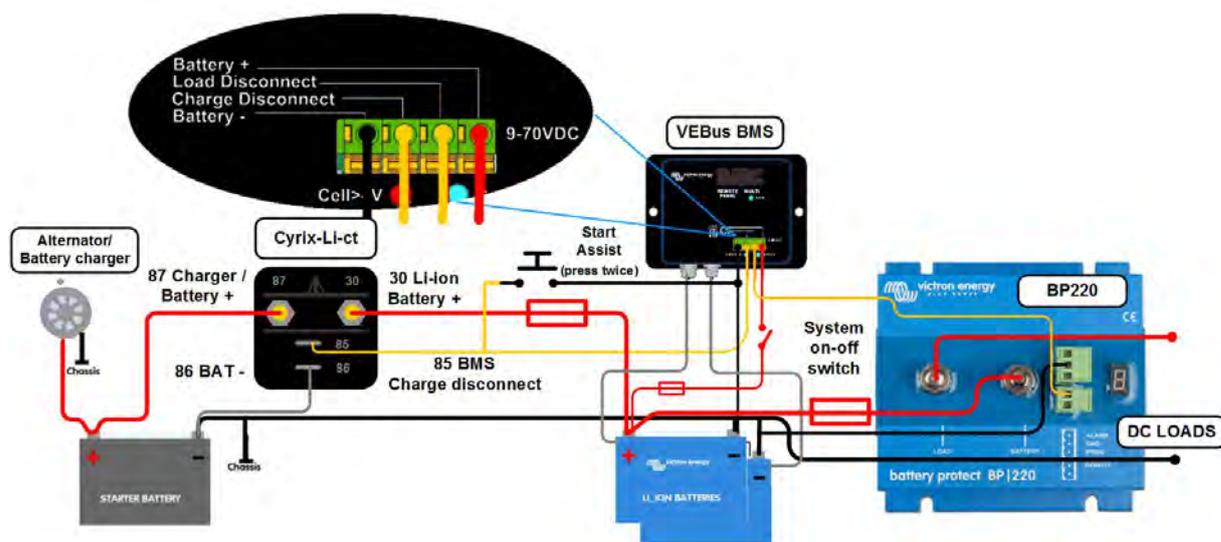


Figure 2: Application example for a vehicle or boat, without inverter/charger.



#### Four Cyrix Combiners especially designed for use with the VE.Bus BMS:

##### Cyrix-LI-ct (120A or 230A)

Is a battery combiner with a Li-ion adapted engage/disengage profile and a control terminal to connect to the Charge Disconnect of the BMS.

##### Cyrix-LI-Charge (120A or 230A)

Is a unidirectional combiner to insert in between a battery charger and the LFP battery. It will engage only when charge voltage from a battery charger is present on its charge-side terminal. A control terminal connects to the Charge Disconnect of the BMS.



## 24V 180Ah Lithium-ion battery and Lynx-ion



**24V 180Ah and 100Ah Lithium-Ion Battery**



**Lynx Ion + Shunt**



**Ion control: Main screen**



**Ion control: History screen**



**Ion control: Lynx Ion Status**

### The advantages of a Lithium-ion battery over conventional lead-acid batteries

- High energy density: more energy with less weight;
- High charge currents (shortens the charge period);
- High discharge currents (enabling for example electrical cooking on a small battery bank);
- Long battery life (up to six times the battery life of a conventional battery);
- High efficiency between charging and discharging (very little energy loss due to heat development);
- Higher continuous power available.

### Why Lithium-Iron-Phosphate?

Lithium-Iron-Phosphate (LiFePO<sub>4</sub> or LFP) is the safest of the mainstream Li-ion battery types. The nominal voltage of a LFP cell is 3,2V (lead-acid: 2V/cell). A 25,6V LFP battery consists of 8 cells connected in series.

### Complete system

A complete system consists of:

- One or more **24V 180Ah or 100Ah Lithium-Ion batteries**.
- (optional) The **Lynx Power In**, a modular dc bus bar.
- The **Lynx Ion + Shunt** is the Battery Management System (BMS) that controls the batteries. It contains a main safety contactor and a shunt. There are two models available: a 350A model and a 600A model.
- (optional) The **Lynx Distributor**, a DC distribution system with fuses.
- (optional) The **Ion Control**, a digital control panel.
- (optional) The **Color Control GX**, a more advanced digital control panel

### The advantages of the Victron Lynx Lithium-ion battery system

The modular system used adds the following advantages:

- The Victron Lithium-Ion Battery System is easy to install due to its modularity. No complicated wiring diagrams are required.
- Detailed information is available on the waterproof Ion Control display.
- The relay in the Lynx-Ion + Shunt provides maximum safety: in case the chargers or loads do not respond to the commands from the Lynx-Ion + Shunt, the main safety relay will open to prevent permanent damage to the batteries.
- For typical marine installations there is an extra small output, so you can still power the bilge pump while disconnecting all other house loads by opening the main relay.

### 24V 180Ah/100Ah Lithium-Ion Batteries

The base of the Victron Lithium-Ion Battery System is formed by individual 24V/180Ah Lithium-ion batteries. They have a built-in Cell Management System (BMS) which protects the battery on a cell level. It monitors individual cell voltage and system temperature, and actively balances the individual cells. All measured parameters are sent to the Lynx Ion which monitors the system as a whole.

### Lynx Ion + Shunt

The Lynx Ion + Shunt is the BMS. It contains the safety contactor, and controls the cell-balancing, charging and discharging of the system. Also it keeps track of the State of Charge of the batteries, and calculates the Time to Go. It protects the battery pack from both overcharging and depletion. When an overcharge is imminent, it will signal the charging devices to decrease or stop charging. This is done with the VE.Can bus (NMEA2000) compatible, and also via the two available open/close contacts. Same when the battery is nearing empty, and there is no charging capability available. It will signal big loads to switch off.

For both overcharging and depletion there is a last safety resort, the built-in 350A or 600 A contactor. In case signalling does not stop the imminent overcharge or depletion, it will open the contactor.

### VE.Can / NMEA2000 Canbus

Communication with the outside world is done via the VE.Can protocol.

### Ion Control

See the separate [Ion Control](#) datasheet for more information.

### Color Control GX

See the separate [Color Control GX](#) datasheet for more information.

### Lithium-Ion battery specifications

	Lithium-ion 24V 100Ah 2.6kWh battery	Lithium-ion 24V 180Ah 4.75kWh battery
Technology	Lithium iron phosphate (LiFePo4)	Lithium iron phosphate (LiFePo4)
Nominal voltage	26,4V	26,4V
Nominal capacity	100Ah	180Ah
Nominal power	2,6kWh	4,75kWh
Weight	30kg	55kg
Power/Weight ratio	86Wh/kg	86Wh/kg
Dimensions (lxwxh)	592x154x278mm	623x193x351mm
<b>Charge/Discharge</b>		
Charge cut-off voltage at 0.05C	28,8V	28,8V
Discharge cut-off voltage	20V	20V
Recommended charge/discharge current	30A (0,3C)	54A (0,3C)
Maximum charge current (1C)	100A	180A
Maximum discharge current (1.5C)	150A	270A
Pulse discharge current (10s)	500A	1000A
Cycle Life @80% DOD (0.3C)	3000	3000
<b>Configuration</b>		
Series configuration	Yes, up to 2 (more in series on request)	Yes, up to 2 (more in series on request)
Parallel configuration	Yes, easy up to 10 (more parallel on request)	Yes, easy up to 10 (more parallel on request)
<b>Environmental</b>		
Operating temp. charge	0~45°C	0~45°C
Operating temp. discharge	-20~55°C	-20~55°C
Storage temp.	-20~45°C	-20~45°C
<b>Standards</b>		
EMC: Emission	EN-IEC 61000-6-3:2007/A1:2011/C11:2012	
EMC: Immunity	EN-IEC 61000-6-1:2007	
Low voltage directive	EN 60335-1:2012/AC:2014	

### Lynx Ion + Shunt specifications

Lynx Ion + Shunt	350A	600A
Maximum number batteries in series	2 (= 48 VDC)	
Maximum number batteries in parallel	48	
Supply voltage range	9 ... 60VDC	
Standby mode	73mW @ 26,2V and 138mW @ 52,4V	
Active mode	8,7 W	
Main safety contactor	350A	600A
<b>Enclosure</b>		
Material	ABS	
Weight	2,0kg	
Dimensions (lxwxh)	185 x 165 x 85 mm	
<b>IO</b>		
Aux. output	5A (output voltage = battery voltage), short circuit protection	
External safety contactor	5A (output voltage = battery voltage), short circuit protection	
Allow-to-charge	1A @ 60VDC, potential free	
Allow-to-discharge	1A @ 60VDC, potential free	
External status signal	12V / 140mA	
<b>Environmental</b>		
Operating temperature range	-20 °C to 50 °C	
Humidity	Max. 95% (non-condensing)	
Protection class	IP22	IP20
<b>Standards</b>		
EMC: Emission	EN-IEC 61000-6-3:2007/A1:2011/C11:2012	
EMC: Immunity	EN-IEC 61000-6-1:2007	
Low voltage directive	EN 60335-1:2012/AC:2014	
RoHS	EN 50581:2012	



**Telecom Battery**  
**Battery AGM 12V 200Ah**

**Designed for telecom applications; excellent 'floor space savers' for marine and vehicle applications**

The deep cycle AGM telecom series has been designed for use in telecom systems. With front access terminals and small footprint, the batteries are ideal for racked systems. Similarly, these batteries can help solve limited floor space and access problems on board boats and vehicles.

**AGM technology**

AGM stands for Absorbent Glass Mat. In these batteries the electrolyte is absorbed into a glass-fibre mat between the plates by capillary action.

**Low self-discharge**

Because of the use of lead calcium grids and high purity materials, Victron VRLA batteries can be stored during long periods of time without recharge. The rate of self-discharge is less than 2% per month at 20°C. The self-discharge doubles for every increase in temperature by 10°C.

**Low internal resistance**

Accepts very high charge and discharge rates.

**High cyclic life capability**

More than 500 cycles at 50% depth of discharge.

**Learn more about batteries and battery charging**

To learn more about batteries and charging batteries, please refer to our book 'Energy Unlimited' (available free of charge from Victron Energy and downloadable from [www.victronenergy.com](http://www.victronenergy.com)).



**Telecom Battery**  
**Battery AGM 12V 200Ah**

12V AGM Telecom battery	115Ah	165Ah	200Ah
Capacity 1 / 3 / 5 / 10 / 20 hours (% of nominal)	60 / 75 / 82 / 91 / 100 (@ 70°F/25°C, end of discharge 10,5V)		
Capacity 10 / 20 / 30 / 40 minutes (% of nominal)	33 / 44 / 53 / 57 (@ 70°F/25°C, end of discharge 9,6V)		
Nominal capacity (77°F/25°C, 10,5V)	115Ah	165Ah	200Ah
Cold Cranking Amps @ 0°F/-18°C	1000	1500	1800
DIN cold start current (A) @ 0°F/-18°C	600	900	1000
Short Circuit Current (A)	3500	5000	6000
Reserve Capacity (minutes)	200	320	400
Shelf life @ 70°F/20°C	1 year		
Absorption voltage (V) @ 70°F/20°C	14,4 – 14,7		
Float voltage (V) @ 70°F/20°C	13,6 – 13,8		
Storage voltage (V) @ 70°F/20°C	13,2		
Float design life @ 70°F/20°C	12 years		
Cycle design life @ 80% discharge	500		
Cycle design life @ 50% discharge	750		
Cycle design life @ 30% discharge	1800		
Dimensions (l x w x h, mm)	395 x 110 x 293mm	548 x 105 x 316mm	546 x 125 x 323mm
Dimensions (l x w x h, inches)	15.37 x 4.33 x 11.53	21.57 x 4.13 x 12.44	21.49 x 4.92 x 12.71
Weight (kg/pounds)	35kg/77lbs	49kg/88lbs	60kg/132lbs



OPzS Solar Batteries 910

### Long life flooded tubular plate batteries

Design life: >20 years at 20°C, >10 years at 30°C, >5 years at 40°C.  
Cycling expectancy of up to 1500 cycles at 80% depth of discharge.  
Manufactured according to DIN 40736, EN 60896 and IEC 61427.

### Low maintenance

Under normal operating conditions and 20°C, distilled water has to be added every 2 - 3 years.

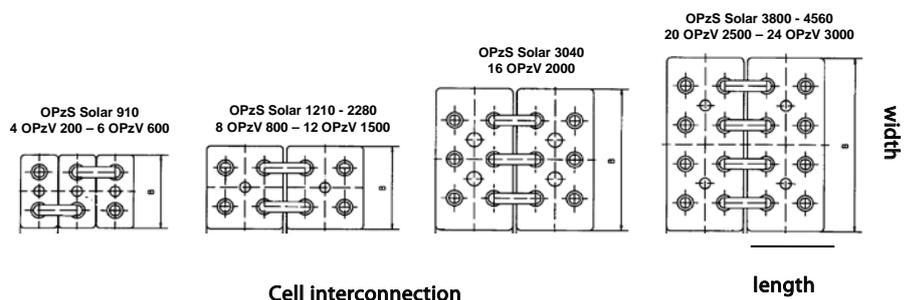
### Dry-charged or ready for use electrolyte filled

The batteries are available filled with electrolyte or dry-charged (for long term stocking, container transport or air transport). Dry charged batteries have to be filled with diluted sulfuric acid (density 1,24kg/l @ 20°C). The electrolyte may be stronger for cold- or weaker for hot climates.

### Learn more about batteries and battery charging

To learn more about batteries and charging batteries, please refer to our book 'Energy Unlimited' (available free of charge from Victron Energy and downloadable from [www.victronenergy.com](http://www.victronenergy.com)).

OPzS Solar type	OPzS Solar 910	OPzS Solar 1210	OPzS Solar 1520	OPzS Solar 1830	OPzS Solar 2280	OPzS Solar 3040	OPzS Solar 3800	OPzS Solar 4560
Nominal capacity (120hr / 20°C)	910Ah	1210Ah	1520Ah	1830Ah	2280Ah	3040Ah	3800Ah	4560Ah
Capacity (10 hr / 20°C)	640Ah	853Ah	1065Ah	1278Ah	1613Ah	2143Ah	2675Ah	3208Ah
Capacity 2 / 5 / 10 hours (% of 10hr capacity)	60 / 85 / 100 (@ 68°F/20°C, end of discharge 1,8 Volt per cell)							
Capacity 20 / 24 / 48 / 72 hours (% of 120hr capacity)	77 / 80 / 89 / 95 (@ 68°F/20°C, end of discharge 1,85 Volt per cell)							
Capacity 100 / 120 / 240 hours (% of 120hr capacity)	99 / 100 / 104 (@ 68°F/20°C, end of discharge 1,85 Volt per cell)							
Self-discharge @ 70°F/20°C	3% per month							
Absorption voltage (V) @ 70°F/20°C	2,35 to 2,50V/cell (28,2 to 30,0V for a 24 Volt battery)							
Float voltage (V) @ 70°F/20°C	2,23 to 2,30V/cell (26,8 to 27,6V for a 24 Volt battery)							
Storage voltage (V) @ 70°F/20°C	2,18 to 2,22V/cell (26,2 to 26,6V for a 24 Volt battery)							
Float design life @ 70°F/20°C	20 years							
Cycle design life @ 80% discharge	1500							
Cycle design life @ 50% discharge	2800							
Cycle design life @ 30% discharge	5200							
Dimensions (lxwxh, mm)	145 x 206 x 711	210 x 191 x 711	210 x 233 x 711	210 x 275 x 711	210 x 275 x 861	212 x 397 x 837	212 x 487 x 837	212 x 576 x 837
Dimensions (lxwxh, inches)	5,7 x 8,1 x 28	8,3 x 7,5 x 28	8,3 x 9,2 x 28	8,3 x 10,8 x 28	8,3 x 10,8 x 33,9	8,4 x 15,6 x 32,9	8,4 x 19,2 x 32,9	8,4 x 22,7 x 32,9
Weight without acid (kg / pounds)	35 / 77	46 / 101	57 / 126	66 / 146	88 / 194	115 / 254	145 / 320	170 / 375
Weight with acid (kg / pounds)	50 / 110	65 / 143	80 / 177	93 / 205	119 / 262	160 / 253	200 / 441	240 / 530



## About Victron Energy

With over 40 years of experience, Victron Energy enjoys an unrivalled reputation for technical innovation, reliability and quality. Victron is a world leader in the supply of self-supporting electrical power. Our products have been designed to meet the most demanding situations faced by a diversity of craft, recreational and commercial alike. Victron's ability to meet the demand for customized off-grid systems is unprecedented. Our product range includes sine wave inverters and inverter/chargers, battery chargers, DC/DC converters, transfer switches, gel and AGM batteries, alternators, battery monitors, solar charge regulators, solar panels, complete network solutions and many other innovative solutions.

### World-wide service and support

Having served the off-grid, industrial and vehicle markets as well as both the commercial and leisure marine sectors for over 40 years, Victron has an established network of dealers and distributors covering the whole world. Our customer base is such that providing prompt and competent local service is essential.

This is reflected in the capabilities of our support network. Our flexible approach to service support and our commitment to quick turnaround for repairs is marketleading. There are countless examples of Victron products that have provided for decades of reliable service in the most demanding applications. This level of reliability combined with the highest level of technical know-how results in Victron Energy power systems that offer the very best value available.







SAL064140020  
REV 02  
2016-11



**Victron Energy B.V.**

De Paal 35 • 1351JG Almere • The Netherlands

Phone: +31 (0)36 535 97 00 • Fax: +31 (0)36 535 97 40 • E-mail: [sales@victronenergy.com](mailto:sales@victronenergy.com)  
[www.victronenergy.com](http://www.victronenergy.com)

