Manual EN

Handleiding NL

Manuel FR

Anleitung DE

Manual ES

Användarhandbok SE

Appendix

BlueSolar charge controller MPPT 150/35

1. General Description

1.1 Charge current up to 35A and PV voltage up to 150V
The BlueSolar MPPT 150/35 charge controller is able to charge a lower nominal-voltage battery from a higher nominal voltage PV array.
The controller will automatically adjust to a 12V, 24V or a 48V nominal battery voltage.

1.2 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.

1.3 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.

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

1.5 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.

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

1.7 Automatic battery voltage recognition
The MPPT 150/35 will automatically adjust itself to a 12V, 24V or a 48V 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 1.11.
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1.8 Flexible charge algorithm
Fully programmable charge algorithm, and eight preprogrammed algorithms, selectable with a rotary switch.

1.9 Adaptive three step charging
The BlueSolar MPPT Charge Controller is configured for a three step charging process: Bulk – Absorption – Float.
1.9.1. Bulk
During this stage the controller delivers as much charge current as possible to rapidly recharge the batteries.
1.9.2. Absorption
When the battery voltage reaches the absorption voltage setting, 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 2A.
1.9.3. Float
During this stage, float voltage is applied to the battery to maintain it in a fully charged state.
When the battery voltage drops below float voltage during at least 1 minute a new charge cycle will be triggered.

1.9.4. Equalization
See section 3.8

1.10 Remote on-off
The MPPT 150/35 can be controlled remotely by a VE.Direct non inverting remote on-off cable (ASS030550300). An input HIGH (Vi > 8V) will switch the controller on, and an input LOW (V < 2V, or free floating) will switch the controller off.
Application example: on/off control by a VE.Bus BMS when charging Li-ion batteries.

1.11 Configuring and monitoring

- Bluetooth Smart (VE.Direct Bluetooth Smart dongle needed): the wireless solution to set-up, monitor and update the controller using Apple and Android smartphones, tablets or other devices.
- 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, a Color Control or the Venus GX.

Several parameters can be customized with the VictronConnect app.
The VictronConnect app can be downloaded from
http://www.victronenergy.nl/support-and-downloads/software/

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

- Please 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 direct 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 3.6.
- 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.

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 Bluetooth Smart Dongle and 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 be guarded against inadvertent contact (e.g. install in an enclosure or install the optional WireBox M).

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 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 energized.
● 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: 150V.

The controller can be used with any PV configuration that satisfies the three above mentioned conditions.

For example:

24V battery and mono- or polycristalline panels

● Minimum number of cells in series: 72 (2x 12V panel in series or one 24V panel).
● Recommended number of cells for highest controller efficiency: 144 cells (4x 12V panel or 2x 24V panel in series).
● Maximum: 216 cells (6x 12V or 3x 24V panel in series).

48V battery and mono- or polycristalline panels

● Minimum number of cells in series: 144 (4x 12V panel or 2x 24V panel in series).
● Maximum: 216 cells.

Remark: at low temperature the open circuit voltage of a 216 cell solar array may exceed 150V, 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 1)

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

3.5 Configuration of the controller

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

Pos	Suggested battery Type	Absorption V	Float V	Equalize V @%I_{nom}	dV/dT mV/°C
0	Gel Victron long life (OPzV) Gel exide A600 (OPzV) Gel MK	28,2	27,6	31,8 @8%	-32
1	Gel Victron deep discharge Gel Exide A200 AGM Victron deep discharge Stationary tubular plate (OPzS) Rolls Marine (flooded) Rolls Solar (flooded)	28,6	27,6	32,2 @8%	-32
2	**Default setting** Gel Victron deep discharge Gel Exide A200 AGM Victron deep discharge Stationary tubular plate (OPzS) Rolls Marine (flooded) Rolls Solar (flooded)	28,8	27,6	32,4 @8%	-32
3	AGM spiral cell Stationary tubular plate (OPzS) Rolls AGM	29,4	27,6	33,0 @8%	-32
4	PzS tubular plate traction batteries or OPzS batteries	29,8	27,6	33,4 @25%	-32
5	PzS tubular plate traction batteries or OPzS batteries	30,2	27,6	33,8 @25%	-32
6	PzS tubular plate traction batteries or OPzS batteries	30,6	27,6	34,2 @25%	-32
7	Lithium Iron Phosphate ($LiFePo_4$) batteries	28,4	27,0	n.a.	0

Note 1: divide all values by two in case of a 12V system and multiply by two in case of a 48V system.
Note 2: equalize normally off, see sect. 3.8 to activate
Note 3: any setting change performed with Bluetooth or via VE.Direct will override the rotary switch setting. Turning the rotary switch will override prior settings made with Bluetooth or VE.Direct.

On all models with software version V 1.12 or higher a binary LED code helps determining the position of the rotary switch. After changing the position of the rotary switch, the LEDs will blink during 4 seconds as follows:

Switch position	LED Bulk	LED Abs	LED Float	Blink frequency
0	1	1	1	Fast
1	0	0	1	Slow
2	0	1	0	Slow
3	0	1	1	Slow
4	1	0	0	Slow
5	1	0	1	Slow
6	1	1	0	Slow
7	1	1	1	Slow

Thereafter, normal indication resumes, as described below.

Remark: the blink function is enabled only when PV power is present on the input of the controller.

3.6 LEDs

LED indication:

- ● permanent on
- ◎ blinking
- ○ off

Regular operation

LEDs	Bulk	Absorption	Float
Bulk (*1)	●	○	○
Absorption	○	●	○
Automatic equalisation (*2)	○	●	●
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.
Note (*2): Automatic equalisation is introduced in firmware v1.16

Fault situations

LEDs	Bulk	Absorption	Float
Charger temperature too high	○	○	◎
Charger over-current	◎	○	◎
Charger over-voltage	○	◎	◎
Internal error (*3)	◎	◎	○

Note (*3): E.g. calibration and/or settings data lost, current sensor issue.

3.7 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 and multiply by two in case of a 48V 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 2Amps, 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:
Any setting change performed with Bluetooth or via VE.Direct will override the rotary switch setting. Turning the rotary switch will override prior settings made with Bluetooth or VE.Direct.

3.8 Automatic equalization

Automatic equalization is default set to ‘OFF’. With the Victron Connect app (see sect 3.9) 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 (see table in section 3.5). The current is limited to 8% of the bulk current for all VRLA (Gel or AGM) batteries and some flooded batteries, and to 25% of the bulk current for all tubular plate batteries and the user defined battery type. The bulk current is the rated charger current unless a lower maximum current setting has been chosen.

In case of all VRLA batteries and some flooded batteries (algorithm number 0, 1, 2 or 3) automatic equalization ends when the voltage limit maxV has been reached, or after t = (absorption time)/8, whichever comes first.
For all tubular plate batteries and 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.

Distributor:

Serial number:

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