Solar Controller / Battery Charger

Input: DC12V Solar panel (Max.25V)

Output: DC12V，10A / 15A / 20A

Input: DC12 /24V Solar panel (Max.50V)

Output: DC12V/24V，10A / 15A / 20A

User's Manual

FEATURE

● Advanced MCU control pulse width modulated (PWM) technology, high efficiency.
● Target for 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 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, charging capacity (Amp hour), battery types and faulty codes.
● 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, do not directly mount to metal surface.
● Conformal-coating circuit boards and plated terminals apply to hostile environments.
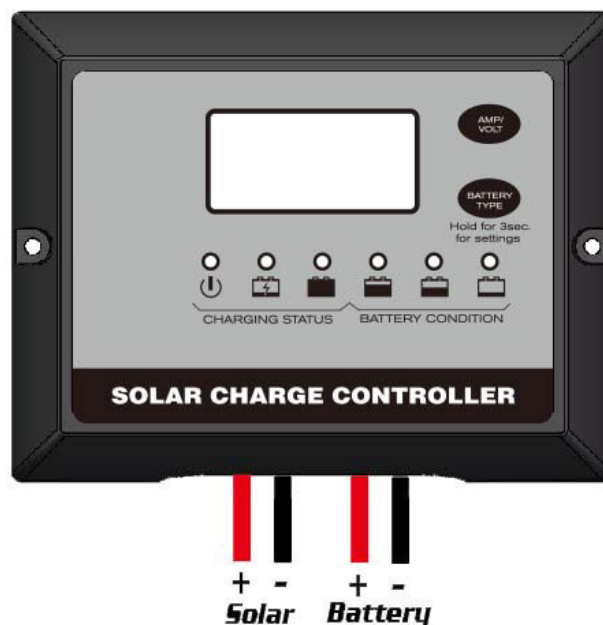
WARNING – IMPORTANT PLEASE READ

- The chargers listed model number with suffix A are designed for indoor use only and should never be exposed to rain; The chargers listed the model number with the suffix W are designed for waterproof type.
- Do not disassemble the controller. Take to a qualified person if the unit requires repairing.
- Lead acid 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,

Warning: To avoid short circuit to the metal terminals, please do not directly mount the controller onto the metal 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)
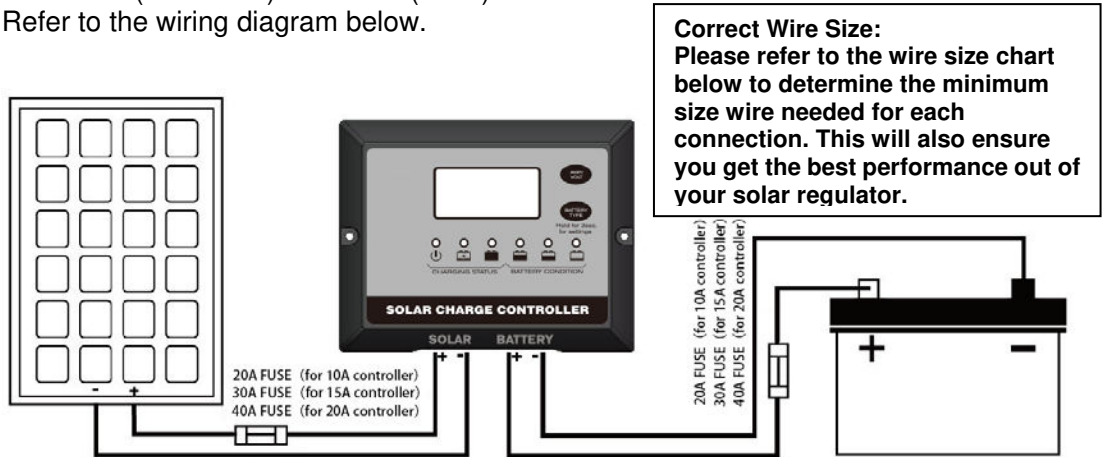Using the dimensions shown in the following diagram, mark a 105mm x 130mm rectangle where you wish to mount the controller and cut-out the panel opening then use the two self- tapping screws supplied to secure the unit.
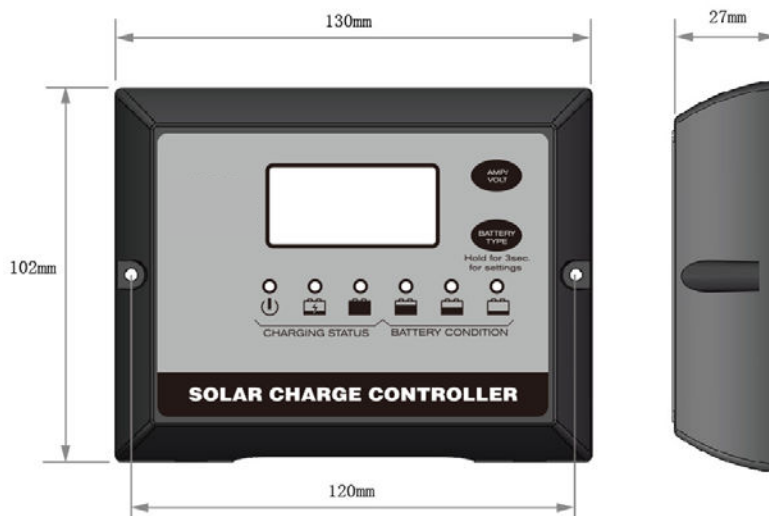
WIRING CONNECTIONS

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, 40A fuse for 20A 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 / 24V) 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.

Rated current	The cable total length One-way distance	Solar panel -> Controller -> Battery (meter)			
		< 3M	3-6M	6-9M	9-12M
10Amp	The cable size (AWG)	16AWG	14AWG	12AWG	10AWG

Rated current	The cable total length One-way distance	Solar panel -> Controller -> Battery (meter)			
		< 3M	3-6M	6-9M	9-12M
15Amp	The cable size (AWG)	14AWG	12AWG	10AWG	8AWG

Rated current	The cable total length One-way distance	Solar panel -> Controller -> Battery (meter)			
		< 3M	3-6M	6-9M	9-12M
20Amp	The cable size (AWG)	12AWG	10AWG	8AWG	6AWG

1. Using the stranded wires, screw tightly the wires to the "Solar" and "Battery" terminals on the back of controller and connect to the Solar Panel and Battery.
2. If the cable gauge is too large to fit into the terminals of the controller, please properly peel the part of copper wires prior to installation.

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 4 battery types for selections: Gel, AGM, WET (conventional lead acid), and Calcium.
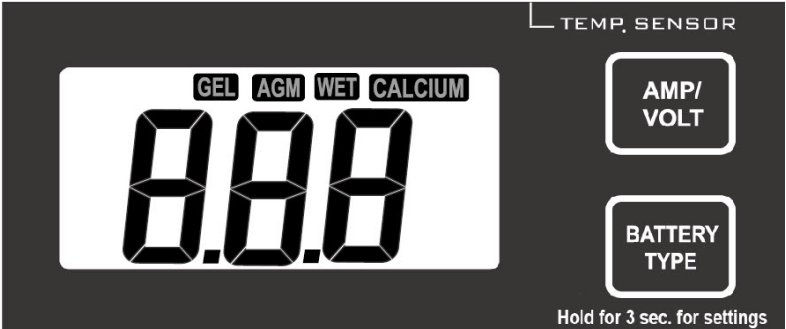
Press **BATTERY TYPE button** and hold for 3 seconds to go into your battery type selection mode, the battery type you select will be shown on the LCD meter, the default setting is AGM Battery; the controller will automatically memorize your battery type setting.

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

8.8.8 Self-test starts, digital meter segments test
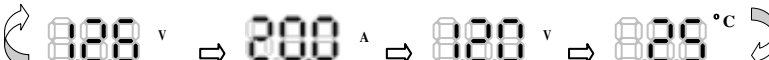
8.8.8 Software version test

12.8 v **20.0** A Rated voltage and current test
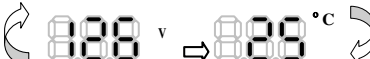
25 °C External battery temperature sensor test (if connected)

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)
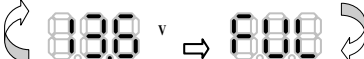
Display in the day time-

12.8 v ⇨ **20.0** A ⇨ **128** v ⇨ **25** °C

Display during the night- -

12.8 v ⇨ **25** °C

Alternatively Display voltage and FUL when battery is fully charged

13.8 v ⇨ **FUL**

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.
A voltage less than 11.5V Volts (for 12V battery) 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)

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Level 4

Level 3

Level 5
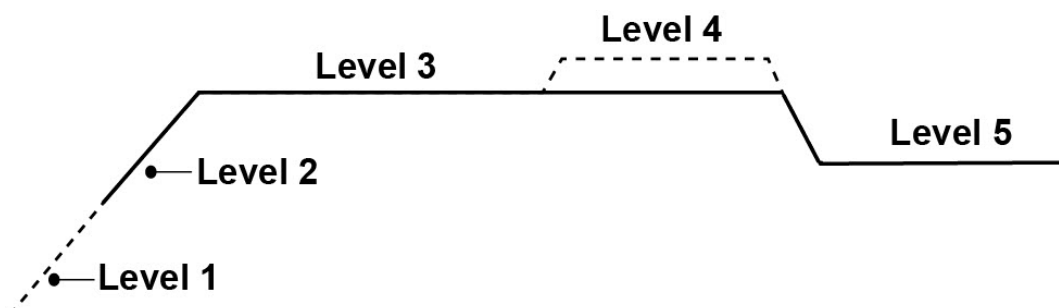
● Level 2

● Level 1

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

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 (for 12V battery), it will automatically run this stage to bring the internal cells as an equal states and fully complement the loss of capacity.(Gel and AGM 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 (for 12V battery), 27.0V (for 24V battery)

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**	OFF	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

Remarks: Values are for 12V use, x 2 for 24V use

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

Remarks: Voltage setting x 2 for 24V battery

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OPTIONAL EXTERNAL DEVICE

The controller provides an optional device (excludes in the packaging box).
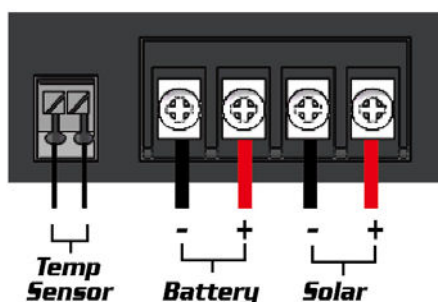
Optional external Battery temperature sensor:
As an option, the unit provides a port to connect the external battery temperature sensor; if the external battery temperature sensor is connected, the unit will optimize the charging performance subjected to the battery temperature detected and also provide 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	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 15		AMP
2-4	Bulk charge voltage	10-14.0	+/-0.2	VDC
2-5	Absorption charging voltage at 25*C			
	--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
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*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	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		°C
4	**Electrical parts**			
4-1	Input output terminal	M5 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	IP22 or IP65		
5-5	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		

Remarks: Values are for 12V use, x 2 for 24V use