ZAMP SOLAR

Solar Controller / Battery Charger

Input: DC12V Solar panel (Max. 25V)
**Output: DC12V 10A / DC12V 15A**
Model Number: ZS-10A / ZS-15A (Non-waterproof)
ZS-10AW / ZS-15AW (Waterproof)

User's Manual

FEATURE

- Advanced MCU control pulse width modulated (PWM) technology, high efficiency operation.
- Target for LiFePO4, LTO (Lithium Titanium Oxide), Gel, AGM, Conventional lead-acid (WET) and Calcium Batteries.
- Built in regulator to prevent your battery from being overcharged. Overcharging occurs when the charge voltage is unregulated. This can result in premature battery failure.
- Come with a regulator to prevent your battery from being under charged, in the solar energy field, battery undercharge always occurs, especially on some Conventional lead –acid or Calcium batteries; The unit provides an automatic Equalization feature for deeply drained Conventional lead acid battery or Calcium battery, as well as provides a cycling automatic Equalizing feature every 28 days.
- Can be connected to the battery permanently to keep the battery fully charged by using a process called "floating". This means the controller will stop charging when the battery is full and will automatically start charging the battery as required. This process will also reduce water loss and help prevent the battery from 'drying out'.
- Protects your battery from discharge at night. Under low light or no light conditions the solar panel voltage could be less than the battery voltage. The unit contains a special circuit which prevents current flowing back from the battery and into the solar panel.
- Colored LED's to easily indicate the operational status and battery conditions.
- Digital LCD to directly display battery voltage, charging current, charge percentage, charging capacity (Amp hour), battery types, full charge and faulty codes.
- Includes a port for external battery temperature sensor. (Temperature sensor optional)
- Multi charging protections against reverse polarity, short circuit, over temperature, over voltage, etc.
- Surface Mount or Flush Panel Mount options.
- Conformal-coating circuit boards and plated terminals will withstand hostile environments.
- Waterproof and non-waterproof selectable.
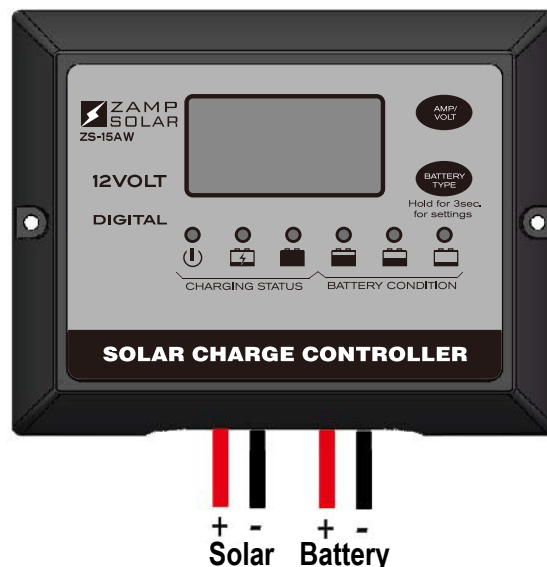
For use with 12Volt Solar Panel Only
Suitable for Solar panels up to 170 Watts for ZS-10A / ZS-10AW
**255 Watts for ZS-15A / ZS-15AW**

WARNING – IMPORTANT PLEASE READ

- This charger is designed for indoor use (non-waterproof type) or outdoor Use (waterproof type).
- Do not disassemble the controller. Talk to a qualified person if the unit requires repairing.
- Lead acid, LiFePO4, LTO batteries can be dangerous. Ensure no sparks or flames are present when working near batteries.
- Eye protection should always be used. Never short circuit 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 reverse connect the wires to the solar panel or battery

MOUNTING THE DEVICE

**The Solar Controller is mounted as shown below**

The quickest and easiest way to mount the unit is to use the two plastic spacers and self tapping screws supplied and mount the unit to a flat surface,
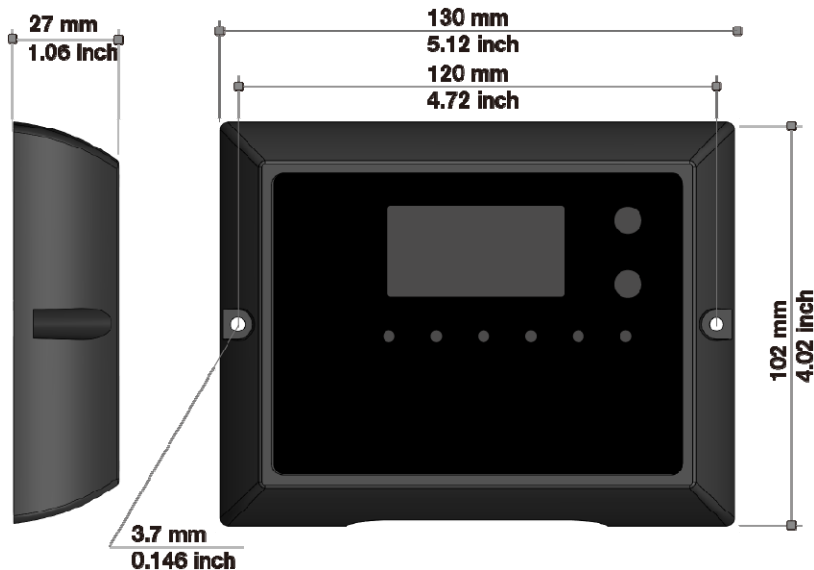
WIRING CONNECTIONS

To protect the Battery and the Solar Panel, we strongly recommend that you place a inline fuse on the positive wire on both the "Solar" and "Battery" Circuits. 20A fuse for 10A controller; 30A fuse for 15A controller (As close to the Battery /Panel as possible) The Solar Controller has 4 terminals which are clearly marked 'Solar' and 'Battery'. There is a (12V) and earth (GND) terminal for each circuit.
Refer to the wiring diagram below.

Correct Wire Size:
Please refer to the wire size chart below to determine the minimum size wire needed for each connection. This will also ensure you get the best performance out of your solar regulator.
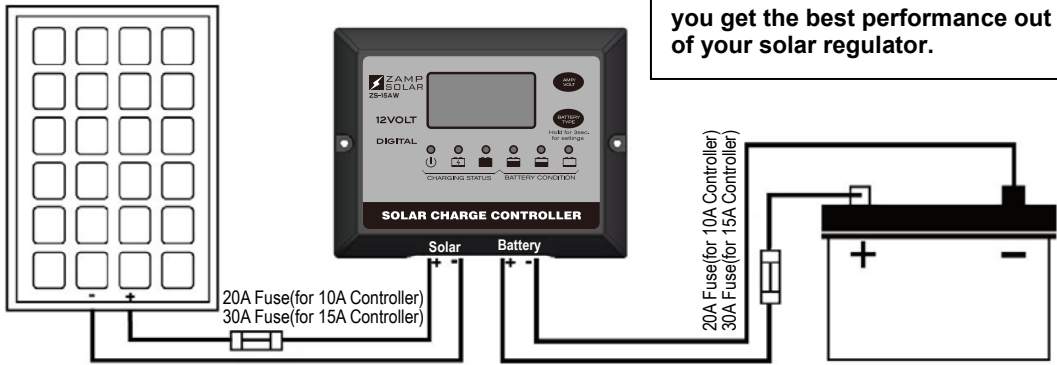
	Battery Connection		Solar Array Connection		
Length of Wire	5ft	10ft	10ft	15ft	20ft
Size (AWG)	12	10	12	10	10

1. Using the stranded wires, screw tightly the wires to the "Solar" terminal on the back of controller and connect to the Solar Panel like shown.
2. Using the stranded wires, screw tightly the wires to the "Battery" terminal on the back of controller and connect to the Battery like shown.

When the connections are completed, the Solar Controller will start working automatically.

OPERATION - LCD DISPLAY

Please check your battery manufacturer's specifications to select correct battery type. The unit provides 6 battery types for selections: LiFePO4, LTO, Gel, AGM, WET (conventional lead acid), and Calcium.
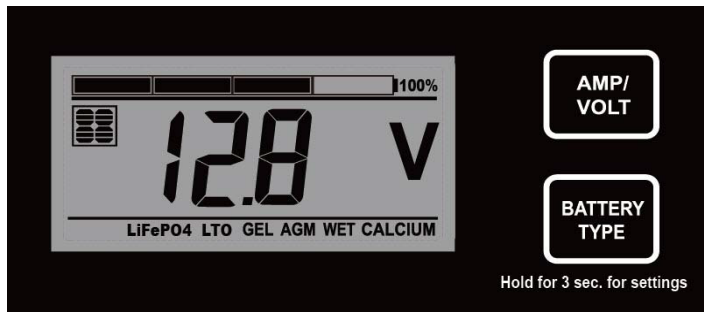
Press **BATTERY TYPE button** and hold for 3 seconds to go into your battery type selection mode, the battery type you select will be shown on the LCD meter, the default setting is AGM Battery; the controller will automatically memorize your battery type setting.

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

888 Self-test starts, digital meter segments test

8.8.8 Software version test

12.0 ᵛ   **15.0** ᴬ   Rated voltage and current test

25 °C   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-

↻ **12.6** ᵛ ⇨ **15.0** ᴬ ⇨ **120** ₐₕ ⇨ **25** °C ↺

Display when battery fully charged

Press **VOLT / AMP button** in sequence, the LCD will display in turn with Battery Voltage, Charging Current, if you do not press the button, the LCD will alternatively display the FUL and VOLT or FUL and AMP every 2 seconds

↻ **12.6** ᵛ ⇨ **FUL** °C ↺   or   ↻ **15.0** ᴬ ⇨ **FUL** °C ↺

The **VOLT / AMP button** can be changed at any time during charging process.

You also can visually monitor your battery charging condition for each battery; there is a LCD bar to show the percentage of charge, you can easily see if the battery is charged to 25%, 50%, 75% or 100%.

The LCD also can be treated as an independent voltage meter or thermometer. A voltage less than 11.5V Volts indicates that the battery is discharged and needs re-charging.

CHARGING STAGES

The unit has a 5-stage charging algorithm.
Soft Charge (Level 1) –Bulk Charge (Level 2)-Absorption charge (Level 3) – Equalizing Charge* (Level 4) - Float Mode (Level 5)
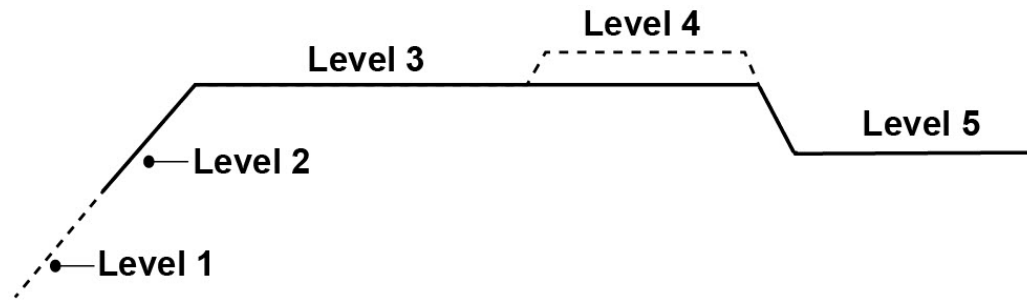
Soft Charge- When batteries suffer an over-discharge, the controller will softly ramp the battery voltage up to 10V.

Bulk Charge-Maximum current charging until batteries rise to Absorption level

Absorption Charge-Constant voltage charging and battery is over 85%.

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

Float Charge--Battery is fully charged and maintained at a safe level.
A fully charged Lead acid battery (GEL, AGM, WET battery) has a voltage of more than 13.6 Volts; A fully charged LiFePO4 or LTO battery has a voltage level of 13.4V.

OPERATION - L.E.D. INDICATION

The 6 LED's indicate the charging status and the battery condition	⏻ Red	⚡ Blue	▮ Green	▬ Green	▬ Yellow	▭ Red
Solar Power Present-No battery connected	ON	OFF	OFF	OFF	OFF	**Flash**
Soft charging	ON	**Flash**	OFF	OFF	OFF	**ON**
Bulk charging	ON	ON	OFF	Subject to battery voltage		
Absorption charging	ON	ON	OFF	**ON**	OFF	OFF
Equalization charging	ON	ON	OFF	**ON**	OFF	OFF
Float charging	ON	OFF	**ON**	ON	OFF	OFF
Solar panel weak	**Flash**	OFF	OFF	Subject to battery voltage		
At night, no charge	OFF	OFF	OFF	Subject to battery voltage		
Battery Voltage below 11.5V (+/-0.2V)	ON	ON	OFF	OFF	OFF	**ON**
Battery Voltage between 11.5V - 12.5V(+/-0.2V)	ON	ON	OFF	OFF	**ON**	OFF
Battery Voltage above 12.5V (+/-0.2V)	ON	ON	OFF	**ON**	OFF	OFF

ABNORMAL OPERATION MODE

Solar panel abnormal mode	LCD display	LED indication	LCD backlight
Solar panel weak		⏻ Flash	ON
Solar panel reverse connection	8.8.8.	⏻ Flash	Flash
Solar panel over voltage (> 26.5V)	8.8.8.	⏻ Flash	Flash

Battery abnormal mode	LCD display	LED indication			LCD backlight
Battery disconnected or less than 3.0V	8.8.8.	🔋 Flash	🔋 Flash	🔋 Flash	Flash
Battery reverse connection	8.8.8.		🔋 Flash		Flash
Battery over voltage than > 17.5V	8.8.8.		🔋 Flash		Flash
Battery temperature over 65C	8.8.8.	🔋 Flash	🔋 Flash	🔋 Flash	Flash

The solar controller abnormal mode	LCD display	LED indication	LCD backlight
The controller over temperature protection	8.8.8.		Flash

OPTIONAL EXTERNAL DEVICE

The controller provides a port for the optional temperature sensor (Temperature sensor not included)

Temp Sensor   Battery   Solar
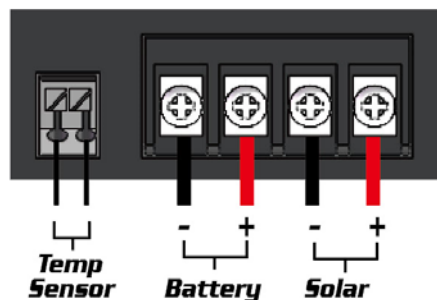
Optional external Battery temperature sensor:
As an option, the unit provides a port to connect the external battery temperature sensor; If the external battery temperature sensor is connected, the unit will optimize the charging performance subjected to the battery temperature detected and provide the battery over temperature protection, in some case, if battery over temperature occurs, the controller will automatically stop charging.

SPECIFICATIONS

1	**Electrical Parameters**			
1-1	Rated solar panel amps for ZS-10A / ZS-10AW	10	Max.	AMP
1-2	Rated solar panel amps for ZS-15A / ZS-15AW	15	Max.	AMP
1-3	Normal input Solar cell array voltage	15-22		VDC
1-4	Max. solar cell array voltage (output has no load)	25	Max.	VDC
1-5	The controller lowest operating voltage (solar or battery side)	8V	Min	VDC
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 15		AMP
2-4	Bulk charge voltage	10-14.0	+/-0.2	VDC
2-5	Absorption charging voltage at 25℃			
	--LTO type battery	14.0	+/-0.2	VDC
	--Gel type battery	14.1	+/-0.2	VDC
	--LiFePO4 battery	14.4	+/-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
2-6	Absorption transits to Equalizing or Float condition:			
	--Charging current drops to	0.5	+/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 charging voltage at 25℃	13.6	+/-0.2	VDC
	-- For LTO and LiFePO4 battery	13.4	+/-0.2	VDC
	-- For Gel, AGM, WET, Calcium battery	13.6	+/-0.2	VDC
2-11	Voltage control accuracy	+/- 1%		
2-12	Battery temperature compensation coefficient	-24		mV/℃
2-13	Temperature compensation range	**-20 ~ +50**		℃
3	**Protection**			
3-1	Against reverse polarity or short circuit			
3-2	No reverse current from battery to solar at night			
3-3	Over temperature protection during charging	65		℃
3-4	Transient over voltage protection with TVS or varistor			
4	**Electrical parts**			
4-1	Input output terminal	M4 terminals		
4-2	Temperature sensor port (Press and Release type)	DA 250-350 2P		
5	**Physical Parameters**			
5-1	Controller material	Plastic, Standard ABS		
5-2	Power terminal maximum stranded wire size	#12 AWG stranded-3 mm^2		
5-3	Mounting	Vertical wall mounting		
5-4	IP grade (ZS-10AW / ZS-15AW) / (ZS-10A / ZS-15A)	IP66 / IP22		
5-5	Net weight	Approx. 0.25kg / 0.55lb		
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		