victron energy
BLUE POWER

Manual EN

Handleiding NL

Manuel FR

Anleitung DE

Manual ES

Användarhandbok SE

Appendix

SmartSolar charge controllers
MPPT 75/10
MPPT 75/15
MPPT 100/15
MPPT 100/20
MPPT 100/20-48V

1 General Description

1.1 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.

1.2 VE.Direct
For a wired data connection to a Color Control panel, PC or other devices

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

1.4 Load output
Deep 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 with high inrush current can best be connected directly to the battery. If equipped with a remote on-off input, these loads can be controlled by connecting the load output of the controller this remote on-off input. A special interface cable may be needed, please see section 3.7.
Alternatively, a BatteryProtect may be used to control the load. Please see our website for specifications.

1.5 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.

1.6 Internal temperature sensor
Compensates absorption and float charge voltages for temperature.

1.7 Automatic battery voltage recognition
The controller will automatically adjust itself to a 12V or a 24V system **one time only**.
If a different system voltage is required at a later stage, it must be changed manually, for example with the Bluetooth app see section 1.9.

1.8 Three step charging
The controller is configured for a three step charging process: Bulk – Absorption - Float.
See section 3.8 and section 5 for default settings.
See section 1.9 for user defined stings

1.8.1. Bulk
During this stage the controller delivers as much charge current as possible to rapidly recharge the batteries.
1.8.2. Absorption
When the battery voltage reaches the absorption voltage, the controller switches to constant voltage mode.
When only shallow discharges occur, the absorption time is kept short in order to prevent overcharging of the battery. After a deep discharge the absorption time is automatically increased to make sure that the battery is completely recharged.
Additionally, the absorption period is also ended when the charge current decreases to less than 1A.
1.8.3. Float
During this stage, float voltage is applied to the battery to maintain a fully charged state.
When the battery voltage drops below float voltage during at least 1 minute a new charge cycle will be triggered.
1.8.4. Equalization
See section 3.8.1

1.9 Configuring and monitoring

- Bluetooth Smart (built-in): connect to a smartphone or tablet running iOS or Android.
- Use the VE.Direct to USB cable (ASS030530000) to connect to a PC, a smartphone with Android and USB On-The-Go support (requires additional USB OTG cable).
- Use a VE.Direct to VE.Direct cable to connect to a MPPT Control or a Color Control panel.

Several parameters can be customized with the VictronConnect app.
The VictronConnect app can be downloaded from
http://www.victronenergy.nl/support-and-downloads/software/
Use the manual – VictronConnect - MPPT Solar Charge Controllers – to get the most out of the VictronConnect App when it's connected to a MPPT Solar Charge Controller:
http://www.victronenergy.com/live/victronconnect:mppt-solarchargers

MPPT Control

Color Control

Venus GX

2. IMPORTANT SAFETY INSTRUCTIONS

SAVE THESE INSTRUCTIONS - This manual contains important instructions that shall be followed during installation and maintenance.

Danger of explosion from sparking

Danger of electric shock

● It is advised to read this manual carefully before the product is installed and put into use.
● This product is designed and tested in accordance with international standards. The equipment should be used for the designated application only.
● Install the product in a heatproof environment. Ensure therefore that there are no chemicals, plastic parts, curtains or other textiles, etc. in the immediate vicinity of the equipment.
● The product is not allowed to be mounted in a user accessible area.
● Ensure that the equipment is used under the correct operating conditions. Never operate it in a wet environment.
● Never use the product at sites where gas or dust explosions could occur.
● Ensure that there is always sufficient free space around the product for ventilation.
● Refer to the specifications provided by the manufacturer of the battery to ensure that the battery is suitable for use with this product. The battery manufacturer's safety instructions should always be observed.
● Protect the solar modules from incident light during installation, e.g. cover them.
● Never touch uninsulated cable ends.
● Use only insulated tools.
● Connections must always be made in the sequence described in section 3.5.
● The installer of the product must provide a means for cable strain relief to prevent the transmission of stress to the connections.
● In addition to this manual, the system operation or service manual must include a battery maintance manual applicable to the type of batteries used.

3. Installation

WARNING: DC (PV) INPUT NOT ISOLATED FROM BATTERY CIRCUIT.
CAUTION: FOR PROPER TEMPERATURE COMPENSATION THE AMBIENT CONDITION FOR CHARGER AND BATTERY MUST BE WITHIN 5°C, or the optional Smart Battery Sense dongle must be used.

3.1. General

● Mount vertically on a non-flammable substrate, with the power terminals facing downwards. Observe a minimum clearance of 10 cm under and above the product for optimal cooling.
● Mount close to the battery, but never directly above the battery (in order to prevent damage due to gassing of the battery).
● Improper internal temperature compensation (e.g. ambient condition battery and charger not within 5°C) can lead to reduced battery lifetime.
We recommend installing the Smart Battery Sense option if larger temperature differences or extreme ambient temperature conditions are expected.
● Battery installation must be done in accordance with the storage battery rules of the Canadian Electrical Code, Part I.
● The battery and PV connections must guarded against inadvertent contact (e.g. install in an enclosure or install the optional WireBox).

3.2 Grounding

● *Battery grounding:* the charger can be installed in a positive or negative grounded system.
Note: apply a single ground connection (preferably close to the battery) to prevent malfunctioning of the system.
● *Chassis grounding:* A separate earth path for the chassis ground is permitted because it is isolated from the positive and negative terminal.
● The USA National Electrical Code (NEC) requires the use of an external ground fault protection device (GFPD). These MPPT chargers do not have internal ground fault protection. The system electrical negative should be bonded through a GFPD to earth ground at one (and only one) location.
● The charger must not be connected with grounded PV arrays (one ground connection only)
● The plus and minus of the PV array should not be grounded. Ground the frame of the PV panels to reduce the impact of lightning.

WARNING: WHEN A GROUND FAULT IS INDICATED, BATTERY TERMINALS AND CONNECTED CIRCUITS MAY BE UNGROUNDED AND HAZARDOUS.

3.3. PV configuration (also see the MPPT Excel sheet on our website)

● Provide a means to disconnect all current-carrying conductors of a photovoltaic power source from all other conductors in a building or other structure.
● A switch, circuit breaker, or other device, either ac or dc, shall not be installed in a grounded conductor if operation of that switch, circuit breaker, or other device leaves the grounded conductor in an ungrounded state while the system remains energyzed.
● The controller will operate only if the PV voltage exceeds battery voltage (Vbat).

● PV voltage must exceed Vbat + 5V for the controller to start. Thereafter minimum PV voltage is Vbat + 1V.
● Maximum open circuit PV voltage: 75V respectively 100V

For example:

12V battery and mono- or polycristalline panels connected to a 75V controller
● Minimum number of cells in series: 36 (12V panel).
● Recommended number of cells for highest controller efficiency: 72
(2x 12V panel in series or 1x 24V panel).
● Maximum: 108 cells (3x 12V panel in series).

24V battery and mono- or polycristalline panels connected to a 100V controller
● Minimum number of cells in series: 72
(2x 12V panel in series or 1x 24V panel).
● Maximum: 144 cells (4x 12V panel in series).

Remark: at low temperature the open circuit voltage of a 108 cell array may exceed 75V and and the open circuit voltage of a 144 cell solar array may exceed 100V, depending on local conditions and cell specifications. In that case the number of cells in series must be reduced.

3.4 Cable connection sequence (see figure 4 at the end of this manual)

First: connect the cables to the load, but ensure that all loads are switched off.

Second: connect the battery (this will allow the controller to recognize system voltage).

Third: connect the solar array (when connected with reverse polarity, the controller will heat up but will not charge the the battery).

The system is now ready for use.

3.5. Configuration of the controller (see figure 1 and 2 at the end of this manual)
If a Bluetooth device or other means of communication is not available, the VE.Direct communication port (see section 1.9) can be used to configure the load output as follows:

3.6 The load output
The load out output can be configured with Bluetooth or via VE.Direct.
Alternatively, a jumper can be used to to configure the load output as follows:

3.6.1. **No jumper:** BatteryLife algorithm (see 1.5.)

3.6.2. **Jumper between pin 1 and pin 2:** conventional
Low voltage load disconnect: 11,1V or 22,2V
Automatic load reconnect: 13,1V or 26,2V

3.6.3**. Jumper between pin 2 and pin 3:** conventional
Low voltage load disconnect: 11,8V or 23,6V
Automatic load reconnect: 14V or 28V

Note: remove the jumper when using Bluetooth to configure the controller

Some loads with high inrush current can best be connected directly to the battery. If equipped with a remote on-off input, these loads can be controlled by connecting the load output of the controller to this remote on-off input. A special interface cable may be needed.
Alternatively, a BatteryProtect may be used to control the load. Please see our website for specifications.

Low power inverters, such as the **Phoenix VE.Direct inverters** up to 375VA, can be powered by the load output, but the maximum output power will be limited by the current limit of the load output.

Phoenix VE.Direct inverters can be controlled by connecting the left side connection of the remote control to the load output.

The bridge on the remote control between left and right must be removed.

The Victron inverters model Phoenix 12/800, 24/800, 12/1200 and 24/1200 can be controlled by connecting the right side connection of the inverter remote control directly to the load output (see figure 4 at the end of this manual).

For the Victron inverters model Phoenix 12/180, 24/180, 12/350, 24/350, the Phoenix Inverter Compact models and the MultiPlus Compact models an interface cable is needed: the Inverting remote on-off cable, article number ASS030550100, see figure 5 at the end of this manual.

3.7 LEDs

LED indication:

- ● permanent on
- ◎ blinking
- ○ off

Regular operation

LEDs	Bulk	Absorption	Float
Not charging (*1)	◎	○	○
Bulk	●	○	○
Absorption	○	●	○
Automatic equalisation	○	●	●
Float	○	○	●

Note (*1): The bulk LED will blink briefly every 3 seconds when the system is powered but there is insufficient power to start charging.

Fault situations

LEDs	Bulk	Absorption	Float
Charger temperature too high	○	○	◎
Charger over-current	◎	○	◎
Charger or panel over-voltage	○	◎	◎
Internal error (*2)	◎	◎	○

Note (*2): E.g. calibration and/or settings data lost, current sensor issue.

3.8 Battery charging information

The charge controller starts a new charge cycle every morning, when the sun starts shining.

Default setting:

The maximum duration of the absorption period is determined by the battery voltage measured just before the solar charger starts up in the morning:

Battery voltage Vb (@start-up)	Maximum absorption time
Vb < 23,8V	6h
23,8V < Vb < 24,4V	4h
24,4V < Vb < 25,2V	2h
Vb > 25,2V	1h

(divide voltages by 2 for a 12V system)

If the absorption period is interrupted due to a cloud or due to a power hungry load, the absorption process will resume when absorption voltage is reached again later on the day, until the absorption period has been completed.

The absorption period also ends when the output current of the solar charger drops to less than 1Amp, not because of low solar array output but because the battery is fully charged (tail current cut off).

This algorithm prevents over charge of the battery due to daily absorption charging when the system operates without load or with a small load.

User defined algorithm:

The default settings can be modified with Bluetooth or via VE.Direct.

3.9 Automatic equalization

Automatic equalization is default set to 'OFF'. With the Victron Connect app (see sect 1.9) this setting can be configured with a number between 1 (every day) and 250 (once every 250 days). When automatic equalization is active, the absorption charge will be followed by a voltage limited constant current period. The current is limited to 8% of the bulk current for the factory default battery type, and to 25% of the bulk current for a user defined battery type. The bulk current is the rated charger current unless a lower maximum current setting has been chosen.

When using the factory default battery type, automatic equalization ends when the voltage limit (16.2V resp. 32.4V) has been reached, or after t = (absorption time)/8, whichever comes first.

For the user defined battery type automatic equalization ends after t = (absorption time)/2.

When automatic equalisation is not completely finished within one day, it will not resume the next day, the next equalisation session will take place as determined by the day interval.

3.10 VE.Direct communication port

See section 1.9 and 3.5.

4. Troubleshooting

Problem	Possible cause	Solution
Charger does not function	Reversed PV connection	Connect PV correctly
	No fuse inserted	Insert 20A fuse (models 75/10, 75/15, 100/15) or 25A fuse (model 100/20)
Blown fuse	Reversed battery connection	1. Connect battery correctly 2. Replace fuse
The battery is not fully charged	A bad battery connection	Check battery connection
	Cable losses too high	Use cables with larger cross section
	Large ambient temperature difference between charger and battery ($T_{ambient\_chrg} > T_{ambient\_batt}$)	Make sure that ambient conditions are equal for charger and battery
	Only for a 24V system: wrong system voltage chosen (12V instead of 24V) by the charge controller	Set the controller manually to the required system voltage (see section 1.9)
The battery is being overcharged	A battery cell is defect	Replace battery
	Large ambient temperature difference between charger and battery ($T_{ambient\_chrg} < T_{ambient\_batt}$)	Make sure that ambient conditions are equal for charger and battery
Load output does not become active	Maximum current limit exceeded	Make sure that the output current does not exceed 15A
	DC load in combination with capacitive load (e.g. inverter) applied	Disconnect DC load during start-up of the capacitive load Disconnect AC load from the inverter, or connect inverter as explained in section 3.6
	Short-circuit	Check for short-circuit in the load connection

5 Specifications, 75V models

SmartSolar charge controller	MPPT 75/10	MPPT 75/15
Battery voltage	12/24V Auto Select	
Maximum battery current	10A	15A
Nominal PV power, 12V 1a,b)	145W	220W
Nominal PV power, 24V 1a,b)	290W	440W
Max. PV short circuit current 2)	13A	15A
Automatic load disconnect	Yes, maximum load 15A	
Maximum PV open circuit voltage	75V	
Peak efficiency	98%	
Self consumption	10mA	
Charge voltage 'absorption'	14,4V / 28,8V (adjustable)	
Charge voltage 'equalization'	16,2V / 32,4V (adjustable)	
Charge voltage 'float'	13,8V / 27,6V (adjustable)	
Charge algorithm	multi-stage adaptive or user defined algrithm	
Temperature compensation	-16mV / °C resp. -32mV / °C	
Continuous load current	15A	
Low voltage load disconnect	11,1V / 22,2V or 11,8V / 23,6V or BatteryLife algorithm	
Low voltage load reconnect	13,1V / 26,2V or 14V / 28V or BatteryLife 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	100%, non-condensing	
Maximum altitude	5000m (full rated output up to 2000m)	
Environmental condition	Indoor type 1, unconditioned	
Pollution degree	PD3	
Data communication	VE.Direct port or Bluetooth See the data communication white paper on our website	
ENCLOSURE		
Colour	Blue (RAL 5012)	
Power terminals	6mm² / AWG10	
Protection category	IP43 (electronic components) IP22 (connection area)	
Weight	0,5kg	
Dimensions (h x w x d)	100 x 113 x 40mm	
STANDARDS		
Safety	EN/IEC 62109-1, UL 1741, CSA C22.2	

1a) If more PV power is connected, the controller will limit input power
1b) The PV voltage must exceed Vbat + 5V for the controller to start.
Thereafter the minimum PV voltage is Vbat + 1V.
2) A higher short circuit current may damage the controller in case of reverse polarity connection of the PV array.

Specifications, 100V models

SmartSolar charge controller	MPPT 100/15	MPPT 100/20
Battery voltage	12/24V Auto Select	
Maximum battery current	15A	20A
Nominal PV power, 12V 1a,b)	220W	290W
Nominal PV power, 24V 1a,b)	440W	580W
Max. PV short circuit current 2)	15A	20A
Automatic load disconnect	Yes, maximum load 15A resp. 20A	
Maximum PV open circuit voltage	100V	
Peak efficiency	98%	
Self consumption	10mA	
Charge voltage 'absorption'	14,4V / 28,8V (adjustable)	
Charge voltage 'equalization'	16,2V / 32,4V (adjustable)	
Charge voltage 'float'	13,8V / 27,6V (adjustable)	
Charge algorithm	multi-stage adaptive	
Temperature compensation	-16mV / °C resp. -32mV / °C	
Continuous load current	15A	20A
Low voltage load disconnect	11,1V / 22,2V or 11,8V / 23,6V or BatteryLife algorithm	
Low voltage load reconnect	13,1V / 26,2V or 14V / 28V or BatteryLife 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	100%, non-condensing	
Maximum altitude	5000m (full rated output up to 2000m)	
Environmental condition	Indoor type 1, unconditioned	
Pollution degree	PD3	
Data communication port	VE.Direct See the data communication white paper on our website	
ENCLOSURE		
Colour	Blue (RAL 5012)	
Power terminals	6mm² / AWG10	
Protection category	IP43 (electronic components) IP22 (connection area)	
Weight	0,6 kg	0,65 kg
Dimensions (h x w x d)	100 x 113 x 50 mm	100 x 113 x 60 mm
STANDARDS		
Safety	EN/IEC 62109-1, UL 1741, CSA C22.2	

1a) If more PV power is connected, the controller will limit input power
1b) The PV voltage must exceed Vbat + 5V for the controller to start.
Thereafter the minimum PV voltage is Vbat + 1V.
2) A higher short circuit current may damage the controller in case of reverse polarity connection of the PV array.

SmartSolar charge controller	MPPT 100/20-48V
Battery voltage	48V (12/24/36V: manual)
Maximum battery current	20A
Nominal PV power, 48V 1a,b)	1160W (290W / 580W / 870W)
Max. PV short circuit current 2)	20A
Automatic load disconnect	Yes, maximum load 20A(12/24V) & 0,1A(36/48V)
Maximum PV open circuit voltage	100V
Peak efficiency	98%
Self consumption	10mA
Charge voltage 'absorption'	14,4V / 28,8V / 43,2V / 57,6V (adjustable)
Charge voltage 'equalization'	16,2V / 32,4V / 48,6V / 64,8V (adjustable)
Charge voltage 'float'	13,8V / 27,6V / 41,4V / 55,2V (adjustable)
Charge algorithm	multi-stage adaptive
Temperature compensation	-16mV/ °C / -32mV/ °C / -48mV/ °C / -64mV/ °C
Continuous load current, 12/24V Continuous load current, 36/48V	20A 0,1A
Low voltage load disconnect	11,1 / 22,2 / 33,3 / 44,4V or 11,8 / 23,6 / 35,4 / 47,2V or BatteryLife algorithm
Low voltage load reconnect	13,1 / 26,2 / 39,3 / 52,4V or 14 / 28 / 42 / 56V or BatteryLife 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	100%, non-condensing
Maximum altitude	5000m (full rated output up to 2000m)
Environmental condition	Indoor type 1, unconditioned
Pollution degree	PD3
Data communication port	VE.Direct See the data communication white paper on our website
ENCLOSURE	
Colour	Blue (RAL 5012)
Power terminals	6mm² / AWG10
Protection category	IP43 (electronic components) IP22 (connection area)
Weight	0,65 kg
Dimensions (h x w x d)	100 x 113 x 60 mm
STANDARDS	
Safety	EN/IEC 62109-1, UL 1741, CSA C22.2

1a) If more PV power is connected, the controller will limit input power
1b) The PV voltage must exceed Vbat + 5V for the controller to start.
Thereafter the minimum PV voltage is Vbat + 1V.
2) A higher short circuit current may damage the controller in case of reverse polarity connection of the PV array.