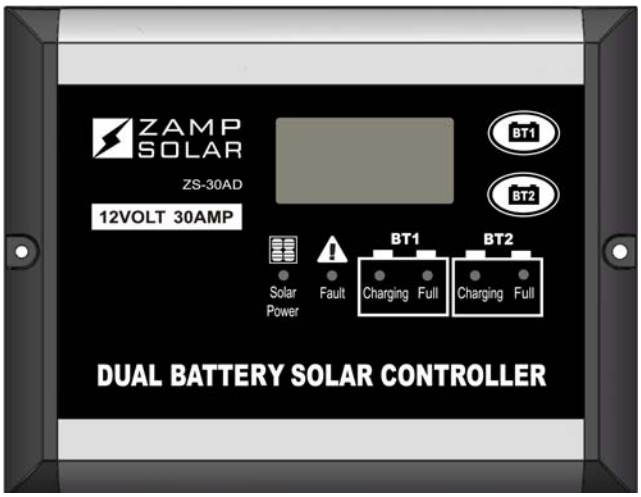
Dual Battery Solar Controller

Nominal Voltage: 12Volts
Rated Solar Current: 30Amps
Model Number: ZS-30AD

User's Manual

FEATURE

- Fully independent dual battery charging control, reduce the extra cost of two separated solar charging system, ideal for Caravans, RVs, Boats and Cottages, etc.
- Charging priority preset, can select the percentage of available charge current to each battery.
- Provide a wide range of Battery type setting for each battery: Gel, AGM, Conventional lead-acid (WET), Calcium, LiFePO4, LTO (Lithium Titanium Oxide) Battery types selection.
- Industrial grade MCU control, Pulse width modulated (PWM) technology, high efficiency operation.
- Ensure charge current is not wasted, if the first battery is fully charged, more charge current will be divided to the second battery, and return to the setting charging automatically when the first battery is in low voltage.
- Built in regulator to prevent two battery from being overcharged. Overcharging occurs when the charge voltage is unregulated. This can result in premature battery failure.
- Come with regulator to prevent two 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.
- Protects two 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 each battery and into the solar panel.
- Colored LED's to easily indicate the operational status and each battery conditions.
- Digital LCD to directly display each battery voltage, charging current, charging capacity, percentage preset, battery type, ambient temperature and faulty codes.
- Provides plug-in remote digital display meter (Optional).
- Provides external battery temperature sensor (Optional).
- Multi charging protections against reverse polarity, short circuit, over temperature, over voltage, etc.
- Surface Mount or Flush Panel Mount options.
- Conformal-coated circuit boards and plated terminals apply to hostile environments.



WARNING – IMPORTANT PLEASE READ

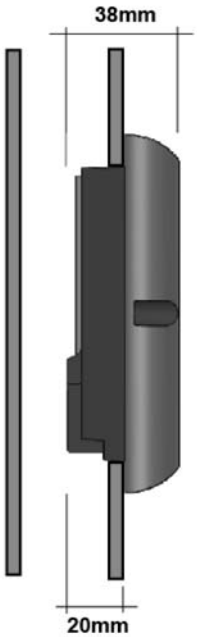
- This charger is designed for indoor use only and should never be exposed to rain.
- Do not disassemble the controller. Take to a qualified person if the unit requires repairing.
- Lead acid batteries, LiFePO4 or LTO batteries can be dangerous. Ensure no sparks or flames are present when working near 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

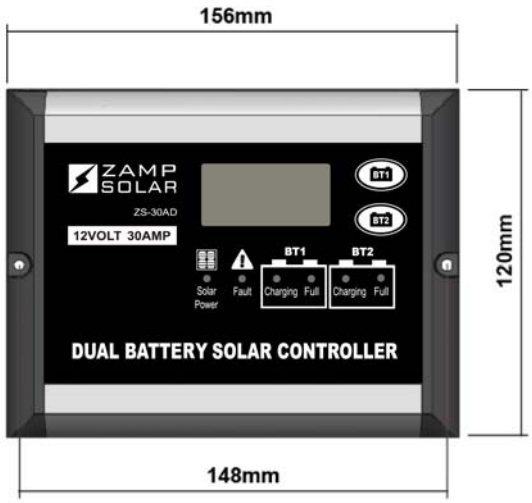
MOUNTING THE DEVICE

The Solar Controller has two mounting options.

1. Surface mount:
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,

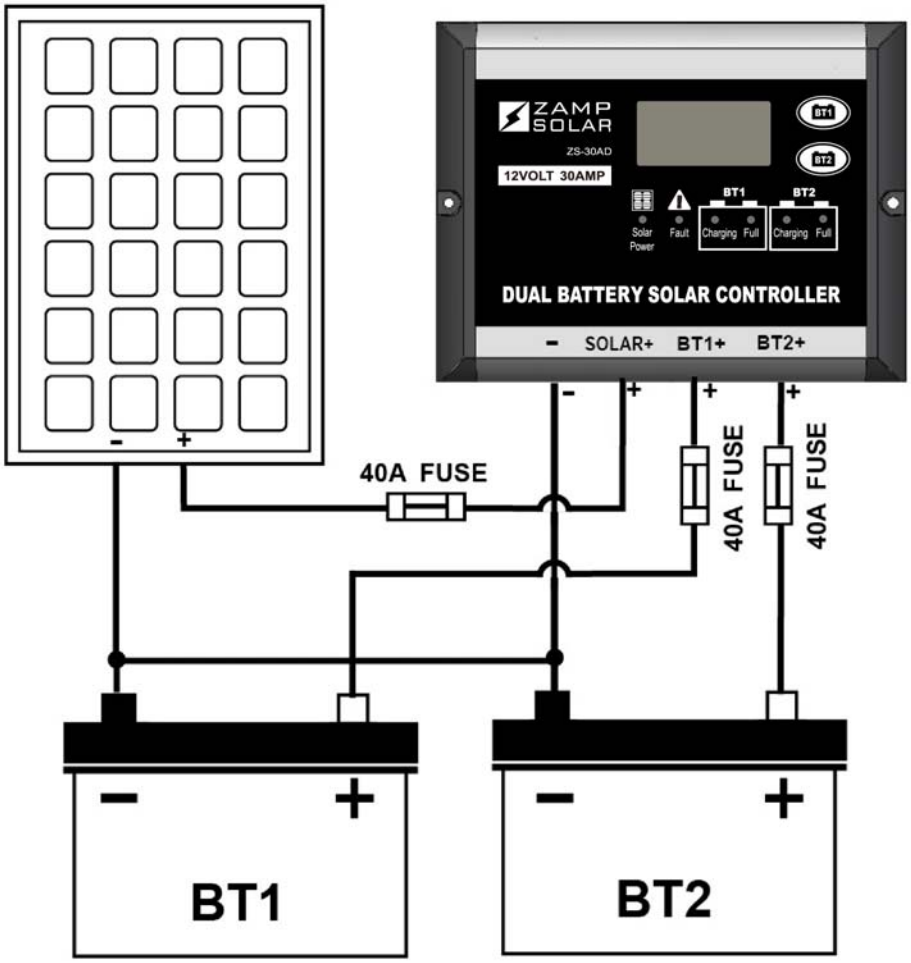
2. Flush (panel) mount:
Before deciding to use this mounting method, please ensure there is sufficient depth behind the controller or in the cavity. (Refer to Diagram below)
Using the dimensions shown in the following diagram, mark a 105mm x 130mm rectangle where you wish to mount the controller and cut-out the panel opening then use the two self- tapping screws supplied to secure the unit.





WIRING CONNECTIONS

Refer to the wiring diagram below.



	Battery Connection	Solar Array Connection		
Length of Wire	< 1m	6m	9m	12m
Size (AWG)	8 or 6	10	8	6

Installation procedure:

1. Using the Terminals supplied, crimp the terminals on your Battery wires.
2. Connect together the Negative polarity of solar controller "-", BAT1 "-" and BT2 "-"
3. Connect the solar controller "BT1+" to the Positive polarity of Battery "BT1+"
   Connect the solar controller "BT2+" to the Positive polarity of Battery "BT2+"
4. Using the Terminals supplied, crimp the terminals on your Solar Array wires and connect to the Solar Panel "+" to the solar controller "+" like shown.

NOTE: The 40Amp inline fuses must be connected into the positive wires as shown.

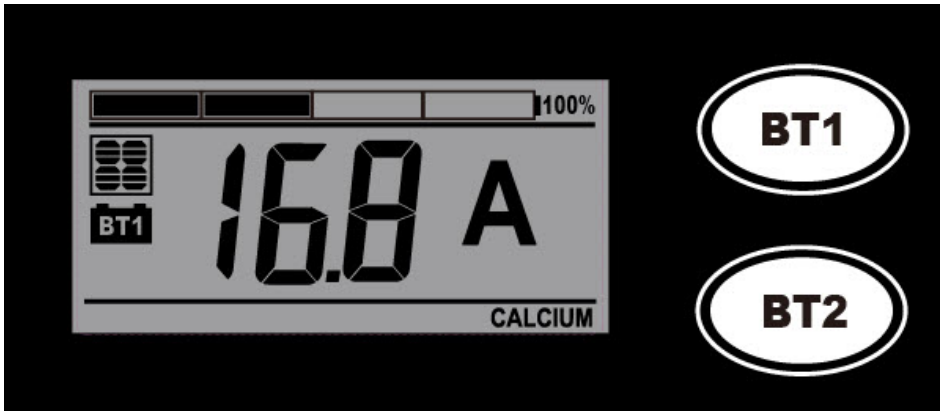
Caution 1: If BT1 and BT2 are different battery type or setting, please do not confuse or reverse the connection of BT1 or BT2 to the controller, otherwise may damage your battery.

Caution 2: The dual battery controller installation must be made by specialized technique person, any wrong size of wires used or loose power connections or corroded wires can melt wire insulation, burn surrounding materials or even cause a fire. Ensure tight all connections and use cable clamps to secure cables.

NOTE: The dual battery controller has a common negative, it does not matter which Negative terminal is grounded.

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

OPERATION - LCD DISPLAY



Charging priority setting: The dual battery controller provides the priority charging setting for Battery 1# and Battery 2#; the user can select the percentage of available charge current to each battery.

Press **the Button BT1** and hold for 3 seconds until the number flashing, you can select 10% into 90% setting via clicking **BT1 button** until you want, it will automatically save the data after you complete the percentage setting, or you go into the next Battery type setting by pressing and holding the button for 5 seconds.

Only need to set the charge rate percentage you want for Battery 1#, the controller will automatically calculate the rest for the Battery 2#:

For example: Battery 1# is set at the charging rate percentage of 50%.

LCD will be shown 50% and indicated the pattern BT1

Note: in the normal charging condition, the controller will divide the charging current as your setting, while Battery 1# is fully charged; more charging current will be diverted to Battery 2#, and return to the former setting automatically when the Battery 1# is in need of charge.

When the controller detects there is only Battery 1# connected, the entire charging current will go into the Battery 1# automatically.

Battery type settings:

Please check your battery manufacturer's specifications to select correct battery type. The unit provides six (6) battery types setting for selections: Gel, AGM, WET (conventional lead acid), Calcium, LiFePO4 and LTO battery. Allow the different battery type for each battery setting.

Press Battery type button **BT1** and hold for 5 seconds to go into your battery 1# type selection mode, the battery 1# type you select will be shown on the LCD meter, the default setting is AGM Battery; the controller will automatically memorize your battery 1# type setting; Press Battery type button **BT2** and hold for 5 seconds to go into your battery 2# type selection mode.

Caution 1: Incorrect battery type setting may damage your battery.

Caution 2: Do not confuse or reverse the Battery 1# or Battery 2# when you select the battery type setting.

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

 V Rated voltage test

 A Rated current test

 ˚C External battery temperature sensor test (if connected)

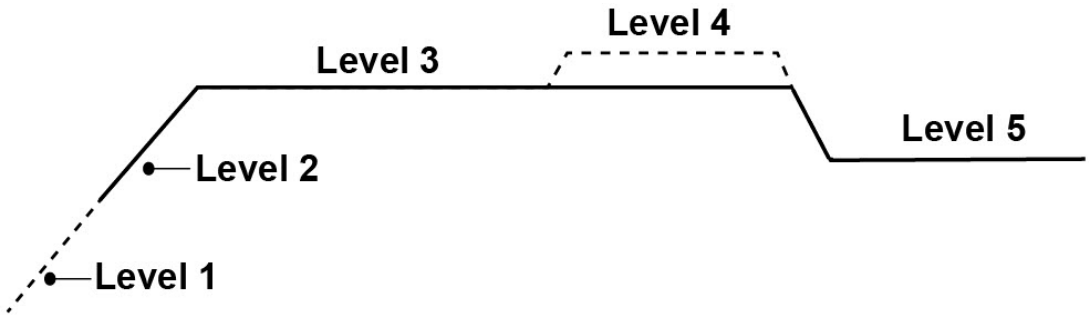
After going into charging process, the LCD displays the charging statues as below:
Press **BT1 or BT2 button** in sequence, the LCD will indicate BT1 or BT2, and display in turn with Battery Voltage, Charging Current, Charged capacity (Amp-hour), charge rate percentage setting and Battery Temperature (if external temperature sensor connected)

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.

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

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 ramps 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 states and fully complement the loss of capacity.(Gel, AGM,LiFePO4 and LTO battery do not run Equalization charge)

Float Charge-Battery is fully charged and maintained at a safe level.
A fully charged battery has a voltage of more than 13.6 Volts.

OPERATION - L.E.D. INDICATION

The 6 LED's indicate the charging status and the battery condition			BT1	BT1	BT2	BT2
	Red	**Red**	**Blue**	**Green**	**Blue**	**Green**
Soft charging	**ON**	OFF	Fast Flash	OFF	Fast Flash	OFF
Bulk charging	**ON**	OFF	**ON**	OFF	**ON**	OFF
Absorption charging	**ON**	OFF	**ON**	OFF	**ON**	OFF
Equalization charging	**ON**	OFF	Slow Flash	OFF	Slow Flash	OFF
Float charging Fully charged	**ON**	OFF	OFF	**ON**	OFF	**ON**
Solar panel weak	Flash	OFF	OFF	**OFF**	OFF	**OFF**

ABNORMAL OPERATION MODE

For example with BT1:

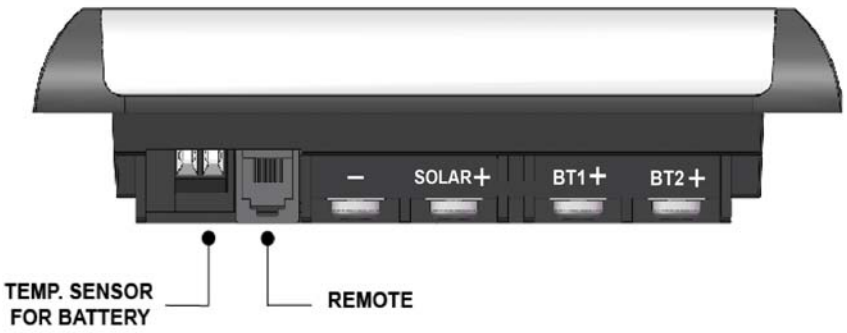
.Solar panel abnormal mode	LCD display	LED indications				LCD backlight
				BT1	BT1	
Solar panel reverse connection	E01	Flash	OFF	OFF	OFF	Flash
Solar panel over voltage (Vs > 26.5V)	E02	Flash	ON	OFF	OFF	Flash
Solar panel weak (Vs < Vbt1 or Vbt2)	P03	Flash	ON	OFF	OFF	ON

Battery abnormal mode	LCD display	LED indications				LCD backlight
				BT1	BT1	
Battery disconnected or less than 3.0V	b01	ON	OFF	Flash	Flash	Flash
Battery reverse connection	b02	ON	ON	Flash	Flash	Flash
Battery over voltage than > 17.5V	b03	OFF	ON	Flash	Flash	Flash
Battery temperature over 65C	b09	ON	ON	Flash	Flash	Flash

The solar controller abnormal mode	LCD display	LED indication	LCD backlight
The controller over temperature protection	b08		Flash

OPTIONAL EXTERNAL DEVICE

The controller provides two optional devices (excludes in the packaging box).



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

Optional external Remote display meter:

As an option, the unit also provides a port to connect the external Remote display meter for some special location needed. The display content on the Remote meter is same as the display on the controller.

SPECIFICATIONS

1	**Electrical Parameters**			
1-1	Rated solar panel amps	30	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	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*C			
	--LTO type battery ((Lithium Titanium Oxide 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 charge active --- only for the battery type	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*C	15.5	+/-0.2	VDC
2-9	Equalization charging timer timed out	2		Hour
2-10	Float charging voltage at 25*C	13.6	+/-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**		*C
3	**Protection**			
3-1	Reverse polarity or short circuit protections			
3-2	No reverse current from battery to solar at night			
3-3	Over temperature protection during charging	65		*C
3-4	Transient over voltage protection with TVS or varistor			
4	**Electrical parts**			
4-1	Input output terminal	M5 terminals		
4-2	Remote port	RJ-45 (8 pins)		
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	IP22,		
5-6	Net weight	Approx. 300g		
6	**Environmental characteristics**			
6-1	Operating temperature	-25 ~ 50*C		
6-2	Storage temperature	-40 ~ 85*C		
6-3	Operating Humidity range	100% no condensation		