



SOLAR CHARGE CONTROLLER

N 2010 / N 2011 / N 2012 / N 2014



Instruction Manual

Please read user manual carefully before use.



1.About this manual

These operating instructions are part of the product.

- ▶ Read these operating instructions carefully before use.
- ▶ keep them over the entire lifetime of the product.
- ▶ Pass them on to any future owner or user of this product.

1.1 Applicability

This manual describes the installation, function, operation and maintenance of the solar charge controller.

Further technical information is provided in a separate technical manual.

1.2 Users

These operating instructions are intended for end customers. A technical expert must be consulted in cases of uncertainty.

1.3 Description of symbols

Safety instructions are identified as follows.



SIGNAL WORD

Type, source and consequences of the danger!

- ▶ **Measures for avoiding danger.**

Instructions relating to the functional safety of the system are in bold type.

2. Safety

2.1 Proper usage

The solar charge controller may only be used in PV systems for charging and controlling lead-acid batteries in accordance with this operating manual and the charging specifications of the battery manufacturer.

2.2 Improper usage

No energy source other than a solar generator may be connected to the solar charge controller. No mains devices, diesel generators or wind generators may be connected.

Do not connect any defective or damaged measuring equipment.

2.3 General safety instructions

- ▶ Follow the general and national safety and accident prevention regulations.
- ▶ Never alter or remove the factory plates and identification labels.
- ▶ Keep children away from PV systems.
- ▶ Never open the device.

2.4 Other risks

Danger of fire and explosion.

- ▶ Do not use the solar charge controller in dusty environments, in the vicinity of solvents or where inflammable gases and vapours can occur.
- ▶ No open fires, flames or sparks in the vicinity of the batteries.
- ▶ Ensure that the room is adequately ventilated.
- ▶ Check the charging process regularly.
- ▶ Follow the charging instructions of the battery manufacturer.

Battery acid

- ▶ Acid splashes on skin or clothing should be immediately treated with soap suds and rinsed with plenty of water.
- ▶ If acid splashes into the eyes, immediately rinse with plenty of water. Seek medical advice.

2.5 Fault behaviour

Operating the solar charge controller is dangerous in the following situations:

- The solar charge controller does not appear to function at all.
- The solar charge controller or connected cables are visibly damaged.
- Emission of smoke or fluid penetration.
- When parts are loose.
- ▶ In these cases immediately remove the solar charge controller from the solar modules and battery.

3. Description

3.1 Functions

The solar charge controller

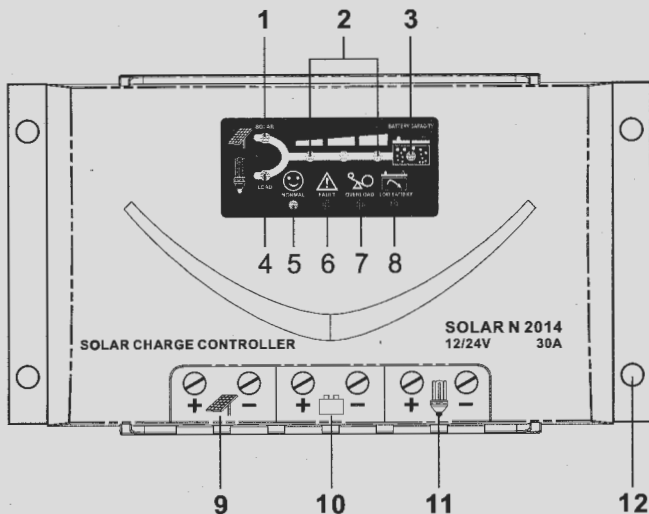
- monitors the state of charge of the battery bank.
- controls the charging process.
- controls the connection/disconnection of loads.

This optimizes battery use and significantly extends its service life.

3.2 Construction

The solar charge controller consists of the following components:

1. Solar LED.
2. 3 LEDs for displaying the state of charge and load.
3. Battery capacity LED.
4. Load LED.
5. Normal LED.
6. Fault LED.
7. Overload LED.
8. Low Battery LED
9. Terminal block for connecting the solar module.
10. Terminal block for connecting the battery.
11. Terminal block for connecting the loads.
12. 5.0mm mounting hole.



3.3 LED displays

	Normal LED	Solar LED	Load LED	Y1 Y2 Y3 LED	Battery capacity LED	Fault LED	Overload LED	Low battery LED
Normal mode	☐	—	—	—	☐!	—	—	—
Charging mode	☐	☐	—	☆ 1,2,3	☆!	—	—	—
Fully charged (after equalisation)	☐	—	—	☆ ALL	☐ GREEN	—	—	—
Load mode	☐	—	☆	☆ 1,2,3	☐!	—	—	—
Solar polarity / short mode	—	☆	—	—	—	☐	—	—
Solar input current overload	—	☆	—	—	—	☆	—	—
Load short mode	—	—	☆	—	—	☐	—	—
Overload mode	☐	—	—	—	—	—	☆	—
Battery polarity mode	—	—	—	—	☆	☐	—	—
Battery type wrong	—	—	—	—	☆ (RED/GREEN ALTERNATE)	☐	—	—
Battery low capacity / voltage mode	—	—	—	—	☐!	—	—	☆
Temperature high mode	—	—	—	—	—	☆	—	—

Note:

☐: ILLUMINATE.

☆: FLASH.

—: EXTINGUISH.

!: The LEDs illuminate in different colors according to battery capacity.

3.4 LED displays

LED	Status	Meaning
Normal LED	illuminates green	normal operation
Solar LED	illuminates green	battery charging by solar
	flashes green	solar module polarity reverse or short circuit
Charge and load LED	flashes yellow	Normal charge state and normal load discharge state
Battery capacity LED	illuminates red	deep-discharge deactivation, state of charge <30%
	illuminates yellow	battery weak, state of charge >40% to 70%
	illuminates green	battery full, state of charge >80% to 100%
	illuminates red	Load discharge, battery capacity <30%
Load LED	flashes green	load discharge state
Fault LED	flashes red	over temperature
	illuminates red	<ul style="list-style-type: none"> ● Solar module polarity reverse ● short circuit or wrong battery type connection or polarity reverse. ● Load short or overload
Overload LED	flashes red	When overload, solar charge controller interrupts load output.
Low Battery Voltage LED	flashes red	12V System battery voltage drops to 11.1V or 24V System battery voltage drops to 22.2V, solar charge controller interrupts load output.

4. Installation



WARNING

Danger of explosion from sparking! Danger of electric shock!

- ▶ The solar charge controller may only be connected to the local loads and the battery by trained personnel and in accordance with the applicable regulations.
- ▶ Follow the installation and operating instructions for all components of the PV system.
- ▶ Ensure that no cables are damaged.

4.1 Mounting the solar charge controller

4.1.1 Mounting location requirements

- Do not mount the solar charge controller outdoors or in wet rooms.
- Do not subject the solar charge controller to direct sunshine or other sources of heat.
- Protect the solar charge controller from dirt and moisture.
- Mount upright on the wall (concrete) on a non-flammable substrate.
- Maintain a minimum clearance of 10 cm below and around the device to ensure unhindered air circulation.
- Mount the solar charge controller as close as possible to the batteries (with a safety clearance of at least 30cm).

4.1.2 Fastening the solar charge controller

- ▶ Mark the position the solar charge controller fastening holes to the wall.
- ▶ Drill 4 $\Phi 6$ mm holes and insert dowels.
- ▶ Fasten the solar charge controller to the wall with the cable openings facing downwards, using 4 oval head screws M4x40.

4.2 Connection

4.2.1 Preparing the wiring

The cross section of the connection cable depends on the power output of the solar charge controller.

Controller type	Load / module Current	Cross-section	AWG	Insulation
10A	10A	6mm ²	10	85 °C
15A	15A	10mm ²	8	85 °C
20A	20A	10mm ²	8	85 °C
30A	30A	16mm ²	6	85 °C

The table above applies to the following cable lengths:

- 10 m solar module connection cable.
- 2 m battery connection cable.
- 5 m load connection cable.

Consult a dealer if the specified cable lengths are inadequate.

An additional external fuse (not provided) must be connected to the battery connection cable, close to the battery pole.

The external fuse prevents cable short circuits. A 40 A fuse can be used for all controller types.

4.2.2 Connection

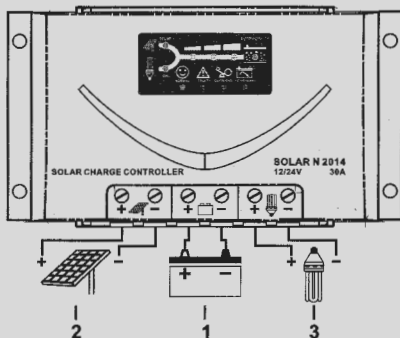


WARNING

Danger of explosion from sparking! Danger of electric shock!

Solar modules generate electricity under incident light. The full voltage is present even when the incident light levels are low.

- ▶ Protect the solar modules from incident light during installation, e. g. cover them.
- ▶ Never touch un-insulated cable ends.
- ▶ Use only insulated tools.
- ▶ Ensure that all loads to be connected are switched off. If necessary, remove the fuse.
- ▶ Connections must always be made in the sequence described below.



Connection sequence

1. battery
2. solar module
3. loads

1st step: Connect the battery

- ▶ Label the battery connection cables as a plus cable (A+) and a minus cable (A-).
- ▶ Lay the battery cables in parallel between the solar charge controller and the battery.
- ▶ Connect the battery connection cable with the correct polarity to the middle pair of terminals on the solar charge controller (with the battery symbol).
- ▶ If necessary, remove any external fuse.
- ▶ Connect battery connection cable A+ to the positive pole of the battery.
- ▶ Connect battery connection cable A- to the negative pole of the battery.
- ▶ Replace the external fuse in the battery connection cable.
- ▶ If the connection polarity is correct, the normal LED illuminates green.



2nd step: Connect the solar module

- ▶ Ensure that the solar module is protected from incident light.
- ▶ Ensure that the solar module does not exceed the maximum permissible input current.
- ▶ Label the solar module connection cables as a plus cable (M+) and a minus cable (M-).
- ▶ Lay both solar module connection cables in parallel between the solar module and the solar charge controller.
- ▶ First connect the M+ solar module connection cable to the correct pole of the left pair of terminals on the solar charge controller (with the solar modules symbol), then connect the M- cable.
- ▶ Remove the covering from the solar module.



3rd step: Connect loads

Notes

- Connect loads that must not be deactivated by the solar charge controller deep discharge protection, e.g. emergency lights or radio connection, directly to the battery.
- Loads with a higher current consumption than the device output can be directly connected to the battery. However, the solar charge controller deep discharge protection will no longer intervene. Loads connected in this manner must also be separately fused.
- ▶ Label the load connection cables as a plus cable (L+) and a minus cable (L-).
- ▶ Lay the load connection cables in parallel between the solar charge controller and the load.
- ▶ First connect the L+ load cable to the correct pole of the right pair of terminals on the solar charge controller (with the lamp symbol), then connect the L- cable.
- ▶ Replace the load fuse or switch on the load.



4th step: Final work

- ▶ Fasten all cables with strain relief in the direct vicinity of the solar charge controller (clearance of approx. 10cm).

4.2.3 Grounding

The components in stand-alone systems do not have to be grounded - this is not standard practice or may be prohibited by national regulations.

Consult the technical manual for more information.

4.2.4 Lightning protection

In systems subjected to an increased risk of overvoltage damage, we recommend installing additional lightning protection / overvoltage protection to reduce dropouts.

Consult the technical manual for more detailed information.

5. Operation

The solar charge controller immediately begins operation once the battery is connected or the external fuse is inserted.

The displays of the solar charge controller show the current operating mode. User intervention or user settings are not required.

Protection functions

The following integrated protection functions of the solar charge controller ensure that the battery is handled as gently as possible.

The following protection functions are part of the basic function of the controller:

- Overcharge protection.
- Deep discharge protection.
- Battery low voltage protection.
- Solar module polarity reverse protection

The following installation faults do not destroy the controller. After correcting the fault, the device will continue to operate correctly:

- Protection from solar module short circuits / incorrect solar module polarity.
- Protection from short circuits at the load output or excessive load current.
- Protection from battery connection with incorrect polarity.
- Protection from solar module over current.
- Protection from device over temperature.
- Protection from overvoltage at the load output.
- Protection from the wrong connection sequence.

6. Maintenance

The solar charge controller is maintenance-free.

All components of the PV system must be checked at least annually, according to the specifications of the respective manufacturers.

- Ensure adequate ventilation of the cooling element.
- Check the cable strain relief.
- Check if all cable connections are secure.
- Tighten screws if necessary.
- Terminal corrosion.

7. Faults and remedies

Fault	Cause	Remedy
No display LED	● battery voltage too low.	▶ pre-charge the battery.
	● the external fuse in the battery connection cable has blown.	▶ replace the external fuse.
	● battery is not connected.	1. unclamp all connections. 2. connect a (new) battery with the correct polarity.
	● battery is connected with the wrong polarity.	3. reconnect the solar module and loads.
Normal LED + Overload LED flashes red	● battery is defective	
	● load output is switched off due to excessive load current.	▶ reduce load current, if necessary switch off or disconnect loads ▶ check loads.
Load cannot be operated + Normal LED + Load LED flashes green + Fault illuminates red	● load output is switched off due to short current at load output.	1. disconnect loads. 2. correct the cause of the short circuit. 3. reconnect loads.
	● load output is switched off due to excessive battery voltage.	the load output automatically switched on again as soon as the battery voltage lies within the permissible range.
	● incorrect grounding.	▶ check the grounding.
	● external charging source is not voltage-limited.	▶ check the external charging source ▶ if necessary, switch off external charging sources.
Normal LED + Fault flashes red	● load output is switched off due to overheating of the solar charge controller.	the load output automatically switches on again once the solar charge controller has cooled down. ▶ improve the cooling air circulation. ▶ remove any other heat sources. ▶ check the conditions of use and the mounting location.
Battery capacity LED illuminates red + Low battery LED flashes red	● load output is switched off due to too low battery voltage.	the load output automatically switched on again as soon as the battery voltage lies within the permissible range. ▶ pre-charge the battery. ▶ equip loads directly connected to the battery with deep discharge protection ▶ check the battery and replace if necessary.
Battery is not charged	● solar module not connected.	▶ connect the solar module.
	● solar module connected with incorrect polarity.	▶ connect the solar module with the correct polarity.
	● short circuit at solar module input.	▶ correct the cause of the short circuit.
	● incorrect solar module voltage.	▶ use a solar module of the specified voltage.
	● solar module defective.	▶ replace the solar module.

8. Technical data

Solar charge controller / P/No.	N 2010	N 2011	N 2012	N 2014
Max module input short circuit current at 50°C	10A	15A	20A	30A
Max load output current at 50°C	10A	15A	20A	30A
System voltage	12 V / 24 V			
Max. voltage of Solar collector	47 V DC			
Enclosure protection class	IP 32			
Terminal size(fine/single wire)	16/25mm ² =4/6 AWB			
Temperature compensation	-4 mV / K / Zelle			
Thermal Protection	85°C			
Ambient temperature allowed	-25°C +50°C			
Weight	350g			
Dimensions l x w x h	177x 96 x 43 mm			

★ Specifications are subjected to change without prior notice.

Charging voltage	State of charge SOC	12V system	24V system
Deep discharge warning	SOC<40%	11.7V	23.4V
Load switch-off	SOC<30%	11.1V	22.2V
Shift-in	SOC>50%	12.5V	25.0V
Boost charging (14.4V / 28.8V)	SOC<40%	11.7V	23.4V
Equalization charging (14.7V / 29.4V)	SOC<70%	12.4V	24.8V
End-of-charge voltage(float)	SOC>70%	13.9V	27.8V

★ Specifications are subjected to change without prior notice.



CAUTION

ALWAYS PLACE THE SOLAR CHARGE CONTROLLER IN AN ENVIRONMENT WHICH IS:

- WELL VENTILATED.
- NOT EXPOSED TO DIRECT SUNLIGHT OR HEAT SOURCE.
- OUT OF REACH FROM CHILDREN.
- AWAY FROM WATER / MOISTURE, OIL OR GREASE.
- AWAY FROM ANY FLAMMABLE SUBSTANCE.
- SECURE NO RISK OF FALLING.