

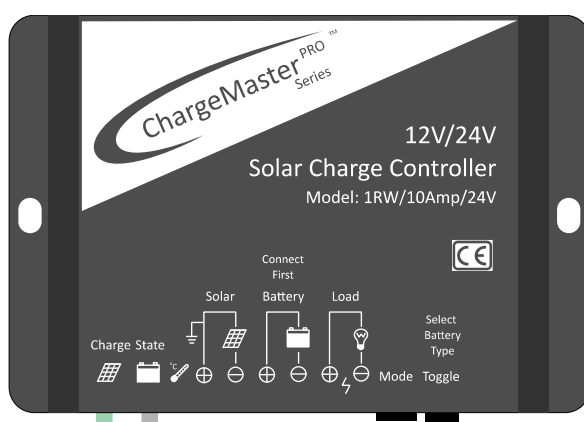


# EcoOnline™

## 12V/24V Solar Regulator Kit

### 1RW/10Amp/24V- Solar Charge Controller

Installation Manual & User Manual - Revised 30/10/2016



**Optex Solar Pty. Ltd.**  
ABN: 88 128 228 884  
www.EcoOnline.com.au  
email: [info@EcoOnline.com.au](mailto:info@EcoOnline.com.au)

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# 1 Key Terms

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Congratulations on the purchase of your EcoOnline™ Solar Regulator Kit. Please print this manual out for your reference. Please take the time to read the manual before starting any work. Particular attention should be given to text contained in the following key terms.

Please note EcoOnline has a strong product safety policy; do not install products without reading safety guidelines in the manual. Please report any product safety issues or near misses to [info@EcoOnline.com.au](mailto:info@EcoOnline.com.au) no matter how trivial.



DANGER

Indicates a **SAFETY** issue that **is likely to** cause injury or death if the user does not follow the instructions.



WARNING

Indicates a **SAFETY** issue that **may** cause injury or death if the user does not follow the instructions.



CAUTION

Indicates a **SAFETY** issue that **may** cause injury or property damage if the user does not follow the instructions



Read Carefully

Refers to **critically important** information related to the **correct functioning** of the system.



Tip

Refers to useful information for the **optimal operation** of the system

## 2 Safety Requirements



DANGER

**Lead acid batteries generate dangerous explosive gases** during normal operation; always provide adequate ventilation to the outdoors. Wear eye protection and gloves at all times when working around lead acid batteries. Be mindful of sources of ignition such as sparks from shorts, fuses, open flames or cigarettes. Note: batteries store a large amount of energy. Never short circuit a battery's positive (+) and negative (-) terminal. Have fresh water available to wash and clean any contact with battery acid.



DANGER

**When sizing your solar array and battery you must check that the maximum current produced by the chosen solar panel(s) array can never exceed the maximum allowable charging current for the battery being charged.** Always follow the battery manufacturer's charging instructions. Please note: panels can produce up to 30% more power than the panels rated power under extraordinary solar conditions.



WARNING

EcoOnline recommend de-rating the regulator. Solar panel wattages and connected loads should **not exceed: 120W solar power (at STC for a 12V system) or 7.5Amp continuous load for the 10Amp regulator.** If appliances are connected to the battery through the regulator, then the **total surge start up current** from all connected appliances should not exceed the 10Amp rated current for the regulator.



WARNING

This appliance is not intended for use by persons (including children) with reduced physical, sensory or mental capabilities, or lack of experience and knowledge, unless they have been given supervision or instruction concerning use of the appliance by a person responsible for their safety. Children should be supervised to ensure that they do not play with the appliance.



WARNING

This regulator is to be used for charging Sealed (AGM), Gel or Flooded **Lead-Acid** type batteries **only**. Not to be used for charging any other battery chemistries apart from **Lead-Acid**. You should check that the **maximum voltage** of the charging profile you select does not exceed the battery manufacturers recommended maximum charging voltage.



WARNING

Always use appropriate gauge wires. Never exceed the rated **Ampacity** (amp rating) of a wire. Keep in mind that **wires situated in highly insulated environments cannot dissipate heat** and hence will have a much lower Ampacity. This could lead to a fire hazard.



WARNING

If you are unskilled in making safe electrical connections, we recommend all electrical connections be carried out by a certified electrician. **Loose, corroded or fatigued electrical connections can become resistive and overheat creating a fire hazard.**



WARNING

Some batteries and/or **banks of batteries connected in parallel** are capable of very high short circuit currents and **may also require a current-limiting fuse**. You should check with your battery supplier as to the type of recommend fuse.



WARNING

Do not expose this regulator or system components including solder joins to water and/or high humidity and/or corrosive environments.



WARNING

**Always disconnect all connections to the regulator before attempting any maintenance or cleaning to reduce risk of electric shock.** Note: there are no serviceable parts inside the controller.



WARNING

Only use 12V “nominal” (36 cell) solar panels with this regulator. Or 72 cell panel(s) for a 24V system.



WARNING

What follows are general installation guidelines, **they should NOT be taken to be appropriate for all installation situations**, if in doubt please seek advice from a certified electrician.

### 3 Warranties

EcoOnline™ offers the following Warranties





- 3 year limited Warranty on all Regulators

See EcoOnline.com.au [Terms and Conditions](#) page for further details.

### 4 Included Charging Kit Components (depending on the kit purchased)

ChargeMaster <sup>PRO</sup> Solar Regulator with Connectors (10Amp)	Solar PV Panel with 6m Wire & Connector (2x2.08mm <sup>2</sup> 10Amp)	Anderson Battery Wire, Alligator Clips & In-line Fuse (2x2.08mm <sup>2</sup> 10Amp)	Spare Anderson Connector (if required)

## 5 ChargeMaster<sup>PRO</sup> Accessories (purchased separately at [www.EcoOnline.com.au](http://www.EcoOnline.com.au))

			
Spare Solar PV Panel with 6m Wire & Connector	Parallel (12V) or In-Series (24V) Tee Connectors (10Amp)	Field Mountable Compatible Connectors 10Amp)	Spare Anderson Connector (if required)

## 6 Designing Your Charging System

Firstly, please visit our online sizing calculators to size your system. They will help you understand important factors involved in sizing a solar charging regulator system. **(Do not assume the supplied components are suitable for all situations!)**

1. [Solar Panel Sizing Calculator](#) (this will help you understand the factors involved in a **sizing solar panels**)
2. [Solar Regulator Calculator](#) (this will help you understand the factors involved **sizing a regulator**)
3. [Solar Wire Sizing Calculator](#) (this will help you understand the factors involved in **sizing wire gauges**)

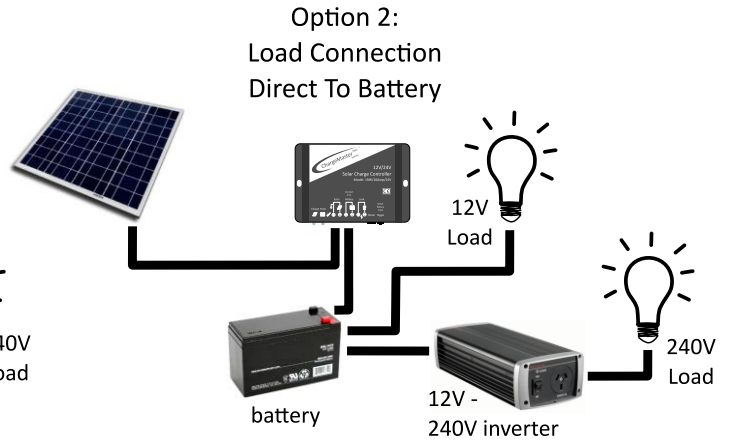
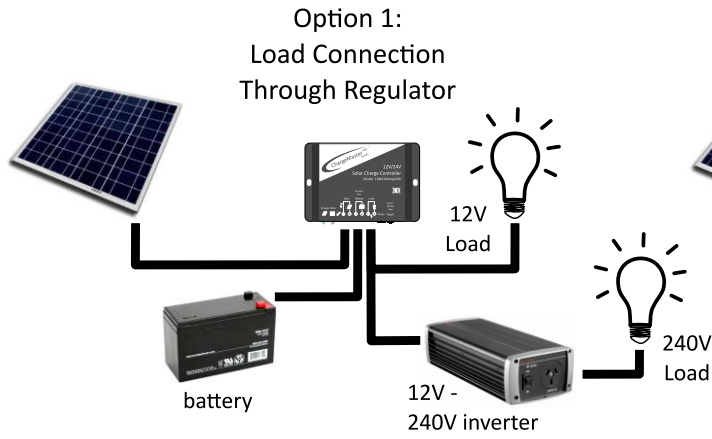


WARNING

A charging system must be sized right, for efficiency, reliability and **safety**. If in doubt please seek advice.

## 7 Connecting the Load Direct to Battery or Through the Regulator

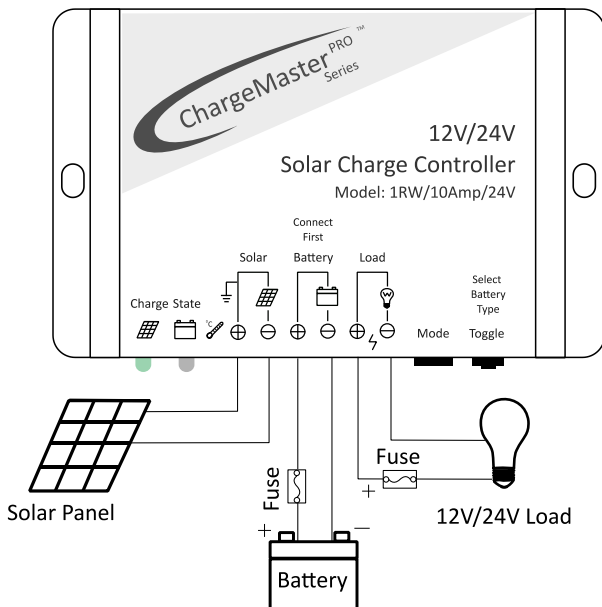
The first choice you have to make is whether you will be connecting your 12V/24V loads direct to your 12V/24V battery or through your regulator.



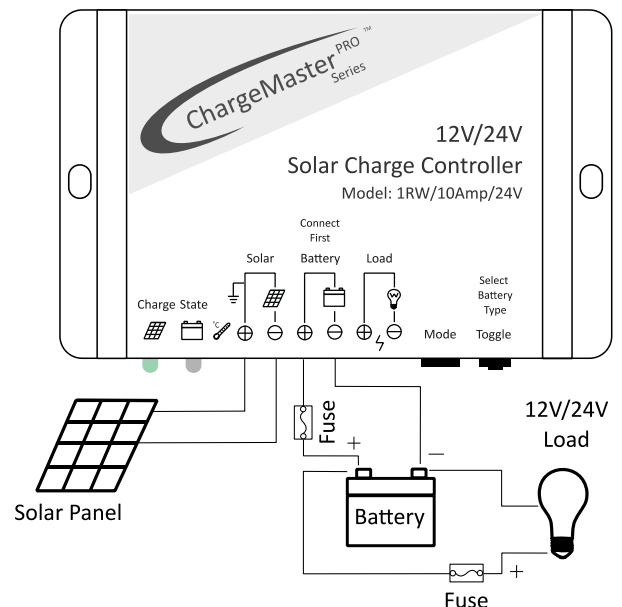
Option 1: Advantages	Option 2: Advantages
* Regulator will protect the battery from low voltage deep discharge	* Higher loads can be run direct of the battery (subject to wire capacity limitations)
Option 1: Disadvantages	Option 2: Disadvantages
* Loads are limited to the 10Amp limit for the regulator	* No deep cycle protection for the battery

## 8 Fuse and Technical Wiring Diagrams

Wiring Diagram for:  
Load Through Regulator System



Wiring Diagram for:  
Load Direct from Battery System





WARNING

The **1RW/10Amp/24V** regulator should have a **15Amp fuse**. You should check with your battery supplier as to the type of fuse to use as some batteries and/or **banks of batteries connected in parallel** are capable of very high short circuit currents and may require a special **current-limiting fuse**.



WARNING

Always use appropriate gauge wires. Never exceed the rated **Ampacity** (amp rating) of a wire. Keep in mind that **wires situated in highly insulated environments cannot dissipate heat** and hence will have a much lower Ampacity. This could lead to a fire hazard.



WARNING

Note: Fuse holder is only dust proof and should not be exposed to the sun and moisture. There should be no flammable objects in contact with or above and below the fuse holder.

## 9 Two Panel Systems in Parallel (12V) or in Series (24V) Solar Panel Wiring

If you have two solar panels and you would like to create a 'nominal' 12V solar panel array for charging a 12V battery/system you will need to wire panels in parallel. Alternatively, if you have a 24V battery/system you will need to wire two 12V 'nominal' solar panels in series. You have the option of using our parallel or in-series connectors or you can wire these in manually.

### 9.1 Using a Parallel or In-Series ChargeMaster<sup>PRO</sup> Connectors



Simply connect the solar panels to the purchased Tee-connector, then connect the Tee-connector to the regulator connection.

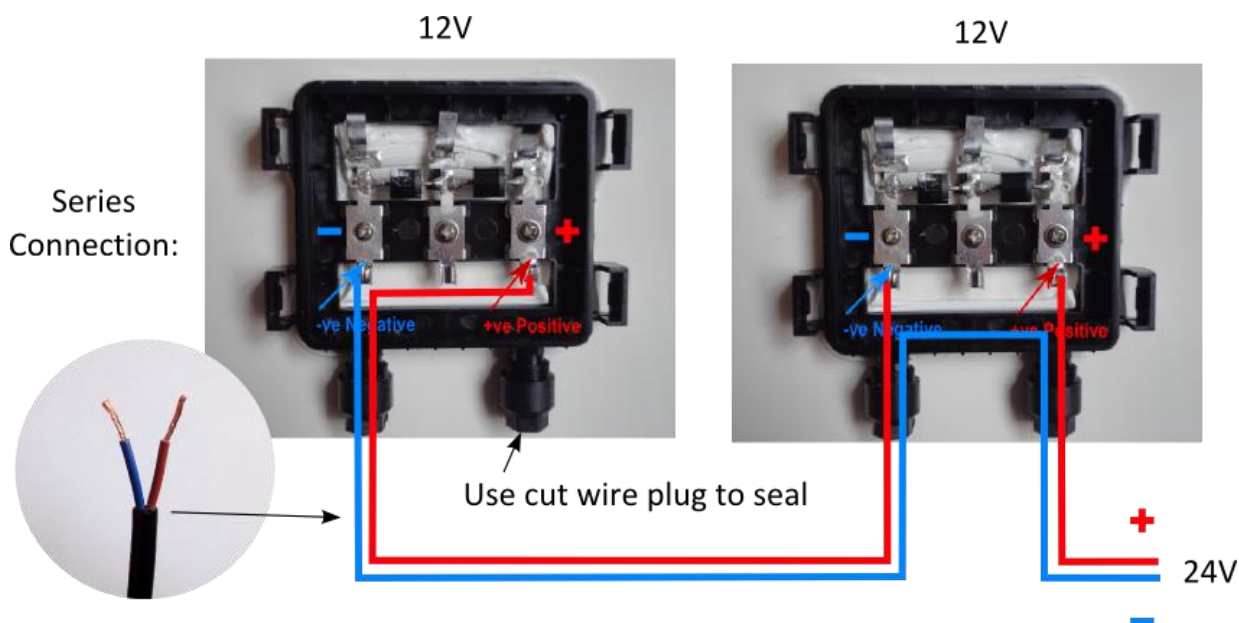
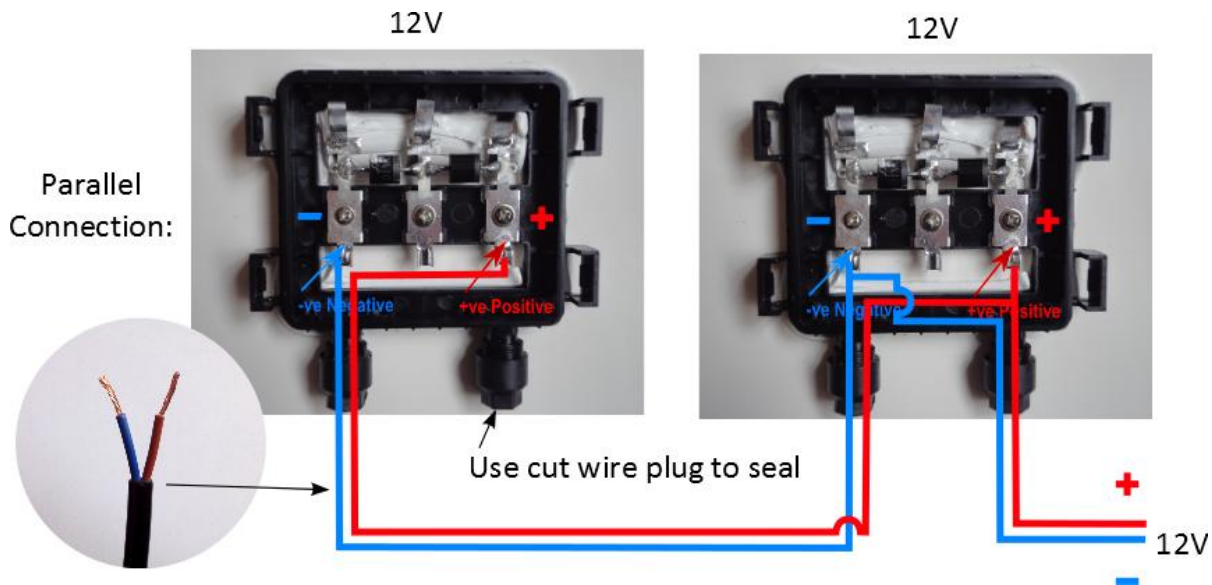


WARNING

Purchase the right connector! A parallel connector keeps the system at 12V while the in-series connector will change the system to 24V. **Note, the 120W max solar limit for a 12V system and 240W limit for a 24V system.**



## 9.2 In Parallel Connection Using Twin Core Wire – for 12V system



WARNING

**NEVER** screw clamp solder tinned wires to the solar junction box terminals. Wires must be soldered onto the terminals inside the junction box.



CAUTION

Always check that the solar modules are wired for the same voltage as the battery by using a **multimeter**. Open circuit voltage of a “12V nominal” or 36 cell solar panel or in parallel connected solar panels should be around 21V. This should be doubled for a 24V system.



CAUTION

For a 24V system the battery voltage must be greater than 18V for the controller to recognize and set the system as a 24V system.



Read Carefully

Note: All panels in an array must be of equal power and face exactly the same direction.

## 10 Mounting the Solar Panel(s)

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### 10.1 Mounting on Building Roof or Caravan



WARNING

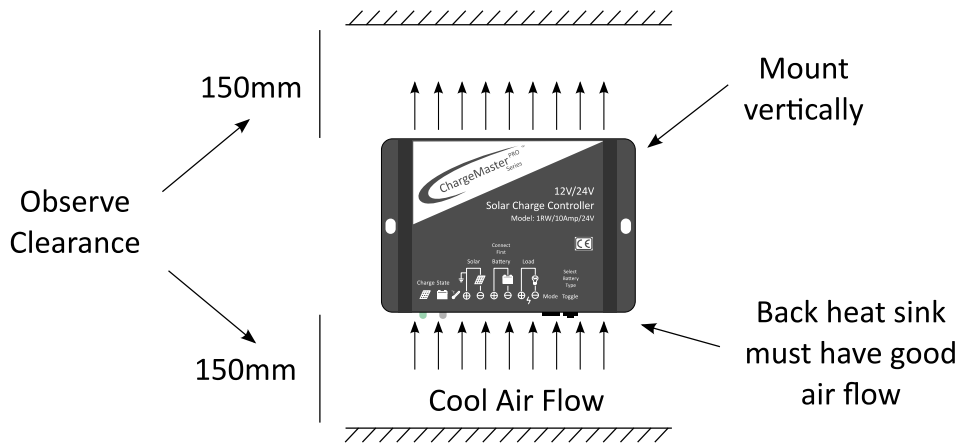
If the panels are to be mounted on a building roof **always check council/building regulations in your area**. We recommend roof mounting of panels be performed by a qualified professional that can advise on appropriate mounting means for your situation.

Generally, when mounting panel we also recommend:

- Panel(s) should be mounted **as close to the ground as possible** for **ease of maintenance, reduced wind loading, shorter wire runs** and a **reduced chance of lightning strike**
- Electrical connections in junction box **MUST be soldered on**.
- The **underside panel moisture barrier should not be scratched** as this will severely limit panel lifetime.
- **Do not use self tapping screws** into the side of frame when installing panels; use the bolt holes on the back with locking bolt & nut set or commercially available mounting means.
- Panels should be installed with **20mm to 50mm underside ventilation gap**.
- Dual or multi-panel arrays **MUST** be of the same power and face the same direction.

## 11 Mounting the Charging Regulator for High Amp Usage

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WARNING

For high power usage or in hot conditions the controller should be mounted on a **vertical, non-flammable surface**, in a cool, dry, sheltered location with adequate ventilation. **Note: the heat sink will get hot under high amp operation.** Ensure that there is sufficient air flow around the controller.



WARNING

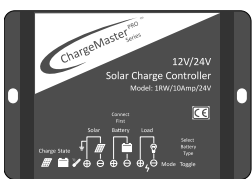
For mobile caravan applications, always secure all wiring to a solid surface. Unsecured wires and connections, that vibrate or work themselves loose will become resistive which could lead to excessive heating and/or fire.



CAUTION

For maximum longevity, do not allow the regulator or components to be exposed to rain or moisture.

## 11.1 Battery Over-Temperature Sensing Function



Battery Temperature Sensor

For applications where monitoring the battery temperature is important, for example when fast charging or when fast discharging a battery (through the regulators load terminals) we recommend the regulator is mounted such that the **Battery Temperature Sensor** wire on the regulator is near, above or in the same compartment as the battery.



DANGER

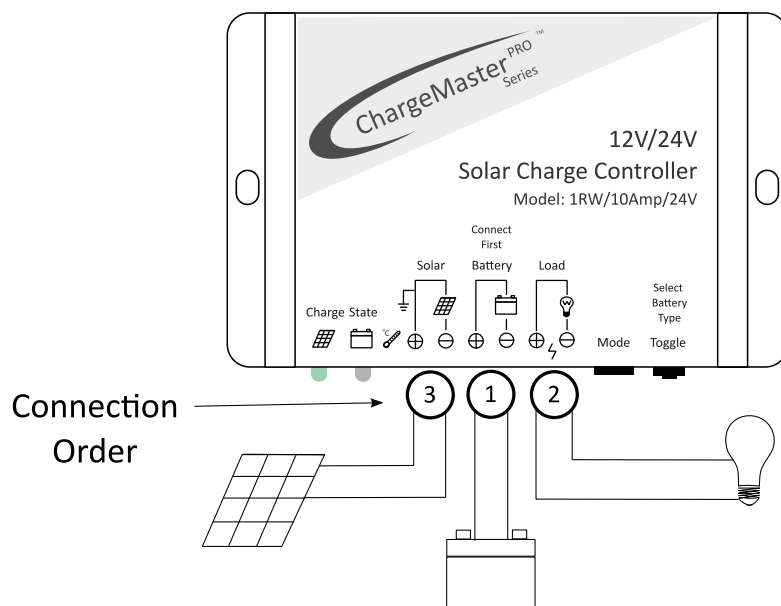
Applications involving fast charge/discharge or poorly ventilated batteries can lead to thermal runaway / explosion / fire. **The regulator's over-temperature function should never be relied upon as the sole safety measure in such situations.** We strongly recommend batteries are well ventilated and are charged and discharged well within their manufacturer specified capacities.



### Read Carefully

For other applications where battery overheating is not an issue, the regulator should at least be mounted in a place where it is likely to experience similar ambient temperatures as the battery so that the temperature compensation function on the regulator functions accurately.

## 12 Wiring and Connection Order



WARNING

Always power the regulator ON by connecting the battery first before making other connections. The regulator's battery indicator light should come on. This will activate the unit's numerous protection mechanisms.



WARNING

When wiring your system never run a 12-24V cable near or in the same compartment or conduit as other 240V cables due to the chance of mistaking the two cables at some later point in time during installation or servicing.



WARNING

Depending on the installation we recommend any wiring work be performed by an experienced and/or qualified person such as an electrician.

### 13 Auto Voltage Selection - 12V or 24V System

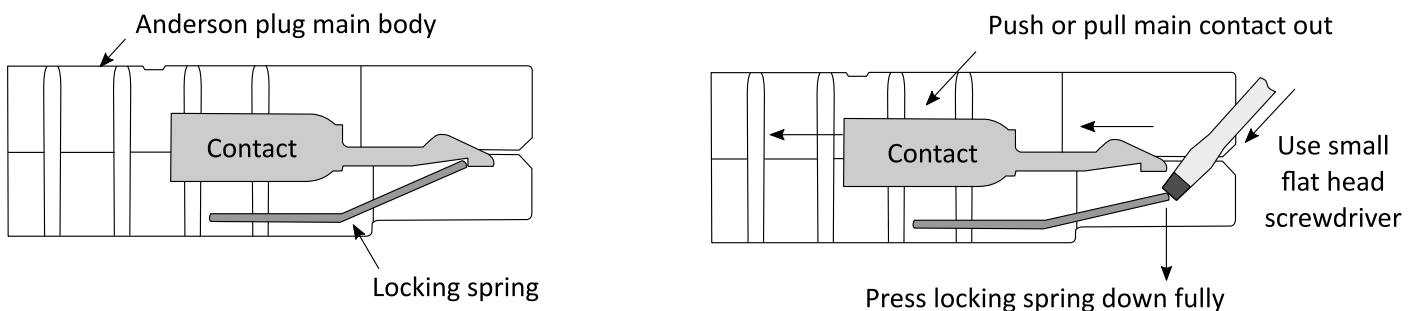


WARNING

Note: the controller will sense and set the system voltage from the battery voltage. If the battery voltage is lower than 18V, it will recognize the system as 12V. If the battery voltage is greater than 18V, it will recognize the system as 24V.

### 14 Regulator Anderson Connectors

The regulator will come with a set of Anderson plugs for the battery connection and load connection. If using the load terminal you will need to connect the supplied spare Anderson plug to your load wiring (load wire not supplied).



WARNING

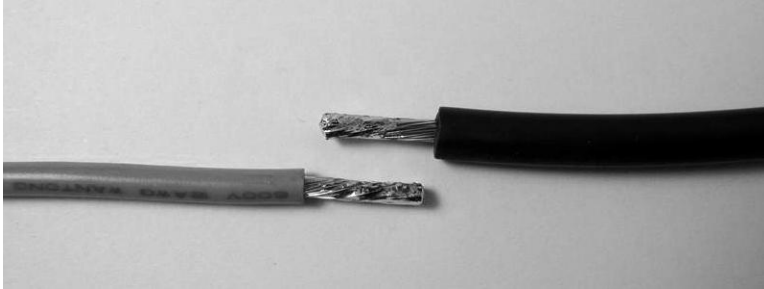
An approved crimping tool must be used to crimp the Anderson contact lug to your load wiring.

## 15 Lap Splice Soldered Connection



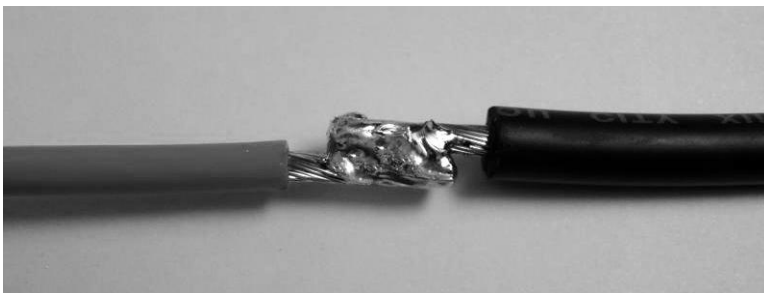
WARNING

A soldered lap splice can be used with this kit to make connection but **ONLY for applications where the wiring and splice joins are to be fixed in place WITHOUT potential for tension or repetitive bending movement across splice joins**. Use **ONLY** rosin-core solder that is specifically approved for electrical work.



Overlap area should be **at least 3 wire diameters but no more than 5 diameters**. Wire overlap must be well pre-tinned with solder.

- \* DO NOT nick wire while stripping insulation
- \* DO NOT allow solder to diffuse into the length of the wire more than 5 wire diameters from tip.



Solder the overlapping wire ends **together across the entire overlap** using sufficient heat to fully melt the solder. Tape down ends to hold in place during soldering. Clean flux residue from the solder using suitable solvent. Cut off any protruding wire strands.

- \* DO NOT allow movement during the solder solidification process



**Use a heat gun** to heat adhesive lined heat shrink sleeve. Press ends to seal.

- \* DO NOT use a naked flame or soldering iron to shrink heat shrink sleeve



**Apply secondary heat shrink sleeve** to immobilize the splice to protect against metal fatigue of solder. Press ends to seal.

- \* DO NOT expose the stiff splice to tension or metal fatiguing bending forces. When mounting soldered splice should be fixed in place at both ends.

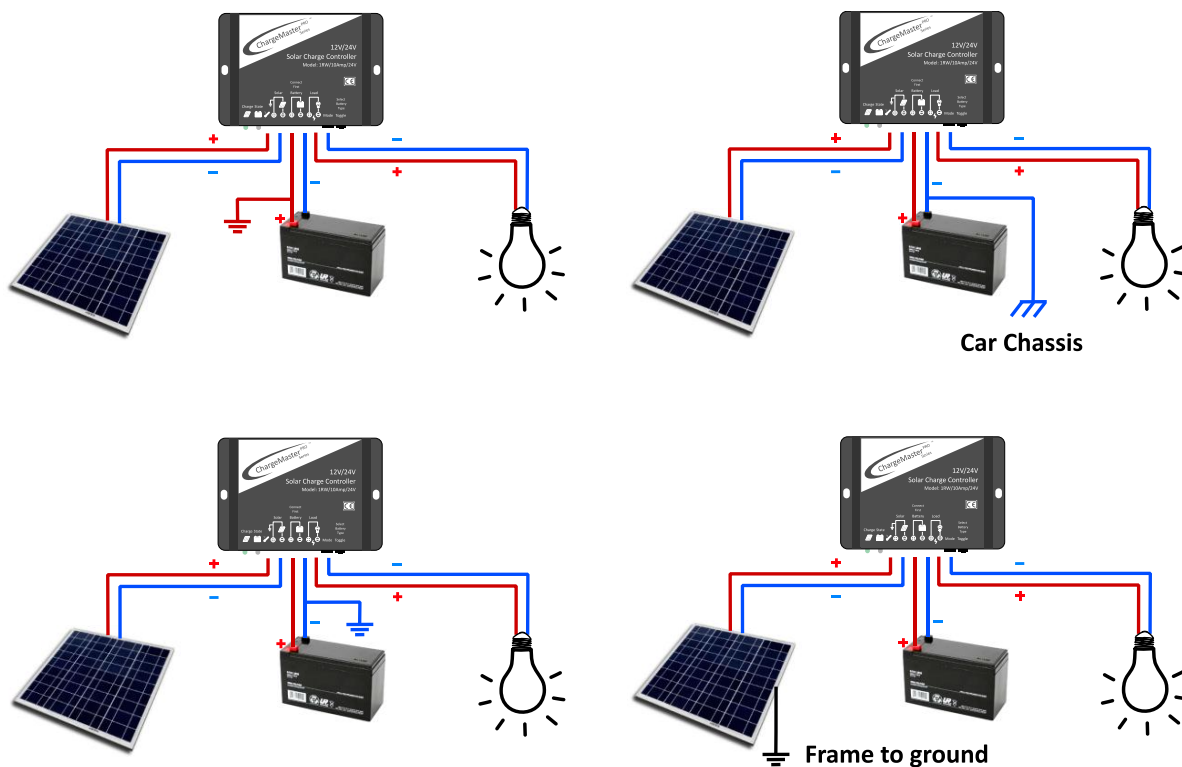
## 16 System Grounding



CAUTION

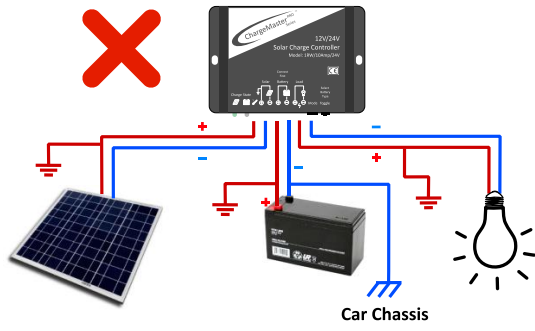
If lightning strikes are a possibility and grounding is required it should be noted that this is a **positively ground regulator**.

### 16.1 Allowable Grounding Options

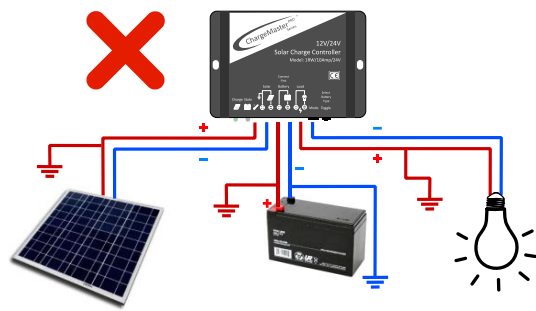


### 16.2 Forbidden Grounding Options

**Not Allowed**



**Not Allowed**





## 17 Specifications

### 17.1 General Regulator Specifications

General Specifications		
Description	Parameter	
Nominal System Voltage	12VDC	24VDC
Battery Voltage Range	9V-16V	18V-32V
Recommended Solar Panel	36 cell	72 cell
Maximum Short Term Current	10A	
Maximum Continuous Current	7.5A	
Self-consumption	9.4mA/12V ; 12.2mA/24V	
Temperature Compensation Coefficient*	-3mV/°C /2V -5mV/°C /2V (25°C)	
Operating temperature	-10°C to +45°C	
Storage temperature	-35°C to +60°C	
Humidity	Max. 90%	
Enclosure	IP67	
Regulator Physical Dimensions	length 108.5mm x width 64mm x height 25.6mm	

\* Compensates equalize, boost, float and low voltage disconnect voltages.

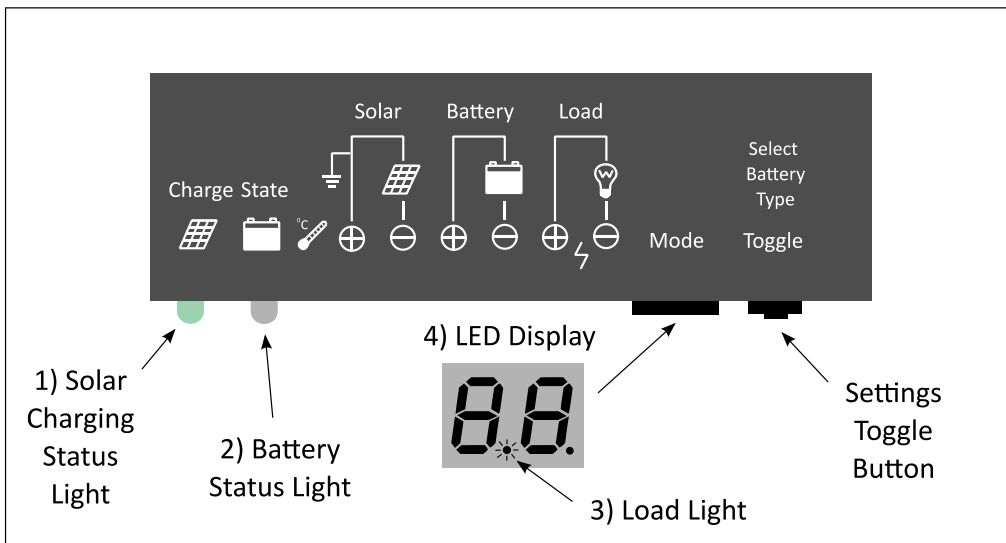
Lead Acid Battery Types			
Regulator selection	GEL	SEALED	FLOODED
Common names	"VRSLAB" also "Sealed" or "Maintenance free"		Lead Acid Battery*
Technical name	Gelled Electrolyte	Advanced Glass Mat (AGM)	Wet Cell Lead Acid
Electrolyte type	Gel suspension	Glass mat suspended liquid	Liquid

\* Note some wet cell batteries have sealed tops and are marketed as "maintenance free" however these are still classed as FLOODED type batteries.

Battery Voltage Charging Parameters (at 25°C)			
Charging Parameter	GEL 12V(24V)	SEALED 12V(24V)	FLOODED 12V(24V)
Equalize Charging Voltage	-----	14.6V (29.2V)	14.8V (29.6V)
Boost Charging Voltage	14.2V (28.4V)	14.4V (28.8V)	14.6V (29.2V)
Float Charging Voltage	13.8V (27.6V)	13.8V (27.6V)	13.8V (27.6V)
Boost Reconnect Charging Voltage	13.2V (26.4V)	13.2V (26.4V)	13.2V (26.4V)
Low Voltage Reconnect Voltage	11.6V (25.2V)	11.6V (25.2V)	11.6V (25.2V)
Low Voltage Disconnect (Adjustable)	11.1V (22.2V)	11.1V (22.2V)	11.1V (22.2V)
Discharging Limit Voltage	10.8V (21.6V)	10.8V (21.6V)	10.8V (21.6V)
Equalize Duration	-----	2 hours	2 hours
Boost Duration	2 hours	2 hours	2 hours

## 18 Operating Instructions

### 18.1 Display Indicator Lights



1) Solar Charging Status Light	
Indicating Light	Charging Status
GREEN - ON Solid	PV Voltage Too Low - Not Charging
GREEN - Slowly Flashing	PV Voltage OK - Charging
GREEN - Fast flashing	Reverse PV Polarity
GREEN - OFF Solid	No PV Voltage Detected

2) Battery Status Light	
Indicating Light	Voltage Status
GREEN - Slow flashing	Battery Full Voltage
GREEN - ON Solid	Battery Normal Voltage
GREEN - Fast flashing	Battery Over Voltage
ORANGE - ON Solid	Battery Under voltage
RED - ON Solid	Battery Depleted
RED - Fast flashing	Battery Overheating ‡
Battery light ORANGE - Flashing Solar Status light GREEN - Flashing	Controller Overheating

3) Load Light	
Indicating Light	Load Status §
RED - ON Solid <b>8*8.</b>	Load Terminals ON
RED - OFF Solid <b>8.8.</b>	Load Terminals OFF

‡ Note: the battery temperature sensing function will only work if the regulator's battery temperature sensor is near and/or in the same compartment as the battery. If this is the case and the battery sensor is above 50°C then the controller will automatically turn off any active load or charging. If the temperature falls below 50°C the controller will resume.

§ Caution: The load state will be concealed during fault display and the parameter setting state.

## 18.2 Toggle Button Usage

- Press and hold the **Toggle Button** for 3 second until **LED Display** lights
- You can now toggle (press and release quickly) the **Toggle Button** between various settings
- Once you have toggled to a particular setting you wish to change, press and hold the **Toggle Button** for a further 3 second until **LED Display** starts flashing
- You can now toggle between the different options for that particular setting
- Once you have toggled to your chosen option for that setting, wait 5 seconds until **LED Display** stops flashing
- Setting option is now saved – you can continue to alter other setting options as required

## 18.3 Regulator Settings 1-6

Setting 1 – Battery Type	
LED Display	Battery Type
11	Sealed*
12	Gel
13	Flooded

Setting 4 – Light Mode Voltage Threshold†	
LED Display	Voltage†
41	0V
42	1V
43	2V
44	3V
45	4V*
46	5V
47	6V
48	7V
49	8V
40.	9V
41.	10V
42.	11V
43.	12V
44.	13V
45.	14V
46.	15V
47.	16V

Setting 2 – Low Voltage Disconnect	
LED Display	Voltage
20	10.6V
21	10.7V
22	10.8V
23	10.9V
24	11V
25	11.1V*
26	11.2V
27	11.3V
28	11.4V
29	11.5V
20.	11.6V
21.	11.7V
22.	11.8V
23.	11.9V
24.	12.0V

Setting 5 – Light/Timer Mode Timer 1	
LED Display	Hours
51	0h
52	1h
53	2h
54	3h
55	4h*
56	5h
57	6h
58	7h
59	8h
50.	9h
51.	10h
52.	11h

Setting 3 – Load Terminal Function (if required)	
LED Display	Mode
30	Lights*
31	Light/Timer
32	Manual
33	Output
34	Test

Setting 6 – Light/Timer Mode Timer 2	
LED Display	Hours
61	0h
62	1h
63	2h
64	3h
65	4h*
66	5h
67	6h
68	7h
69	8h
60.	9h
61.	10h
62.	11h
63.	12h
64.	13h

53.	12h
54.	13h

\* Default

† If the regulator is in “Lights” mode (Setting 3) then the load will automatically turn ON/OFF when PV voltage is below/above this threshold voltage.

## 18.4 Error Codes

To clear errors, please restart the controller. Disconnect the PV array firstly, then load (if any), and then battery. To reconnect the controller, first connect battery then the load if any, then the PV array.

Error Code	
LED Display	Error
E1	Battery Over Discharged
E2	Battery Under Voltage
E3	Load Ampage Overload
E4	Load Short Circuit

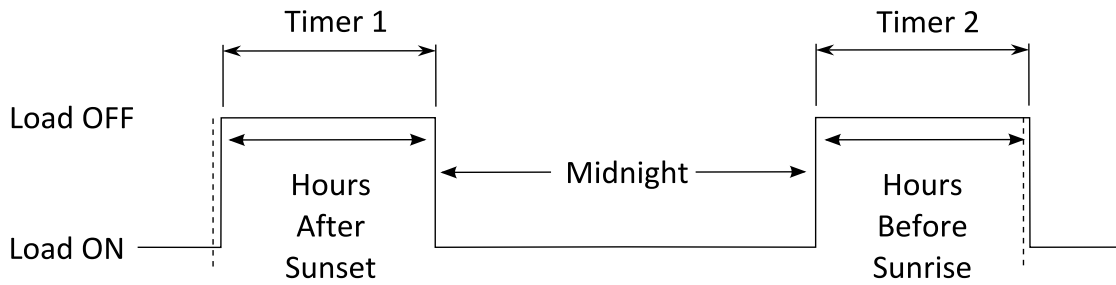
## 19 Load Control Programs (Setting 3)

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### 19.1 Lights Mode

When the solar module voltage drops below the **Light Mode Voltage Threshold (LMVT)** - Setting 4 at sunset, the controller will turn on the load after 10 minutes delay. When solar module voltage increases above the LMVT in the morning, the solar controller will turn off the load after a 10 minutes delay.

### 19.2 Light/Timer Mode



**Timer 1:** When the solar module voltage drops below the **Light Mode Voltage Threshold (LMVT)** - Setting 4 at sunset, the controller will turn ON the load after a 10 minutes delay for the number of hours specified in setting 5.

**Timer 2:** The controller will turn the load ON for the number of hours specified in setting 6 before sunrise and turn OFF the load 10 minutes after sunrise when the module voltage reaches the LMVT. Note the regulator may take a few days to learn and predict sunrise times.

### 19.3 Manual, Output, Test Mode

In **Manual Mode** the load is turned ON/OFF manually by pressing the **Toggle Button**. In **Output Mode** the load will be on for 24 hours. **Test mode** is the same **Lights Mode** but with no 10 minutes delay.

## 20 System Maintenance



WARNING

Important: before carrying out any system maintenance you **MUST** check for any manual updates and download the latest installation manual from

[www.EcoOnline.com.au/downloads](http://www.EcoOnline.com.au/downloads)

The following inspections and maintenance tasks are recommended at least two times per year for best controller performance.

- Check that the controller is securely mounted in a clean and dry environment.
- Check that the air flow and ventilation around the controller is not blocked. Clear all dirt or fragments on the heat sink.
- Check fixings holding wiring in place.
- Check all wires to make sure insulation is not damaged from, UV exposure, frictional wear, moisture/corrosion, fatigue, insects or rats etc. Maintain or replace the wires if necessary.
- Inspect regulator connections for loose, corroded, broken, wires or signs of high temperatures such as discoloured or burnt areas.
- Confirm that all the system components are ground connected tightly and correctly if the system is grounded.
- Check that any fuses and fuse holders are not corroded and/or lose and/or warm or hot during operation. Replace as needed.



WARNING

Fatigued, weathered, loose and/or corroded wiring or electrical connections poses a fire risk even at low voltage. The systems wiring should be checked periodically for any wear, cracking resulting from UV damage of insulation on wiring and corrosion of any solder or controller connections. Any affected parts should be replaced at the first sign of damage.

## 21 Trouble Shooting Guide

