SOLAR CHARGE CONTROLLER

Input: DC12V Solar Panel (Max.25V)
Output: DC12V, 10A / 15A / 20A

Input: DC12/24V Solar Panel (Max.52V)
Output: DC12/24V, 10A / 15A / 20A

User's Manual

THIS MANUAL CONTAINS IMPORTANT SAFETY AND OPERATING INSTRUCTIONS

INTRODUCE-

●This solar charger controller is designed with PWM (pulse width modulated) technology.

●Common negative grounding design and 100% solid state (no fuses or fans)

●Suitable for all kinds of solar panel, 12V system or 24V system depends on model number.

●Suitable for most of the rechargeable batteries:

-- Lead crystal battery; Lead acid Flooded (WET), AGM, GEL, and Calcium battery

-- Lithium ion battery type, targeted for the following 3-series LI-ion battery (see the following battery type setting)

-- Lithium Iron Phosphate, $LiFePO_4$ (LFP) battery,

-- Lithium titanite oxidized battery, $Li_4Ti_5O_{12}$ (LTO) battery

●Built into high efficiency smart regulator to prevent your battery from being overcharge and undercharge, optimize the battery performance, permanently to keep your battery fully charged.

●Colored LED's to easily indicate the charging status and battery conditions.

●Big Digital LCD to directly display battery voltage, charging current, charging capacity (Amp hour), battery types, charging percentage, battery temperature and faulty codes.

●Includes a port for external battery temperature sensor. (Temperature sensor optional)

●Waterproof design, suitable for indoor or outdoor use, surface Mount or flush panel mount options

●Designed according to CE standard, EMC, FCC compliance.

WARNING –

RISK OF EXPLOSIVE GASES WORKING IN VICINITY OF A LEAD-ACID BATTERY IS DANGEROUS. EXPLOSIVE GASES DEVELOP DURING NORMAL BATTERY OPERATION.

IT IS IMPORTANT THAT EACH TIME BEFORE USING OR CONNECTING YOUR SOLAR CONTROLLER, YOU READ THIS MANUAL AND FOLLOW THE INSTRUCTIONS EXACTLY.

●To reduce risk of battery explosion, follow these instructions and those published by battery manufacturer and manufacturer of any equipment you intend to use in vicinity of battery. Review cautionary marking on these products and on engine.

●Lead acid, Lead crystal, Lithium ion, LiFePO4, LTO batteries can be dangerous. Ensure no sparks or flames are present when working near batteries. Refer to battery manufactures specific recommended values for battery type and charging rate setting. Do not charge to an improper type of battery. (For example, do not charge Gel battery with Calcium battery setting)

● Never attempt to charge a damaged battery or frozen battery or non-rechargeable battery.

● Never smoke, use an open flame, or create sparks near battery or solar controller during charging operation as batteries may give out explosive gas.

●Eye protection should always be used. Never short circuit the battery.

●Someone should be within range of your voice or close enough to come to your aid when you work near a lead-acid battery or Lithium ion battery.

●If battery acid contacts skin or clothing, wash immediately with soap and water. If acid enters eye, immediately flush eye with running cold water for at least 10 minutes and get medical attention immediately.

●To reduce risk; avoid dropping a metal tool onto the battery.

●Given sufficient light solar panels always generate energy even when they are disconnected.

●Accidental 'shorting' of the terminals or wiring can result in sparks causing personal injury or a fire hazard. We recommend that you cover up the panel(s) with some sort of soft cloth, so you can block all incoming light during the installation. This will ensure that no damage is caused to the Solar Panel or Battery if the wires are accidentally short circuited.

●Always install a battery fuse on each circuit including the solar controller
● Do not disassemble charger, take it to a qualified person when repair is required.
● Do not reverse connect the wires to the solar panel or battery
●Appliances incorporating batteries which contain materials hazardous to the environment.

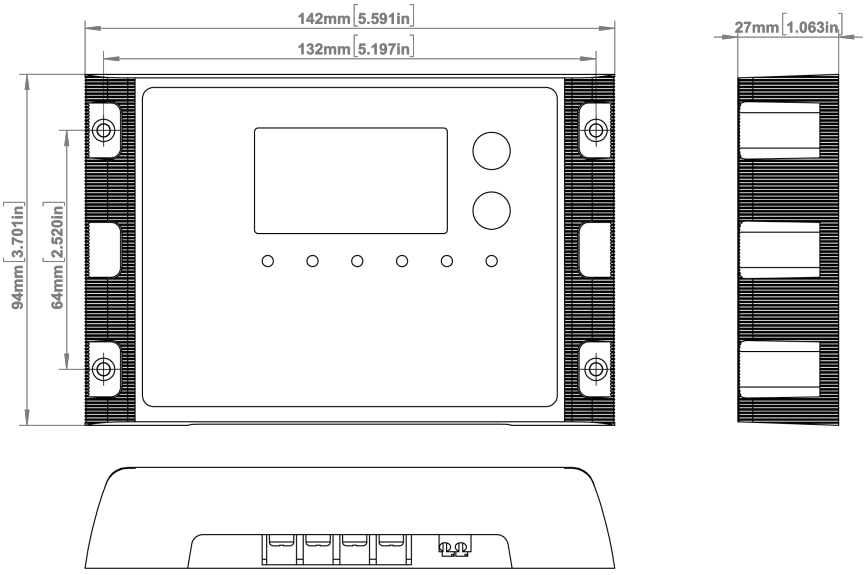
FEATURES-

- Common negative grounding connection
- PWM technology, switching control by MOSFET
- High efficiency and low power consumption
- Battery type setting and battery condition indication
- Smart charging control, Charging time management
- LED indication for the battery condition and charging statues
- Digital display charging parameters and battery settings
- Automatically active to Lithium battery against BMS protection
- Thermal protection
- Over voltage protection, Short circuit protection, Reverse polarity protection
- No sparks
- Water proof
- Solid-duty cables
- Corrosion-resistant terminals and connectors.
- Flexible cable connection method

INSTALLATION-

The Solar Controller is mounted as shown below

The quickest and easiest way to mount the unit is to use the four (4) plastic spacers and self-tapping screws supplied and mount the unit to a flat surface.



WIRING CONNECTIONS

To protect the Battery and the Solar Panel, we strongly recommend that you place an inline fuse on the positive wire on both the “Solar” and “Battery” Circuits. 40A fuse for 20A controller; 30A fuse for 15A controller, 20A fuse for 10A controller (As close to the Battery /Panel as possible)

The Solar Controller has 4 terminals which are clearly marked ‘Solar’ and ‘Battery’.
The cable connection method is flexible and easy.

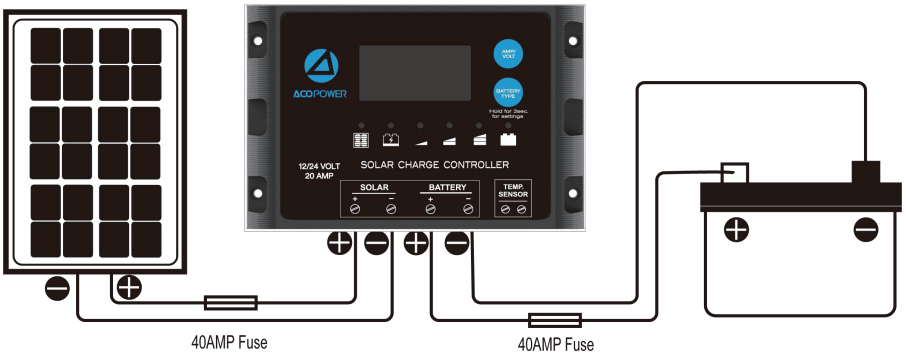
Use the string wires, directly secure the input and output wires into the terminal holes of the solar controller, screw tightly the wires to the “Solar” terminal to the Solar Panel. screw tightly the wires to the “Battery” terminal to the Battery.

Optional external Battery Temperature Sensor BTS

The solar controller provides an external temperature sensor, as an option, the unit provides a port to connect the external battery temperature sensor; if the external battery temperature sensor is connected, the unit will optimize the charging performance subjected to the battery temperature detected and also provide the battery over temperature protection, in some case, if battery over temperature occurs, the controller will automatically stop charging.

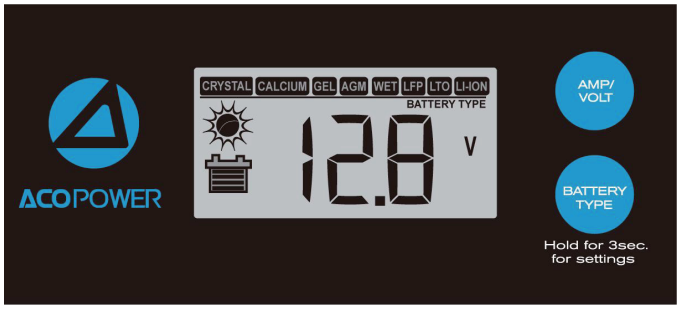
Wiring diagram

Refer to the below drawing, please cover the solar panel before connecting cables.



OPERATION - LCD DISPLAY-

Please check your battery manufacturer’s specifications to select correct battery type. The unit provides eight (8) battery types for selections: Lead crystal, Lithium-ion, LiFePO4, LTO, Gel, AGM, WET (conventional lead acid), and Calcium battery.



Press **BATTERY TYPE button** and hold for 3 seconds to go into your battery type selection mode, the battery type you select will be shown on the LCD meter, the default setting is AGM Battery; the controller will automatically memorize your battery type setting.

Li-ion battery shown in LCD indicates 3-SERIES Li-ion battery shown as below:
-- Lithium Cobalt Oxide $LiCoO_2$ (LCO) battery
-- Lithium Manganese Oxide $LiMn_2O_4$ (LMQ) battery
-- Lithium Nickel Manganese Cobalt Oxide $LiNiMnCoO_2$ (NMC) battery
-- Lithium Nickel Cobalt Aluminum Oxide $LiNiCoAlo_2$ (NCA) battery

Remarks: This solar controller is recommended to just work with 3 x series above Li-ion batteries.

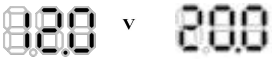
LiFePO4 battery shown in LCD indicates Lithium Iron Phosphate battery, LFP battery.
LTO battery shown in LCD indicates Lithium titianate oxidized, $Li4Ti_5O_{12}$ battery.

Caution: Incorrect battery type setting may damage your battery.

When the controller powers on, the unit will run self-qualify mode and automatically show below items on LCD before going into charging process

 Self-test starts, digital meter segments test

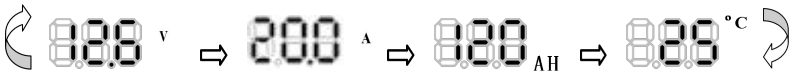
 Software version test

 Rated voltage and current test

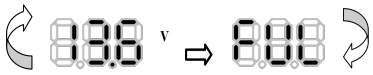
 External battery temperature sensor test (if connected)

 Indicates the solar panel connected.

After going into charging process, the LCD displays the charging statues as below:
Press **VOLT / AMP button** in sequence, the LCD will display in turn with
Battery Voltage, Charging Current, Charged capacity (Amp-hour) and Battery Temperature (if external temperature sensor connected)
Display in sequence-



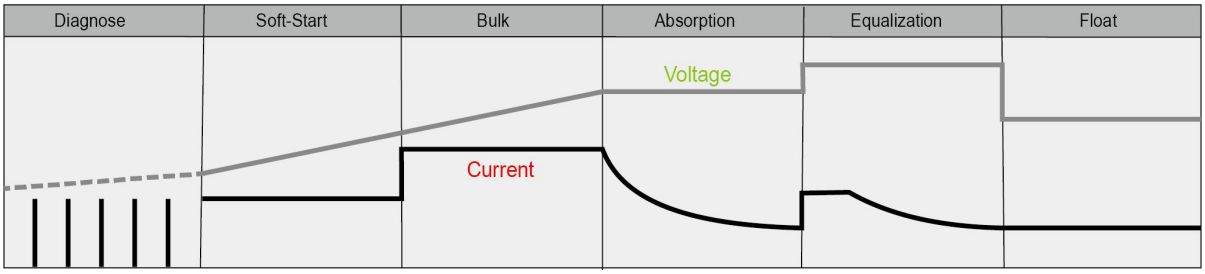
Alternatively Display voltage and FUL when battery is fully charged



The **VOLT / AMP button** can be changed at any time during charging process.
The LCD also can be treated as an independent voltage meter or thermometer.

CHARGING STAGE-

The unit has a 6-stage charging algorithm.
Diagnose* - Soft Charge – Bulk Charge - Absorption charge – Equalizing Charge* - Float Mode



Diagnose * – Only for Lithium battery type, subjected to the Lithium battery initial voltage then determine going to Soft start or Bulk charge; if the Lithium battery is protected by BMS, the controller will automatically send the signal periodically to the battery terminal to activate the BMS against protection.

Soft start - When batteries suffer an over-discharge, the controller will softly ramp the battery voltage up to 10V for 12V battery, 20V for 24V battery.

Bulk Charge - Maximum current charging until batteries rise to Absorption level.
For Lead crystal battery type, the charge controller will deliver two step level of Bulk charge, when the first level rises the battery voltage up to14.4V, then switch into the second level of the 50% of the first bulk charge rate, until the Lead crystal battery voltage up to 14.7V.

Absorption - Constant voltage charging and battery is over 85% for lead acid battery; a Li-ion battery, LiFePO4 battery and LTO battery will close fully charging after absorption stage, the absorption voltage level will reach 12.6V for Li-ion battery, 14.4V for LiFePO4 battery; 14.0V for LTO battery. 14.7V for Lead crystal battery.

Equalization * - Only for WET battery or Calcium battery type, when the battery is deeply drained below 10V or every 28 days cycle, it will automatically run this stage to bring the internal cells as an equal state and fully complement the loss of capacity. (Lead crystal, Li-ion, LiFePO4, LTO, Gel and AGM battery do not run Equalization charge)

Float Charge or Re-Bulk charge - Battery is fully charged and maintained at a safe level.
A fully charged Lead acid battery (Crystal, GEL, AGM, WET battery) has a voltage of more than 13.8 Volts; if the lead acid battery voltage drops to 12.8V at float mode, it will return to Bulk charge; Li-ion,LiFePO4 and LTO battery have no float mode; If a Li-ion battery voltage drops to 12.0V after absorption stage, it will return to Bulk charge; if a LIFePO4 battery voltage drops to 13.4V, or LTO battery voltage drops to 13.2V after Absorption stage, they will return to Bulk charge. (voltage x 2 for 24V use)

LED INDICATION

<table>
<tr><th>LED indications</th><th>  </th><th>  </th><th>  </th><th>  </th><th>  </th><th>  </th><th>LCD Display</th><th>LCD Backlight</th></tr>
<tr><td>LED Color</td><td>ORG</td><td>BLUE</td><td>BLUE</td><td>BLUE</td><td>BLUE</td><td>GREEN</td><td></td><td>WHITE</td></tr>
<tr><td>Soft start charging</td><td>ON</td><td>ON</td><td>FLASH</td><td>OFF</td><td>OFF</td><td>OFF</td><td rowspan="9">Normal Display</td><td rowspan="8">ON</td></tr>
<tr><td>Bulk charge (charged capacity < 25%)</td><td>ON</td><td>ON</td><td>FLASH</td><td>OFF</td><td>OFF</td><td>OFF</td></tr>
<tr><td>Bulk charge (charged capacity < 50%)</td><td>ON</td><td>ON</td><td>ON</td><td>FLASH</td><td>OFF</td><td>OFF</td></tr>
<tr><td>Bulk charge (charged capacity < 75%)</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td><td>FLASH</td><td>OFF</td></tr>
<tr><td>Absorption charging</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td><td>FLASH</td></tr>
<tr><td>Float charging</td><td>ON</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>ON</td></tr>
<tr><td>Solar weak (At dawn or dusk)</td><td>FLASH</td><td>OFF</td><td colspan="4" rowspan="2">Subject to battery voltage</td></tr>
<tr><td>In the night</td><td>OFF</td><td>OFF</td><td>OFF</td></tr>
<tr><td>Solar good, VB < 5V</td><td>ON</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>b03 / bLv</td><td>FLASH</td></tr>
</table>

LED indications							LCD Display	LCD Backlight
LED Color	**ORG**	**BLUE**	**BLUE**	**BLUE**	**BLUE**	**GREEN**		**WHITE**
Solar good, battery reversed	ON	OFF	OFF	OFF	OFF	OFF	**b02/ brc**	FLASH
Solar good, battery over-voltage	ON	OFF	FLASH	FLASH	FLASH	FLASH	**b01 / bov**	FLASH
Solar off, battery over-voltage	OFF	OFF	FLASH	FLASH	FLASH	FLASH	**b01 / bov**	FLASH
Solar good, battery over 65ºC	ON	OFF	Subject to battery voltage				bot/c	FLASH
Battery good, solar reverse	FLASH	OFF					**P02/prc**	FLASH
Battery good, solar over-voltage	FLASH	OFF					**P01/pou**	FLASH
Over Temperature Protection							**Pot/c**	FLASH

Voltage are for 12V use, x 2 for 24V use

SAFETY PROTECTION -

-Spark-free protection.
-Reverse polarity solar and battery connection.
-Against reverse current from battery to solar panel at night.
-Over temperature protection with charging current de-rate.
-Transient overvoltage protection, a varistor or transient voltage suppressor (TVS) at the solar input and battery output against surge voltage.

-Safety and EMC compliance
IEC/EN 60335, EN61000-4-2, EN61000-4-3, EN61000-4-4, EN61000-4-5 FCC Class-B
EN61000-4-6, EN61000-4-11, EN61000-3-3, CISPR14-1

MAINTENANCE-

Occasionally, clean the case using a damp cloth and mild cleaning agent. Check with terminals without loose, rusty; If connecting cable is damaged, replace the cable by qualified person.

SPECIFICATION-

Voltage in below table are for 12V use, x 2 for 24V use.

1	**Electrical Parameters**			
1-1	Rated solar panel amps	10/15/20	Max.	AMP
1-2	Normal input Solar cell array voltage	15-22		VDC
1-3	Max. solar cell array voltage (output has no load)	25	Max.	VDC
1-4	The controller lowest operating voltage at solar or battery side	8V	Min	VDC
1-5	Standby current consumption at night	5	Max	mA
1-6	Maximum voltage drop-Solar panel to battery	0.25	Max.	VDC
2	**Charging characteristics**			
2-1	Minimum battery start charging voltage	3	Min	VDC
2-2	Soft start charging voltage	3-10	+/-0.2	VDC
2-3	Soft start charging current (50% PWM duty)	Up to 5/7.5/10		AMP
2-4	Bulk charge	By the maximum rated current		
	Bulk charge level1 for Lead Crystal battery	By 100% maximum rated current charge up to 14.4V.		
	Bulk charge level2 for Lead Crystal battery	By 50% rated current charge up to 14.7V from 14.4V.		
2-5	Absorption charging voltage at 25℃			
	--Lead Crystal battery	14.7	+/-0.2	VDC
	--Gel type battery	14.1	+/-0.2	VDC
	--AGM type battery (default setting)	14.4	+/-0.2	VDC
	--WET type battery	14.7	+/-0.2	VDC

	--Calcium type battery	14.9	+/-0.2	VDC
	--LTO battery	14.0	+/-0.2	VDC
	--LFP battery	14.5	+/-0.2	VDC
	--Li-ion battery	12.6	+/-0.2	VDC
2-6	Absorption transits to Equalizing or Float condition:			
	--Charging current drops to	1.5	+/0.1	AMP
	-- or Absorption charging timer timed out	4		Hour
2-7	Equalization charging active			
	--Only for WET or Calcium battery			
	--Battery voltage discharged to less than	10	+/-0.2	VDC
	--Automatic equalizing charging periodical	28		Day
2-8	Equalization charging voltage at 25℃	15.5	+/-0.2	VDC
2-9	Equalization charging timer timed out	2		Hour
2-10	Float voltage (for Crystal, GEL, WET, Calcium, AGM battery) at 25℃	13.8	+/-0.2	VDC
	Restart voltage for LTO battery	13.2	+/-0.2	VDC
	Restart voltage for LFP battery	13.4	+/-0.2	VDC
	Restart voltage for Li-ion battery	12.0	+/-0.2	VDC
2-11	Voltage control accuracy	+/- 1%		
2-12	Battery temperature compensation coefficient	-24		mV/*C
2-13	Temperature compensation range	**-20 ~ +50**		℃
3	**Protection**			
3-1	Against reverse polarity or short circuit at panel or battery			
3-2	No reverse current from battery to solar at night			
3-3	Over temperature protection during charging	65		℃
4	**Electrical parts**			
4-1	Input output terminal	M5 terminals		
5	**Physical Parameters**			
5-1	Controller material	Plastic, Standard ABS		
5-2	Power terminal maximum stranded wire size	#6 AWG stranded-16 mm^2		
5-3	Power terminal torque	Up to 17 in-lb (0.2n-m)		
5-4	Mounting	Vertical wall mounting		
5-5	IP grade	IP65,		
5-6	Net weight	Approx. 0.5KG		
6	**Environmental characteristics**			
6-1	Operating temperature	-25 ~ 50℃ / -13~122 ℉		
6-2	Storage temperature	-40 ~ 85℃ / -40~185 ℉		
6-3	Operating Humidity range	100% no condensation		

Voltage in below table are for 12V use, x 2 for 24V use.

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Power Your Green Life!

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