



---

# Go Power! Solar Charging Kit Manual

## RV Solar Power Kits:

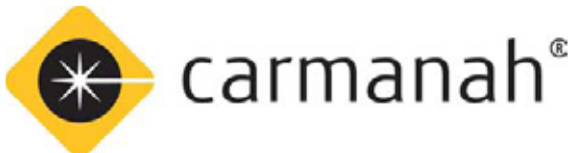
**GP-RV-50**  
**GP-RV-80**  
**GP-RV-95**  
**GP-RV-110**  
**Weekender SW**  
**Weekender HD**  
**Solar Elite**



## Expansion Kits:

**GP-RV-50E**  
**GP-RV-80E**  
**GP-RV-95E**  
**GP-RV-110E**

*Powered by:*



### Canadian Contact Information

Go Power!  
A Division of Carmanah  
Technologies Corporation  
4, 203 Harbour Rd  
Victoria, BC V9A 3S2  
Tel: 800-667-6527  
Fax: 250-380-0062  
Email: [info@gpelectric.com](mailto:info@gpelectric.com)

### US Contact Information

Go Power!  
US Warehouse  
1750 Grant Avenue  
Blaine, WA 98230  
Tel: 800-667-6527  
Email: [info@gpelectric.com](mailto:info@gpelectric.com)

# ***RV Kit Installation***

## **Table of Contents**

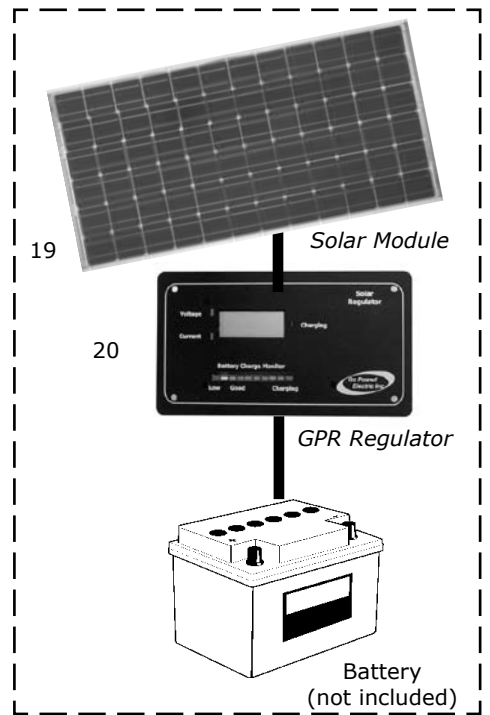
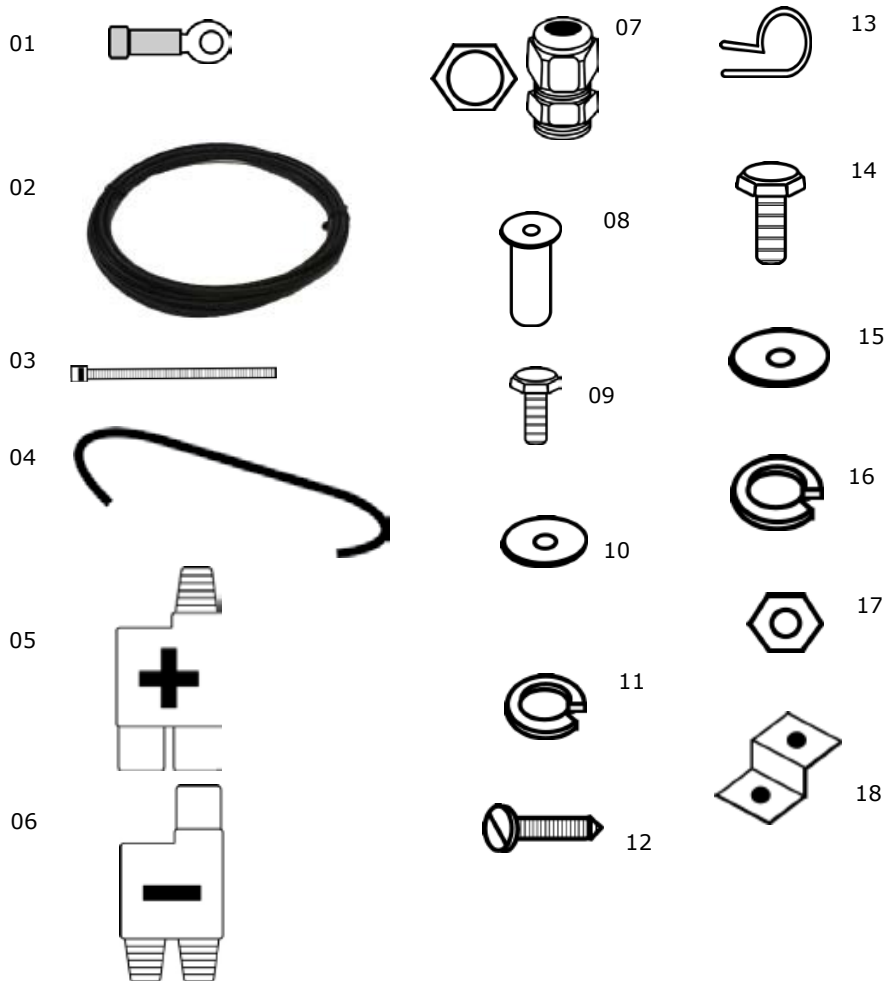
<b>RV Installation Parts and Checklist</b>	<b>3</b>
<b>1.0 Installation Overview</b>	<b>4</b>
<b>1.1 How Does the Go Power! RV Solar Kit Work</b>	<b>4</b>
<b>1.2 Warnings</b>	<b>4</b>
<b>1.3 Tools Required (Additional tools may be required)</b>	<b>5</b>
<b>2.0 Wiring the Solar Module and Power Cable</b>	<b>5</b>
<b>2.1 GP RV-50/80 – Single Module/Standard Junction Box</b>	<b>5</b>
<b>2.2 GP RV-50E/80E - Standard Junction Box - Using an Interconnect Cable</b>	<b>5</b>
<b>3.0 Wiring Modules with MC Cables</b>	<b>6</b>
<b>3.1 GP RV-95/110/Weekender HD/Weekender SW - Single Module System/MC Junction Box</b>	<b>6</b>
<b>3.2 Solar Elite - Multimodule System/MC Junction Box</b>	<b>6</b>
<b>3.3 GP RV-95E/110E - Expanding to a Multimodule System/MC Junction Box</b>	<b>6</b>
<b>3.4 Modules with MC Connectors Wired to a Non-Potted Junction Box</b>	<b>6</b>
<b>4.0 Routing Power Cable through the Fridge Vent</b>	<b>6</b>
<b>4.1 Method 1 – Hole in Side of Vent</b>	<b>7</b>
<b>4.2 Method 2 – Through Screen Grid</b>	<b>7</b>
<b>5.0 Mounting the Solar Module</b>	<b>7</b>
<b>5.1 Using the Mounting Feet</b>	<b>8</b>
<b>6.0 Installing The GPR Regulator</b>	<b>8</b>
<b>6.1 Mounting The GPR Regulator</b>	<b>8</b>
<b>7.0 Connecting to the Battery &amp; Solar Array</b>	<b>8</b>
<b>7.1 Typical Battery Connection</b>	<b>9</b>
<b>8.0 Limited Warranty</b>	<b>9</b>
<b>8.1 General Warranty Issues</b>	<b>9</b>
<b>8.2 Warranty Return Procedure</b>	<b>9</b>
<b>8.3 Additional Information</b>	<b>10</b>
<b>8.4 Out of Warranty Items</b>	
<b>9.0 System Glossary</b>	

# RV Kit Installation

PART	Standard Kits			Expansion Kits		
	GP-RV-50	GP-RV-80	GP-RV-95/110 *Weekender HD or SW	*Solar Elite	GP-RV-50E/80E	GP-RV-95E/110E
01. Ring Terminal Battery Connector	2	2	2	2	0	0
02. Power Cable (7 m)	1	1	1	1	0	0
03. Tie Wrap	6	6	6	6	0	0
04. Interconnect cable	0	0	0	0	1	0
05. Positive MC Parallel Connector	0	0	0	1	0	1
06. Negative MC Parallel Connector	0	0	0	1	0	1
07. Connector & lock nut	1	1	0	0	2	0
08. #10/32 Well Nut	4	4	6	12	4	6
09. #10/32 Well Nut Bolt	4	4	6	12	4	6
10. #10/32 Well Nut Flat Washer	4	4	6	12	4	6
11. #10/32 Well Nut Lock Washer	4	4	6	12	4	6
12. #6 Self-tapping screws	6	6	6	0	0	0
13. Cable clamp	6	6	6	0	0	0
14. 1/4" Bolt	4	4	6	12	4	6
15. 1/4" Flat Washer	4	4	6	12	4	6
16. 1/4" Lock Washer	4	4	6	12	4	6
17. 1/4" Nut	4	4	6	12	4	6
18. Mounting Feet	4	4	6	12	4	6
19. Solar module	1	1	1	2	1	1
20. GPR-25 Amp Regulator	1	1	1	1	0	0
21. ARM-UNI Mount (Optional)	0	0	0	0	0	0

\* The Solar Elite Kit also includes: GP-SW2000-12, GP-SWR-B-12, GP-DC Kit4, GPC-45, GPC-SMART-CONTROL, and GP-TS.  
 \* The Weekender HD Kit also includes: GP-1750HD, GP-Remote, GP-DC Kit #3, and TS-30.  
 \* The Weekender SW Kit also includes: GP-SW1500, GP-Remote, GP-DC Kit #3, and GP-TS.

## Parts Checklist



# RV Kit Installation

## 1.0 Installation Overview

Congratulations on your purchase of a Go Power! RV Solar Power Kit. You have chosen a clean, quiet and sustainable way to provide power to your recreational vehicle. A Go Power! RV Solar Power Kit gives you the ability to dry camp while ensuring your batteries remain fully charged. The Go Power! RV Solar Power Kit allows you to enjoy the luxuries that electricity provides, without a campsite hookup. For simple battery maintenance or full-time live-aboard power, Go Power! RV Solar Power Kits are available in a variety of sizes and can be installed on RVs, campers, trailers, 5<sup>th</sup> wheels and motor homes.

## 1.1 How Does the Go Power! RV Solar Power Kit Work

The solar module converts the sun's energy into DC electricity and this electricity charges the battery. The battery stores the electricity, similar to a water tank storing water. The battery power may be used at any time to operate devices connected to the battery. To stop the battery from being overcharged by the solar module, a solar regulator is connected between the two. The GPR-25 regulator will disconnect power from the solar module when the battery is fully charged. Once the battery voltage drops by approximately one volt, the GPR-25 regulator will resume charging.

Please read and understand all instructions before installing your new product for the easiest and safest installation. Before installing the kit, please review the installation diagram included in this Installation Manual. If you have any doubts as to this kit's compatibility with your RV, please contact your authorized Go Power! RV Dealer. It is advisable to retain this manual for future reference.

## 1.2 Warnings

### Electrical Safety

Disconnect all power sources before attempting installation. Electricity can be very dangerous. Installation should be performed only by a licensed electrician or qualified personnel.

### Solar Module Safety

Photovoltaic modules generate DC electricity when exposed to sunlight or other light sources. Contact with the electrically active parts of the module, such as terminals, can result in burns, sparks and lethal shock whether the module is connected or disconnected.

When modules are connected in parallel, amperages are additive. Consequently, a system assembled from photovoltaic modules can produce high amperages, which constitute an increased hazard.

Do not touch terminals while module is exposed to light. Cover the module face completely with opaque material to halt the production of electricity when installing or working with modules or wiring.

### Battery Safety

Observe all safety precautions of the battery manufacturer when handling or working around batteries. When charging, batteries may produce explosive hydrogen gas. Work in a well ventilated area and use caution when making or removing electrical connections. Ensure wires are disconnected from their power sources when wiring. Do not expose battery to open flame, cigarettes, or sparks. Shield skin and eyes from battery acid.

**Wiring Safety** Ensure all connections are tight and secure. Loose connections may generate sparks.

**Work safely** Wear protective eyewear and appropriate clothing during installation. Use extreme caution when working with electricity and when handling and working around batteries. Use properly insulated tools only.

**Observe correct polarity at all times.** Any contact in reverse polarity, however brief, will cause the regulator and/or inverter fuse to blow and may damage the unit.

**Do not exceed the voltage and current ratings of the regulator.** The total current of the solar system is the sum of the short circuit current of the solar modules in parallel multiplied by a safety factor of 1.25. The resulting system current is not to exceed the amperage rating of the regulator. The voltage of the array is the rated open circuit voltage of the solar modules and is not to exceed 26 volts for a 12 volt system. The GPR-25 is designed for use with 12 volt solar modules only. Damage will occur if connected to 24 volt solar modules.



# RV Kit Installation

## 1.3 Tools Required (Additional tools may be required)

- |  |                                |
|--|--------------------------------|
| a. Slot Screwdriver                      |                                |
| b. # 2 Robertson Square Head Screwdriver | g. Wire crimpers               |
| c. Keyhole saw                           | h. Electric hand drill         |
| d. Punch or Awl                          | i. 1/16 and 3/8 inch drill bit |
| e. Pliers                                | j. 5/16 and 7/16 inch wrench   |
| f. Wire Strippers                        | k. Sealant                     |

## 2.0 Wiring the Solar Module and Power Cable

Please follow the directions in the appropriate section, depending on which kit you are about to install.

Kit Model	Manual Section
GP-RV-50/80	Section 2.1
GP-RV-50/80E	Section 2.2
GP-RV-95/110/Weekender HD/Weekender SW	Section 3.1
Solar Elite	Section 3.2
GP-RV-95E/110E	Section 3.3

### Wiring Diagrams (located at the end of the manual)

Junction Boxes	Diagram-1
Wiring Single and Parallel Modules	Diagram-2
MC Power Cables for RV Kits	Diagram-3
Wiring Parallel Modules with MC Cables	Diagram-4
Parallel Wiring Between Standard and MC Junction Boxes	Diagram-5
RV System Electrical Layout - Off Grid	Diagram-6
RV System Electrical Layout - Manual Power Switching	Diagram-7
RV System Electrical Layout - Automatic Power Switching	Diagram-8

### Note:

This installation guide does not list all possible variations of available solar modules. This installation guide will address the assembly of standard Go Power! RV Solar Power Kits, which contain one or two solar modules connected in parallel for a 12 volt system. Expander Kits are available to add solar modules to an existing system.

## 2.1 GP-RV-50/80 – Single Module/Standard Junction Box

1. Strip 6" of outer sheathing from the power cable exposing the positive (red) and negative (black) wires. Do not "nick" wires.
2. On each of the positive and negative conductors (wires), strip back 1" of insulation to expose the bare copper wire.
3. Remove the module's Junction Box cover. Remove the appropriate knockout on the Junction Box for the power cable. To remove the knockout on the Junction Box, hold a screwdriver tip against the knockout and strike sharply.
4. Refer to Diagram-1, "Junction Boxes" and Diagram-2, "Wiring Single and Parallel Modules". Install the 1/2" connector for the power cable onto the Junction Box. Secure the red wire under the positive terminal, and the black wire under the negative terminal. Ensure that all wiring connections are tight. Replace the Junction Box cover.
5. Continue to Section 4, "Routing the Power Cable through the Fridge Vent."

## 2.2 GP-RV-50E/80E - Standard Junction Box - Using an Interconnect Cable

1. Strip 6" of outer sheathing from the power cable, exposing positive (red) and negative (black) wires. Do not "nick" wires. Remove the modules' Junction Box covers. Place the modules side-by-side, glass down.
2. On each of the positive and negative conductors (wires), strip back 1" of insulation to expose the bare copper wire.
3. Remove the appropriate knockout on the Junction Box for the power cable. To remove the knockout on the Junction Box, hold a screwdriver tip against the knockout and strike sharply.
4. Refer to Diagram-1, "Junction Boxes" and Diagram-2, "Wiring Single and Parallel Modules".

# RV Kit Installation

5. Install the interconnect cable between the modules as shown in Diagram-2, "Wiring Single and Parallel Modules". Make sure the red wires are secured under the positive terminals, and the black wires are secured under the negative terminals. Ensure that all wiring connections are tight. Replace the Junction Box covers.
6. Continue to Section 4, "Routing the Power Cable through the Fridge Vent."

## 3.0 Wiring Modules with MC Cables

RV Kits with MC cables contain a potted or sealed junction box with a positive and negative MC connector. This is referred to as an MC junction box. MC connectors are either positive or negative and each connector has its polarity symbol embossed close to the connection point. To extend a cable from an MC junction box, a polarity opposite connector must be used. E.G. a negative connector must plug into a positive connector in order to extend it. Please remember, the polarity of an MC cable wire run is the polarity symbol on the connector closest to the MC junction box. It is advisable to attach a polarity sticker to the positive extension cable in order to avoid confusion.

### 3.1 GP-RV-95/110/Weekender HD/Weekender SW Single Module System/MC Junction Box

RV Kits containing a single module with MC cables will be equipped with a single MC power cable that will be cut in half. Refer to Diagram-3, "MC Power Cables for RV Kits."

### 3.2 Solar Elite Multimodule System/MC Junction Box

RV Kits containing two modules with MC cables via an expander kit will be equipped with an MC power cable, a negative MC parallel connector, and a positive MC parallel connector. Refer to Diagram-4, "Wiring Parallel Modules with MC Cables."

### 3.3 GP-RV-95E/110E Expanding to a Multimodule System/MC Junction Box

RV Kits containing two modules with MC cables via an expander kit will be equipped with an MC power cable, a negative MC parallel connector, and a positive MC parallel connector. Refer to Diagram-4, "Wiring Parallel Modules with MC Cables."

### 3.4 Modules with MC Connectors Wired to a Non-Potted Junction Box

Please be aware that some modules are equipped with MC cables and a fully functioning non-potted Junction Box. In this case, it is recommended that the MC cables be used as described in Section 3. Do not connect the positive and negative MC cables from the same junction box together; this will short circuit the module.

## 4.0 Routing Power Cable through the Fridge Vent

Locate the refrigerator vent on the roof of the RV. Remove vent cover to gain access to the duct opening. Refer to **Figure 1**. Retain vent-fastening hardware.

### 4.1 Method 1 – Hole in Side of Vent

Drill a hole through the side of the vent (5/8" hole). Insert a rubber grommet (not included) into the hole. Insert the power cable (already wired to the solar module) through the hole and carefully route it to the battery. Be certain to leave enough slack to allow cable routing from module to vent along desired path.

### 4.2 Method 2 – Through Screen Grid

1. Thread power cable (already wired to solar module) carefully through the screen and into opening. Enlarge screen grid hole if necessary.
2. Avoid strapping the power cable to existing wire between the module and the battery. Allowing a few inches of space between the power cable and existing wire will lessen the chance of voltage loss through thermal conduction. Use cable clamps with the # 6 self-tapping screw and/or tie wraps every few feet along RV roof and interior route to battery.
3. Ensure all penetrations into the RV roof are watertight. Use an appropriate sealant as recommended by your RV Dealer to seal holes wherever necessary.

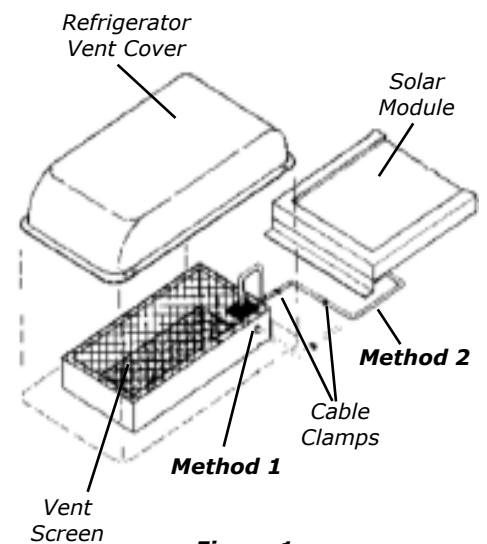


Figure 1

### Caution:

The screen may have sharp edges or burrs.

# RV Kit Installation

4. Replace vent cover.

## 5.0 Mounting the Solar Module

Cover the entire module with paper to prevent the danger of shock during installation. Do not remove the paper until the installation is complete. The solar modules may be horizontally mounted to the roof using the included mounting feet. An optional adjustable roof mount (ARM-UNI) is also available from Go Power!.

### 5.1 Using the Mounting Feet

1. Assemble the mounting feet onto the ends of the solar module using the 1/4" bolts, washers and nuts as shown in **Figure 2**.

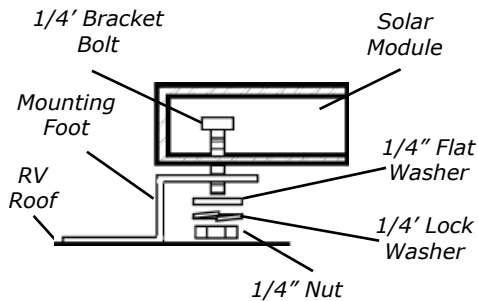


Figure 2

2. Tighten nuts securely using a 7/16" wrench.

3. Place the module in a location that follows the criteria listed here:
  - Select a location where the mounting surface is at least 1/2" thick and strong enough to support mounting hardware, the solar module and wind loads.
  - Minimize distance between the location of the solar module and the location where the power cable will enter the vehicle to connect to the battery.
  - Place the module lengthwise along the roof to reduce wind loading on vehicles (if applicable).
  - Avoid internal wiring when selecting the spots for drilling the four mounting holes.
  - Ensure obstacles, such as air conditioners, will not shade the solar module.

\* Place module so that you have room to expand the current system if needed.

4. Mark the mounting hole locations by using a pencil to trace through the holes in the mounting feet. Drill mounting holes only one inch deep with a 3/8" drill bit.

5. Use the appropriate sealant as recommended by your RV Dealer to ensure a watertight installation.

6. Gently insert the well-nuts into the drill holes so that only the topmost flange part remains above the roofline. Be careful not to push well-nuts through the holes.

7. Insert screws with lock washers and tighten. Do not overtighten.

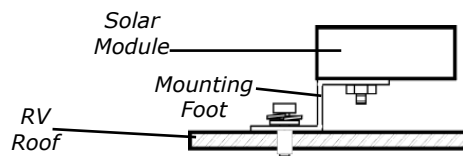


Figure 3

## 6.0 Installing The GPR Regulator

The GPR Regulator is included in all Go Power! RV Kits mentioned in this manual except for the Expander Kits.

The GPR Regulator provides the necessary protection for the RV battery system. A condensed version of the installation instructions appear below, however please read the full installation manual included with the GPR Regulator.

1. Disconnect or cover the solar modules and disconnect the batteries before commencing the GPR regulator wiring.

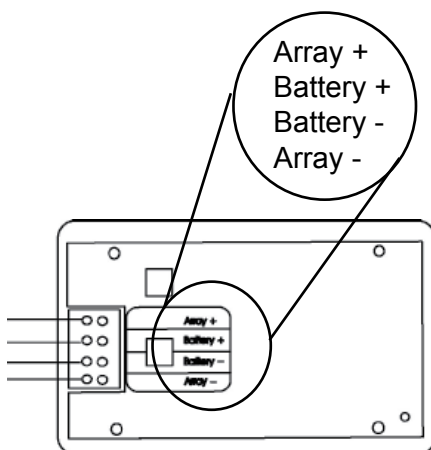
2. Run the solar module power cable to the location of The GPR Regulator. **Do not connect the wires to the regulator or the batteries. Identify the polarity of the wires located on the battery and solar module (positive and negative).** Use coloured wires or mark wire ends with tags. Contacting the leads of the regulator in reverse polarity, however brief, will blow the panel fuse and may damage the regulator.

3. Wire the regulator according to the terminal identification on the back of regulator, illustrated in **Figure 4**. Tighten all connections.

4. Read The *GPR Regulator Manual* prior to installing.

### 6.1 Mounting The GPR Regulator

The GPR Regulator should be mounted in a location relatively close to the battery, but easily seen for monitoring system operation. Wires must be run from the solar module to the regulator and then to the battery. The GPR Regulator is designed to be flush mounted on the side of a cabinet or wall where the wiring can be accessed from the back. Allow two to three inches behind the unit. **The regulator should be mounted indoors, in a dry location.**



GPR Regulator  
Terminal Identification

Figure 4

# RV Kit Installation

1. Select a suitable location for the installation of the regulator. Run the power cable from the solar module to the location selected.
2. Use the template included in the *GPR Regulator Manual* to mark the four mounting holes and the "cutting line for flush mounting". Drill the mounting holes. Use a keyhole or jig saw to cut along the rectangular outline you marked.
3. Wire the regulator as shown in the *GPR Regulator Manual*. Use the leftover power cable to connect the regulator to the batteries.
4. Mount the regulator to the wall using the four wood screws provided. Slip the washers (supplied) over the screws so the washers are between the back of the regulator and the wall. This provides an air gap for added cooling. Ensure the back of the regulator is protected from damage by any object.

## 7.0 Connecting to the Battery & Solar Array

It is recommended to connect directly to the battery wherever possible.

1. Clean all corrosion from battery terminals before proceeding. Crimp ring terminals onto the negative and positive wires of the power cable to be attached to the battery.
2. Attach the negative (black) wire's 3/8" ring terminal to the RV battery. Check all electrical connections and apply a protective coating to battery terminals.

### 7.1 Typical Battery Connection

1. Single 12 Volt battery connection (See Figure 5)
2. Parallel 12 Volt battery connection. (See Figure 6)
3. 6 Volt series battery connection. (See Figure 7)

## 8.0 Limited Warranty

1. Go Power! warrants the Go Power! RV Solar Power Kit for a period of one (1) year from the date of shipment from its factory. This warranty is valid against defects in materials and workmanship for the one (1) year warranty period. It is not valid against defects resulting from, but not limited to:
  - Misuse and/or abuse, neglect, or accident.
  - Exceeding the unit's design limits
  - Improper installation, including, but not limited to, improper environmental protection and improper hook-up
  - Acts of God, including lightning, floods, earthquakes, fire, and high winds
  - Damage in handling, including damage encountered during shipment
2. This warranty shall be considered void if the warranted product is in any way opened or altered. The warranty will be void if any eyelet, rivets, or other fasteners used to seal the unit are removed or altered, or if the unit's serial number is in any way removed, altered, replaced, defaced or rendered illegible.
3. The one (1) year term of this warranty does not apply to equipment where another limited warranty is available. This may include but is not limited to, the solar regulator five (5) years, the solar modules five (5) to twenty-five (25) years and the inverter: modified sine wave inverter one (1) year, pure sine wave inverter two (2) years.

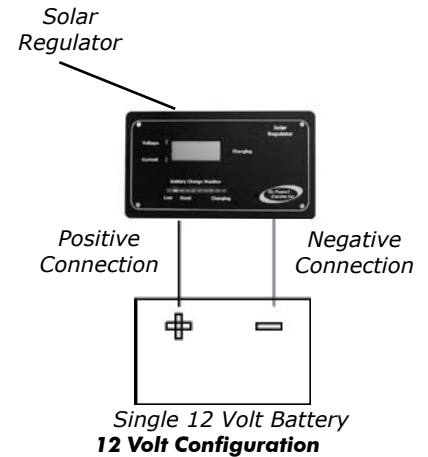


Figure 5

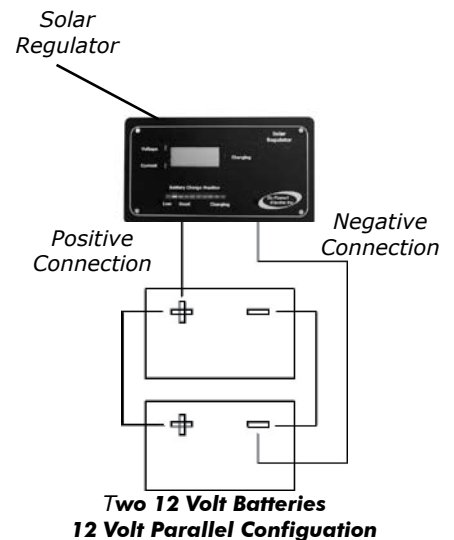


Figure 6

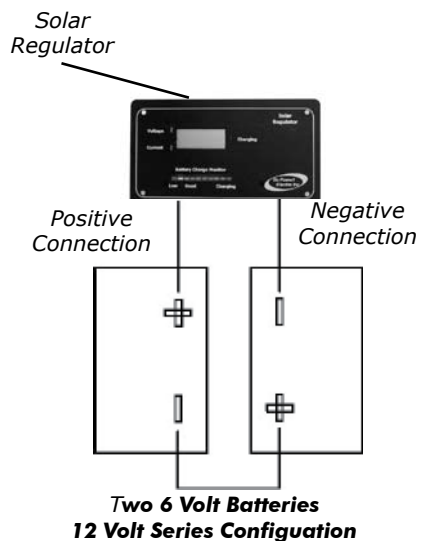


Figure 7

# ***RV Kit Installation***

## **8.1 General Warranty Issues**

1. Go Power! cannot assume responsibility for any damages to any system components used in conjunction with Go Power! products, nor for claims of personal injury or property damage resulting from the use of Go Power! products or the improper operation thereof or consequential damages arising from the products or use of the products.
2. Go Power! cannot guarantee compatibility of its products with other components used in conjunction with Go Power! products, including, but not limited to, solar modules, batteries, and system interconnects, and such loads as inverters, transmitters, and other loads which produce "noise" or electromagnetic interference, in excess of the levels to which Go Power! products are compatible.
3. The purchaser's exclusive remedy for any and all losses or damages resulting from the date of sale of this product including, but not limited to, any allegations of breach of warranty, breach of contract, negligence or strict liability, shall be limited, at the option of Go Power!, to either the return of the purchase price or the replacement of the particular product for which claim is made and proved. In no event shall Go Power! be liable to purchaser or purchaser's customers or to anyone else for any punitive, special, consequential, incidental or indirect losses or damages resulting from the sale of the product, whether based upon loss of goodwill, lost profits, work stoppages, impairments of other goods, breach of contract, or otherwise.
4. This warranty supersedes all other warranties and may only be modified by statement in writing, signed by Go Power!.
5. Warranty terms effective as of July 4, 2005.

## **8.2 Warranty Return Procedure**

This warranty procedure is based on the typical flow of sale being:  
Go Power! --- Supplier --- Dealer --- End User

### **8.2.1 End Users**

Contact your sales representative or Dealer and discuss the problem. Often the sales representative can troubleshoot common scenarios. If applicable, warranty will be handled between the End User and the Dealer. Go Power! will only accept returned items from an End User as a last resort. If you are unable to contact the Dealer, or the Dealer refuses to provide service, please contact Go Power! directly.

### **8.2.2 Dealers**

Dealers will handle warranty either through their supplier or Go Power!, depending on where the product was purchased from.

### **8.2.3 Units bought directly from Go Power!**

The customer will return the product, freight prepaid, to Go Power!. You must obtain a Return Material Authorization (RMA) number from Go Power! before returning a product. The RMA number MUST be clearly indicated on the outside of the box. Items received without an RMA number will be refused.

## **8.3 Additional Information**

Unless approved by Go Power! management, all product shipped collect to Go Power! will be refused. Test items or items that are not under warranty, or units that are not defective, will be charged a minimum bench charge of (\$50.00 US) plus taxes and shipping. A 15% restocking charge will be applied on goods returned and accepted as "new" stock.

## **8.4 Out of Warranty Items**

Go Power! electronic products are non-repairable, Go Power! does not perform repairs on its products nor does it contract out those repairs to a third party. Go Power! does not supply schematics or replacement parts for any of its electronic products.

# RV Kit Installation

## 9.0 System Glossary

**Ampere** A unit of electrical current. Designates the number of electrons flowing per second through a conductive material.

**Ampere-Hour (Ahr or amp hour):** A unit of energy, typically referring to battery capacity. One ampere of current flowing for one hour.

**Azimuth of the Sun:** The angular measure between due south and the point on the horizon directly below the sun.

**Array:** A number of photovoltaic modules electrically connected to produce a single electrical output.

**Angle of Incidence:** The angle between a ray of sunlight striking a surface and a line perpendicular to that surface. Rays perpendicular to a surface have a zero angle of incidence.

**Battery:** Two or more electrochemical cells connected to provide energy storage. May be used to designate one cell. PV system batteries may be "sealed" or "flooded".

**Blocking Diode:** A diode application that prevents a battery from discharging through the array at night or if the array becomes shaded. Most charge controllers are equipped with a blocking diode.

**Charge Controller (regulator):** The PV system component that controls the battery's state of charge. It may also provide other system control functions. Also known as a regulator.

**Charge Rate:** The current applied to a battery to restore its energy capacity. The battery manufacturer will usually have a recommended charge rate for their product. The rate is typically 10 –20 percent of the amp hour capacity at the 20-hour rate.

**Current:** DC or Direct Current is the type of electron flow provided by a battery or solar cell, which flows in one direction. The unit for current is ampere or amp for short and designated by the letter A.

**Cycle:** One battery cycle equals one discharge and one charge.

**Deep Cycle Battery:** Batteries that are designed to discharge as much as 80% of their capacity as opposed to engine-starting or *shallow cycle* batteries which are designed for heavy cranking but will not stand up to repeated deep discharges.

**Depth of Discharge:** A measure of how much energy has been withdrawn from a battery, expressed as a percentage of full capacity. A 100 Ahr battery from which 30 Ahr has been withdrawn has undergone a 30% depth of discharge (DOD). This term is the inverse of state of charge (SOC); the example battery would be at 70% SOC.

**Diode:** A semi-conductor device that allows current to flow in one direction only. "Blocking diodes" and "isolation diodes" are standard diodes that have specific applications.

**Electrolyte:** Battery acid.

**Equalization:** The process that equalizes the specific gravity of all the cells in a battery by means of a controlled overcharge that breaks down sulfation on the battery plates. Most inverter/chargers and some charge controllers are equipped with this feature. Usually performed only on flooded batteries.

**Flooded or Wet Cell Batteries:** The most common type of PV battery. Battery caps may be removed to expose the electrolyte inside the battery. Need proper ventilation due to gassing and may need to be topped up with distilled water at regular intervals.

**Grid-Connected:** A power system interconnected with the grid (or *mains*) of the local electric utility. Also referred to as *utility-interactive* or *grid-tie*.

**Hybrid System:** A power system consisting of two or more energy sources (e.g., a PV array and a wind generator).

# RV Kit Installation

**Hydrometer:** A device used to measure the specific gravity (SG) of the electrolyte in a flooded battery. A very accurate way to see the true charge of a battery.

**Insolation:** The solar energy received at a place over a given period. May be expressed as sunhours per day, watts per square meter per hour, or any number of other units.

**Inverter:** A device that converts DC electricity to AC.

**Isolation Diode:** A diode application that prevents one segment of an array from interacting with another array segment. Usually used in situations where two parts of an array are facing in different directions therefore one part of an array may experience shading while the other does not. Prevents array energy from flowing backwards through a low voltage string of the array. May also serve the function of blocking diode.

**Maximum Power (peak power):** The point of a solar array, panel or module output where the product of  $I_{mp}$  and  $V_{mp}$  ( $P_{max}$ , measured in watts) is maximized. The points used to calculate  $P_{max}$  are  $I_{mp}$  (current @ max power) and  $V_{mp}$  (voltage @ max power).

**Module:** A number of solar cells electrically connected, and protected from the environment usually by an aluminum frame covered with a pane of glass. A module is self-contained and not sub dividable, therefore providing a single electrical output.

**NOCT (Nominal Operating Cell Temperature):** the temperature at which PV cells in a module operate under *Standard Operating Conditions* (SOC), which are: irradiance of 0.8 kW/m<sup>2</sup>, 20°C ambient temperature, and average wind speed of 1 m/s, with the wind oriented parallel to the plane of the array, and all sides of the array fully exposed to the wind.

**Open-Circuit Voltage (Voc):** Refers to a photovoltaic device's voltage potential when it is disconnected from the rest of the PV system.

**Panel:** A group of photovoltaic modules (or single module) mechanically mounted on a single frame.

**Parallel Connection:** Electrical connection where the positive terminals of a number of devices are connected together, as are their negative terminals. The output voltage is usually limited to the device with the lowest voltage, and the total current is the sum of the current of all the devices.

**Photovoltaic (PV):** Capable of producing a voltage when exposed to radiant energy, especially light.

**Regulator:** See "Charge Controller" definition.

**Sealed Batteries:** Electrolyte will not spill out and gassing is kept to a minimum. A sealed battery is maintenance free and may be installed in several orientations.

**Series Connection** Electrical connection where the positive terminal of one device is attached to the negative terminal of the next in a series string; in this connection, the string voltage is the sum of the device voltages and the string current is limited to the current of the least productive device in the string.

**Short-Circuit Current (Isc):** Refers to a PV device's current output when the positive terminal is directly connected to the negative terminal.

**Specific Gravity:** In relation to a flooded battery, it is the density of the "electrolyte" compared with the density of water thereby measuring the battery state of charge.

**Standard Operating Conditions (SOC):** A set of reference PV device measurement conditions consisting of irradiance of 0.8 kW/m<sup>2</sup>, 20°C ambient temperature, and average wind speed of 1m/s, with the wind oriented parallel to the plane of the array, and all sides of the array fully exposed to the wind.

**Standard Test Conditions (STC):** A set of reference PV device measurement conditions consisting of irradiance of 1 kW/m<sup>2</sup>, AM 1.5, and 25°C cell temperature.

# ***RV Kit Installation***

**Standalone System:** A power system not connected to the utility grid (*mains.*) Sometimes referred to as an autonomous system.

**State of Charge:** The percentage of energy in a battery referenced to its nominal full capacity.

**Sulfation:** The formation of lead sulfate crystals on the plates of a lead-acid battery. Normally used to refer to large sulfate crystals, rather than small crystals formed in normal battery operation. The sulfate on the plates of a battery will harden if left in a partially charged state, causing reduced battery capacity and shortening the life of the battery. If caught in time, "equalization" will remove the buildup of sulfation.

**Voltage:** The electrical potential between two points. Voltage is analogous to water pressure in that it pushes the electrons or current through a conductor. The unit for voltage is volt and designated by the letter V.

# ***RV Kit Installation***

## ***Diagrams***

Junction Boxes

Wiring Single and Parallel Modules

MC Power Cables for RV Kits

Wiring Parallel Modules with MC Cables

Parallel Wiring Between Standard and MC Junction Boxes

RV System Electrical Layout - Off Grid

RV System Electrical Layout - Manual Power Switching

RV System Electrical Layout - Automatic Power Switching

Diagram-1

Diagram-2

Diagram-3

Diagram-4

Diagram-5

Diagram-6

Diagram-7

Diagram-8

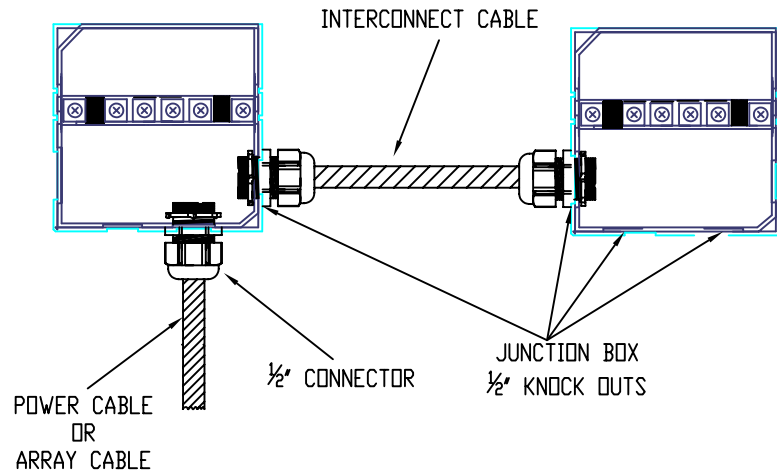
**CONFIDENTIAL**

THIS DRAWING AND ANY DATA, DESCRIPTION, AND OTHER INFORMATION CONTAINED HEREIN ARE CONSIDERED AS PROPRIETARY AND THE EXCLUSIVE PROPERTY OF CARMANAH TECHNOLOGIES CORP. AND SHALL NOT BE PUBLISHED, REPRODUCED, COPIED, DISCLOSED, OR USED, IN WHOLE OR IN PART, FOR ANY PURPOSE WITHOUT THE EXPRESS WRITTEN PERMISSION OF A DULY AUTHORIZED REPRESENTATIVE OF CARMANAH TECHNOLOGIES CORP.

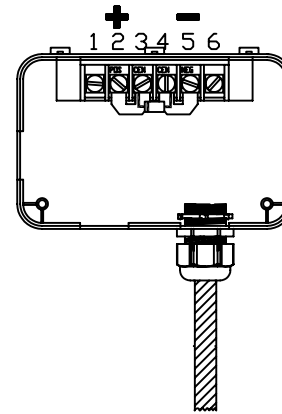
REVISION NOTES:

REV #	BY	DATE	REVISION DESCRIPTION

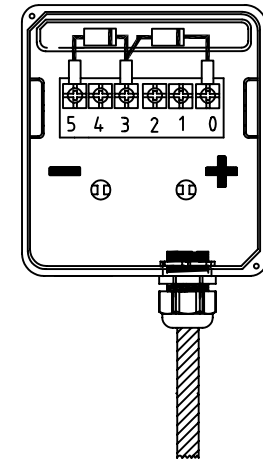
# VARIOUS RV SOLAR MODULE JUNCTION BOXES



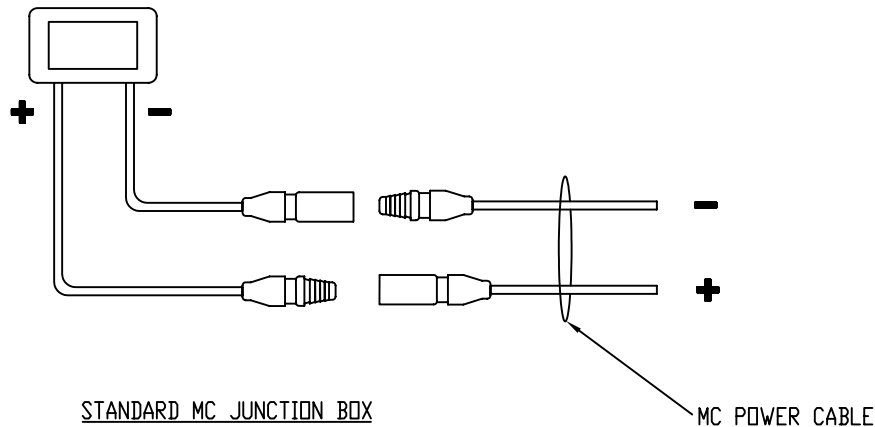
EXAMPLES OF VARIOUS CONNECTIONS TO THE SOLAR MODULE JUNCTION BOX



STANDARD CTI-50 JUNCTION BOX  
 TERMINAL 2 IS POSITIVE  
 TERMINAL 5 IS NEGATIVE



STANDARD CTI-80 JUNCTION BOX  
 TERMINAL 0,1 ARE POSITIVE  
 TERMINAL 4,5 ARE NEGATIVE  
 TERMINAL 2,3 ARE NOT USED



STANDARD MC JUNCTION BOX  
 ONE POSITIVE AND ONE NEGATIVE CONDUCTOR  
 LOCATION OF CONDUCTORS MAY VARY  
 VOLTAGE IS NOT ADJUSTABLE AND SPECIFIC  
 TO EACH MODULE.

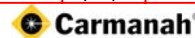


GO POWER!™

A wholly owned subsidiary of Carmanah Technologies Corp.

COPYRIGHT 2006 CARMANAH TECHNOLOGIES CORP. ALL RIGHTS RESERVED

DRAWN BY	APPROVED BY	DATE	SCALE	UNITS
KK	JT	12/03/04	NTS	



GO POWER!  
 SOLAR MODULE WIRING  
 JUNCTION BOXES FOR RV KITS

DWG #:

1

REV 2.4

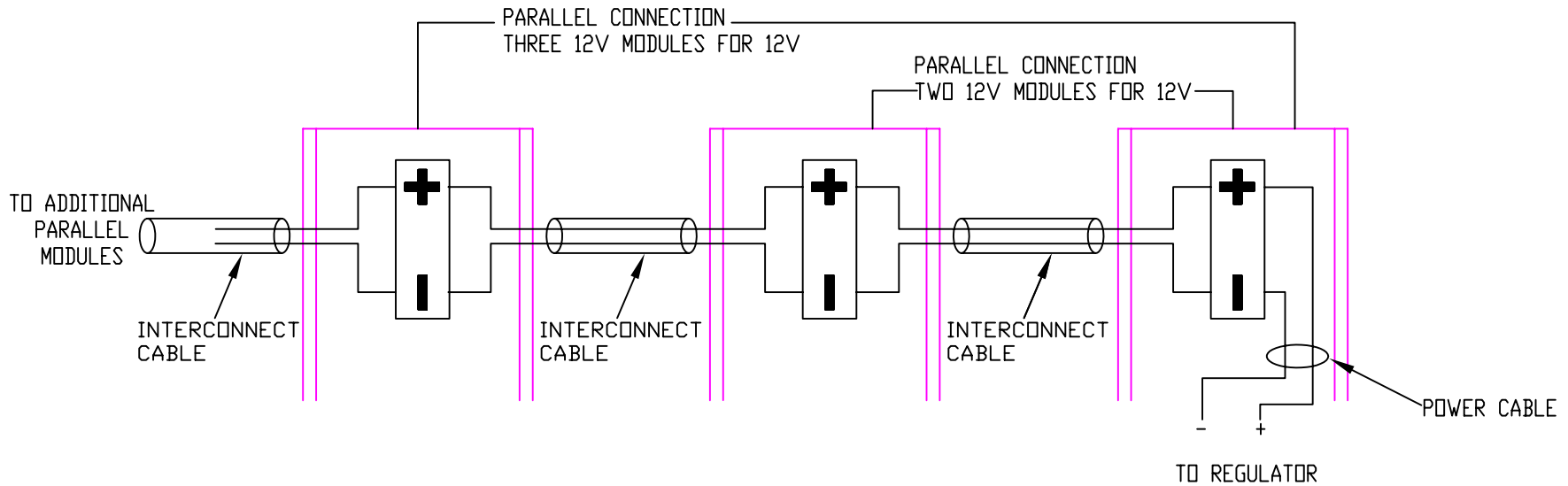
**CONFIDENTIAL**

THIS DRAWING AND ANY DATA, DESCRIPTION, AND OTHER INFORMATION CONTAINED HEREIN ARE CONSIDERED AS PROPRIETARY AND THE EXCLUSIVE PROPERTY OF CARMANAH TECHNOLOGIES CORP. AND SHALL NOT BE PUBLISHED, REPRODUCED, COPIED, DISCLOSED, OR USED, IN WHOLE OR IN PART, FOR ANY PURPOSE WITHOUT THE EXPRESS WRITTEN PERMISSION OF A DULY AUTHORIZED REPRESENTATIVE OF CARMANAH TECHNOLOGIES CORP.

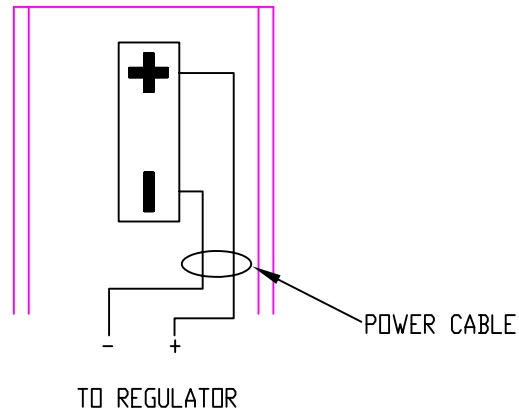
REVISION NOTES:

REV #	BY	DATE	REVISION DESCRIPTION

# WIRING SINGLE AND PARALLEL MODULES



## SINGLE CONNECTION ONE 12V MODULE FOR 12V



NOTES

1. IF RED AND BLACK WIRES ARE USED, RED IS POSITIVE AND BLACK IS NEGATIVE.
2. IF A WHITE WIRE IS USED, WHITE IS NEGATIVE.
3. TERMINAL + AND - LOCATIONS VARY FROM MODULE TO MODULE  
ENSURE TERMINAL IS CLEARLY LABELED + OR -

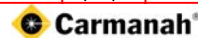


GO POWER!™

A wholly owned subsidiary of Carmanah Technologies Corp.

COPYRIGHT 2005 CARMANAH TECHNOLOGIES CORP. ALL RIGHTS RESERVED

DRAWN BY	APPROVED BY	DATE	SCALE	UNITS
KK	JT	12/03/04	NTS	



GO POWER!  
SOLAR MODULE WIRING  
WIRING SINGLE AND PARALLEL MODULES

DWG #:

2

REV 3.3

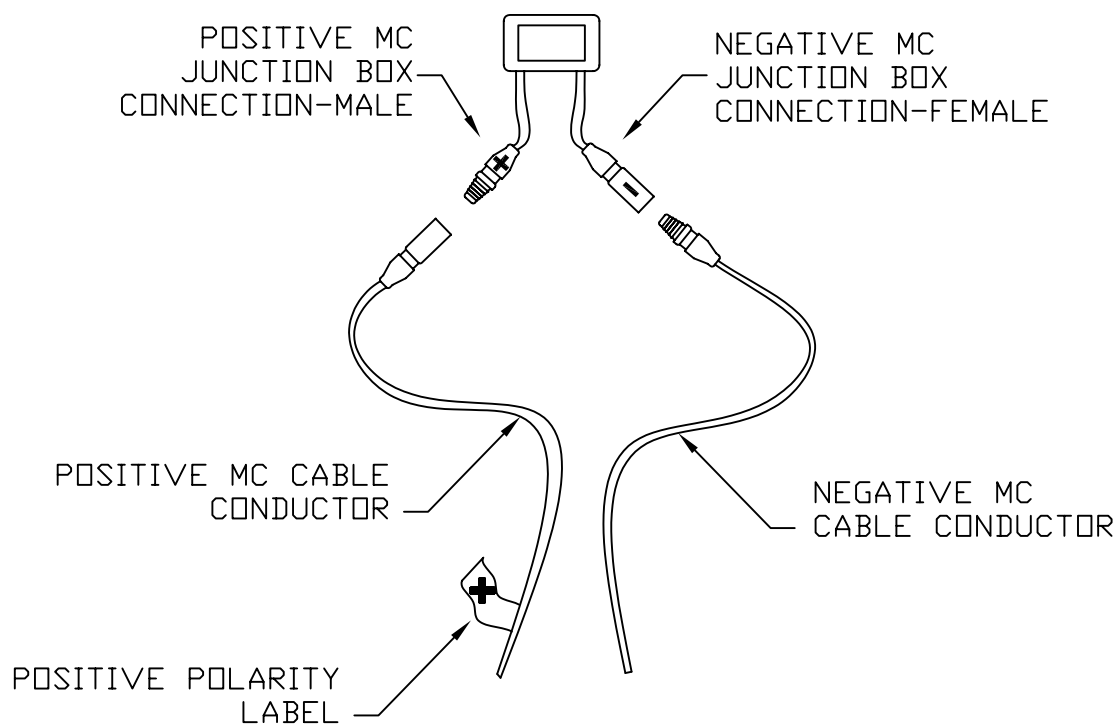
**CONFIDENTIAL**

THIS DRAWING AND ANY DATA, DESCRIPTION, AND OTHER INFORMATION CONTAINED HEREIN ARE CONSIDERED AS PROPRIETARY AND THE EXCLUSIVE PROPERTY OF CARMANAH TECHNOLOGIES CORP. AND SHALL NOT BE PUBLISHED, REPRODUCED, COPIED, DISCLOSED, OR USED, IN WHOLE OR IN PART, FOR ANY PURPOSE WITHOUT THE EXPRESS WRITTEN PERMISSION OF A DULY AUTHORIZED REPRESENTATIVE OF CARMANAH TECHNOLOGIES CORP.

## REVISION NOTES:

REV #	BY	DATE	REVISION DESCRIPTION

## MC POWER CABLES FOR RV KITS



THE MC POWER CABLE IS USUALLY THE FINAL CONNECTION BETWEEN THE SOLAR ARRAY AND THE REGULATOR. **CUT THE MC POWER CABLE INTO TWO PIECES SO THAT THERE IS A POSITIVE CONDUCTOR CABLE AND NEGATIVE CONDUCTOR CABLE.**

1. COVER THE SOLAR MODULE(S) WITH AN OPAQUE MATERIAL. ATTACH THE APPROPRIATE MC POWER CABLE CONDUCTOR TO THE POSITIVE AND NEGATIVE CONNECTORS OF THE MC JUNCTION BOX. IF YOU HAVE MORE THAN ONE MODULE, REFER TO THE SPECIFIC DIAGRAM FOR WIRING A PARALLEL MC CONNECTION.
2. RUN THE POSITIVE AND NEGATIVE MC CABLE CONDUCTORS FROM THE SOLAR ARRAY TO THE REGULATOR. ATTACH A POSITIVE POLARITY LABEL (NOT INCLUDED) TO THE END OF THE POSITIVE CONDUCTOR. IF THE POSITIVE CONDUCTOR NEEDS TO BE SHORTENED AND THE POLARITY LABEL IS REMOVED, REMEMBER TO RE-LABEL IT AS BOTH POSITIVE AND NEGATIVE CONDUCTORS LOOK EXACTLY THE SAME. LEAVE A FEW EXTRA FEET OF CABLE AT THE REGULATOR IN CASE OF FUTURE ADJUSTMENT.

NOTE: SOLAR MODULE JUNCTION BOX AND MC CABLES MAY NOT BE EXACTLY AS SHOWN

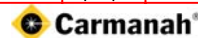


GO POWER!™

A wholly owned subsidiary of Carmanah Technologies Corp.

COPYRIGHT 2005 CARMANAH TECHNOLOGIES CORP. ALL RIGHTS RESERVED

DRAWN BY	APPROVED BY	DATE	SCALE	UNITS
KK	MS	12/30/05	NTS	



GO POWER!  
MC CABLE WIRING DIAGRAM  
MC POWER CABLES FOR RV KITS

DWG #:

3

REV 1.3

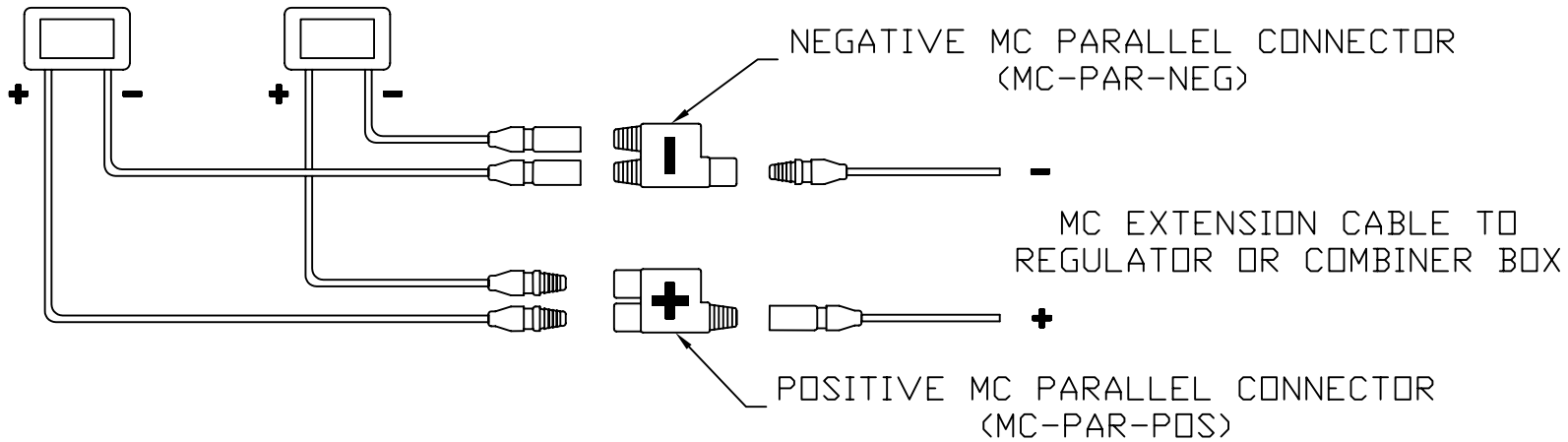
**CONFIDENTIAL**

THIS DRAWING AND ANY DATA, DESCRIPTION, AND OTHER INFORMATION CONTAINED HEREIN ARE CONSIDERED AS PROPRIETARY AND THE EXCLUSIVE PROPERTY OF CARMANAH TECHNOLOGIES CORP. AND SHALL NOT BE PUBLISHED, REPRODUCED, COPIED, DISCLOSED, OR USED, IN WHOLE OR IN PART, FOR ANY PURPOSE WITHOUT THE EXPRESS WRITTEN PERMISSION OF A DULY AUTHORIZED REPRESENTATIVE OF CARMANAH TECHNOLOGIES CORP.

REVISION NOTES:

REV #	BY	DATE	REVISION DESCRIPTION

# WIRING PARALLEL (2) MODULES WITH MC PARALLEL CONNECTORS



MC CABLE CONNECTIONS FOR 2 PARALLEL MODULES  
E.G. TWO 12V MODULES AT 12V

NOTE: SOLAR MODULE JUNCTION BOX AND MC CABLES MAY NOT BE EXACTLY AS SHOWN



GO POWER!<sup>TM</sup>

A wholly owned subsidiary of Carmanah Technologies Corp.

COPYRIGHT 2005 CARMANAH TECHNOLOGIES CORP. ALL RIGHTS RESERVED

DRAWN BY	APPROVED BY	DATE	SCALE	UNITS
KK	JT	11/04/05	NTS	



GO POWER!  
MC CABLE WIRING DIAGRAM  
WIRING PARALLEL (2) MODULES WITH MC CABLES

DWG #:

4

REV 1.4

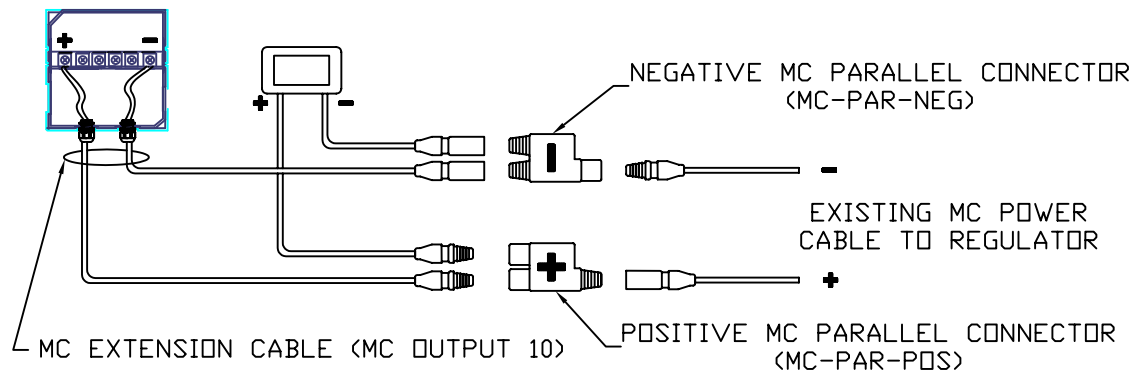
**CONFIDENTIAL**

THIS DRAWING AND ANY DATA, DESCRIPTION, AND OTHER INFORMATION CONTAINED HEREIN ARE CONSIDERED AS PROPRIETARY AND THE EXCLUSIVE PROPERTY OF CARMANAH TECHNOLOGIES CORP. AND SHALL NOT BE PUBLISHED, REPRODUCED, COPIED, DISCLOSED, OR USED, IN WHOLE OR IN PART, FOR ANY PURPOSE WITHOUT THE EXPRESS WRITTEN PERMISSION OF A DULY AUTHORIZED REPRESENTATIVE OF CARMANAH TECHNOLOGIES CORP.

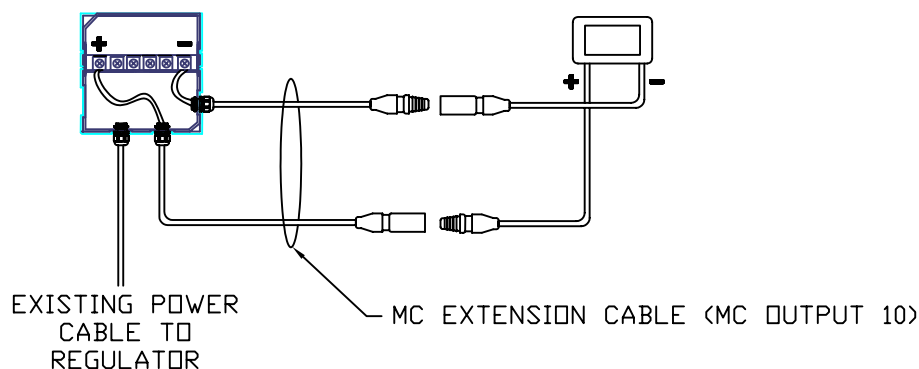
REVISION NOTES:

REV #	BY	DATE	REVISION DESCRIPTION

PARALLEL WIRING BETWEEN A STANDARD JUNCTION BOX AND AN MC CABLE JUNCTION BOX



PARALLEL WIRING BETWEEN A STANDARD JUNCTION BOX AND AN EXISTING MC JUNCTION BOX



NOTE: SOLAR MODULE JUNCTION BOX AND MC CABLES MAY NOT BE EXACTLY AS SHOWN

PARALLEL WIRING BETWEEN AN MC JUNCTION BOX AND AN EXISTING STANDARD JUNCTION BOX

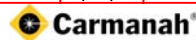


GO POWER!™

A wholly owned subsidiary of Carmanah Technologies Corp.

COPYRIGHT 2005 CARMANAH TECHNOLOGIES CORP. ALL RIGHTS RESERVED

DRAWN BY	APPROVED BY	DATE	SCALE	UNITS
KK	JT	11/04/05	NTS	



GO POWER!  
MC CABLE WIRING DIAGRAM  
PARALLEL WIRING BETWEEN STANDARD MC J-BOX

DWG #:

5

REV 1.2

**CONFIDENTIAL**

THIS DRAWING AND ANY DATA, DESCRIPTION, AND OTHER INFORMATION CONTAINED HEREIN ARE CONSIDERED AS PROPRIETARY AND THE EXCLUSIVE PROPERTY OF CARMANAH TECHNOLOGIES CORP. AND SHALL NOT BE PUBLISHED, REPRODUCED, COPIED, DISCLOSED, OR USED, IN WHOLE OR IN PART, FOR ANY PURPOSE WITHOUT THE EXPRESS WRITTEN PERMISSION OF A DULY AUTHORIZED REPRESENTATIVE OF CARMANAH TECHNOLOGIES CORP.

REVISION NOTES:

REV #	BY	DATE	REVISION DESCRIPTION

## RV ELECTRICAL LAYOUT - OFF GRID

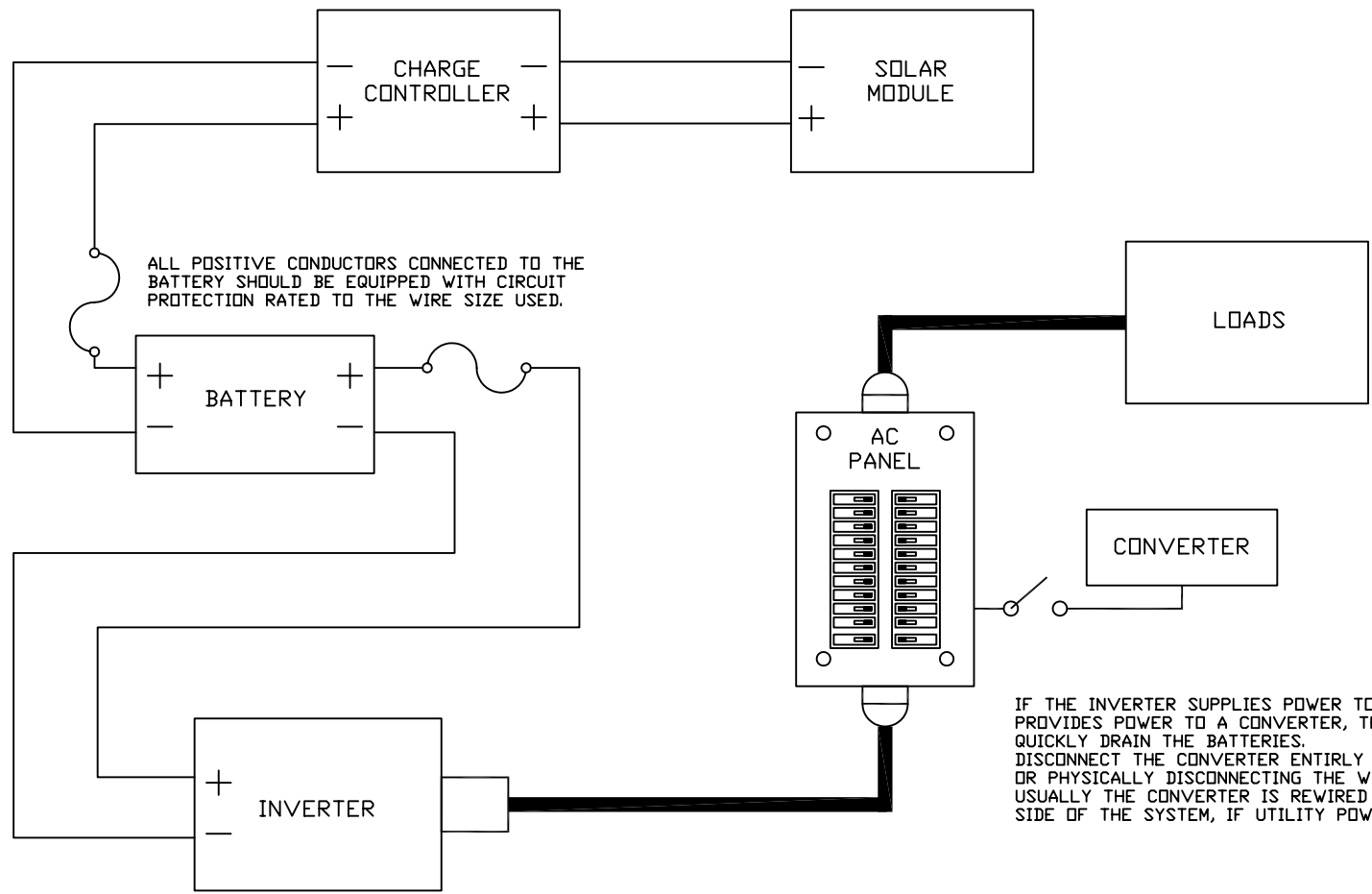


DIAGRAM IS RECOMMENDED WIRING ONLY.  
COMPLIANCE WITH GOVERNING ELECTRICAL CODE IS ASSUMED.

IN NO EVENT WILL CARMANAH BE LIABLE TO ANY PARTY OR FOR ANY DIRECT, INDIRECT, SPECIAL OR OTHER CONSEQUENTIAL DAMAGES RESULTING FROM USE OF THIS DIAGRAM.



**GO POWER!™**

A wholly owned subsidiary of Carmanah Technologies Corp.

COPYRIGHT 2007 CARMANAH TECHNOLOGIES CORP. ALL RIGHTS RESERVED

DRAWN BY	APPROVED BY	DATE	SCALE	UNITS
KK	JT	02/24/07	NTS	



GO POWER!  
RV SYSTEM  
ELECTRICAL LAYOUT - OFF GRID

DWG #:

6

REV 1.2

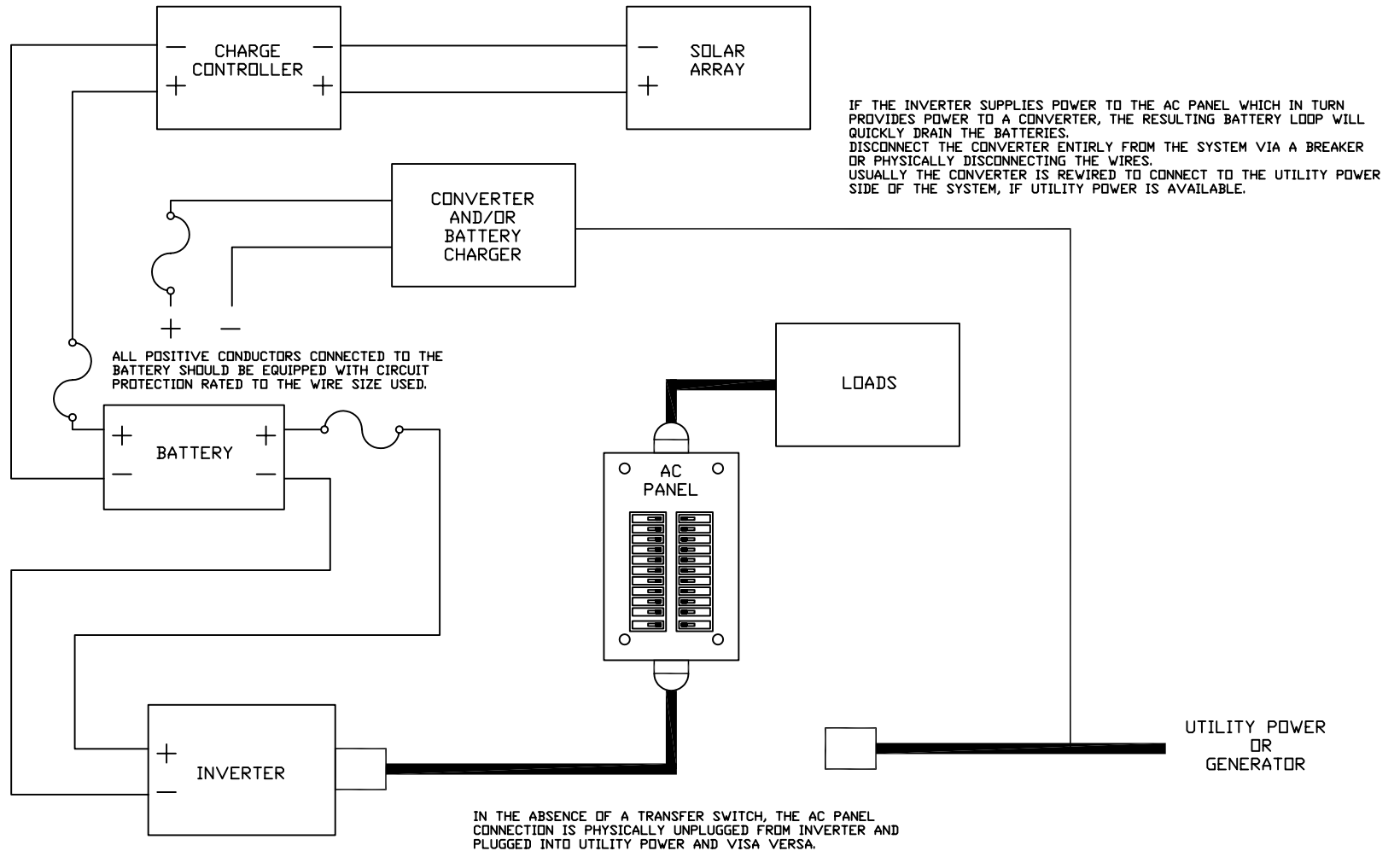
**CONFIDENTIAL**

THIS DRAWING AND ANY DATA, DESCRIPTION, AND OTHER INFORMATION CONTAINED HEREIN ARE CONSIDERED AS PROPRIETARY AND THE EXCLUSIVE PROPERTY OF CARMANAH TECHNOLOGIES CORP. AND SHALL NOT BE PUBLISHED, REPRODUCED, COPIED, DISCLOSED, OR USED, IN WHOLE OR IN PART, FOR ANY PURPOSE WITHOUT THE EXPRESS WRITTEN PERMISSION OF A DULY AUTHORIZED REPRESENTATIVE OF CARMANAH TECHNOLOGIES CORP.

REVISION NOTES:

REV #	BY	DATE	REVISION DESCRIPTION

## RV ELECTRICAL LAYOUT - TWO AC POWER SOURCES NO TRANSFER SWITCH - MANUAL SWITCHING



IN NO EVENT WILL CARMANAH BE LIABLE TO ANY PARTY OR FOR ANY DIRECT, INDIRECT, SPECIAL OR OTHER CONSEQUENTIAL DAMAGES RESULTING FROM USE OF THIS DIAGRAM.

DIAGRAM IS RECOMMENDED WIRING ONLY. COMPLIANCE WITH GOVERNING ELECTRICAL CODE IS ASSUMED.

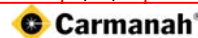


**GO POWER!™**

A wholly owned subsidiary of Carmanah Technologies Corp.

COPYRIGHT 2007 CARMANAH TECHNOLOGIES CORP. ALL RIGHTS RESERVED

DRAWN BY	APPROVED BY	DATE	SCALE	UNITS
KK	JT	02/24/07	NTS	



GO POWER!  
RV SYSTEM  
ELECTRICAL LAYOUT - MANUAL POWER SWITCHING

DWG #:

7

REV 1.2

**CONFIDENTIAL**

THIS DRAWING AND ANY DATA, DESCRIPTION, AND OTHER INFORMATION CONTAINED HEREIN ARE CONSIDERED AS PROPRIETARY AND THE EXCLUSIVE PROPERTY OF CARMANAH TECHNOLOGIES CORP. AND SHALL NOT BE PUBLISHED, REPRODUCED, COPIED, DISCLOSED, OR USED, IN WHOLE OR IN PART, FOR ANY PURPOSE WITHOUT THE EXPRESS WRITTEN PERMISSION OF A DULY AUTHORIZED REPRESENTATIVE OF CARMANAH TECHNOLOGIES CORP.

REVISION NOTES:

REV #	BY	DATE	REVISION DESCRIPTION

## RV ELECTRICAL LAYOUT - TWO AC POWER SOURCES WITH AUTOMATIC TRANSFER SWITCH

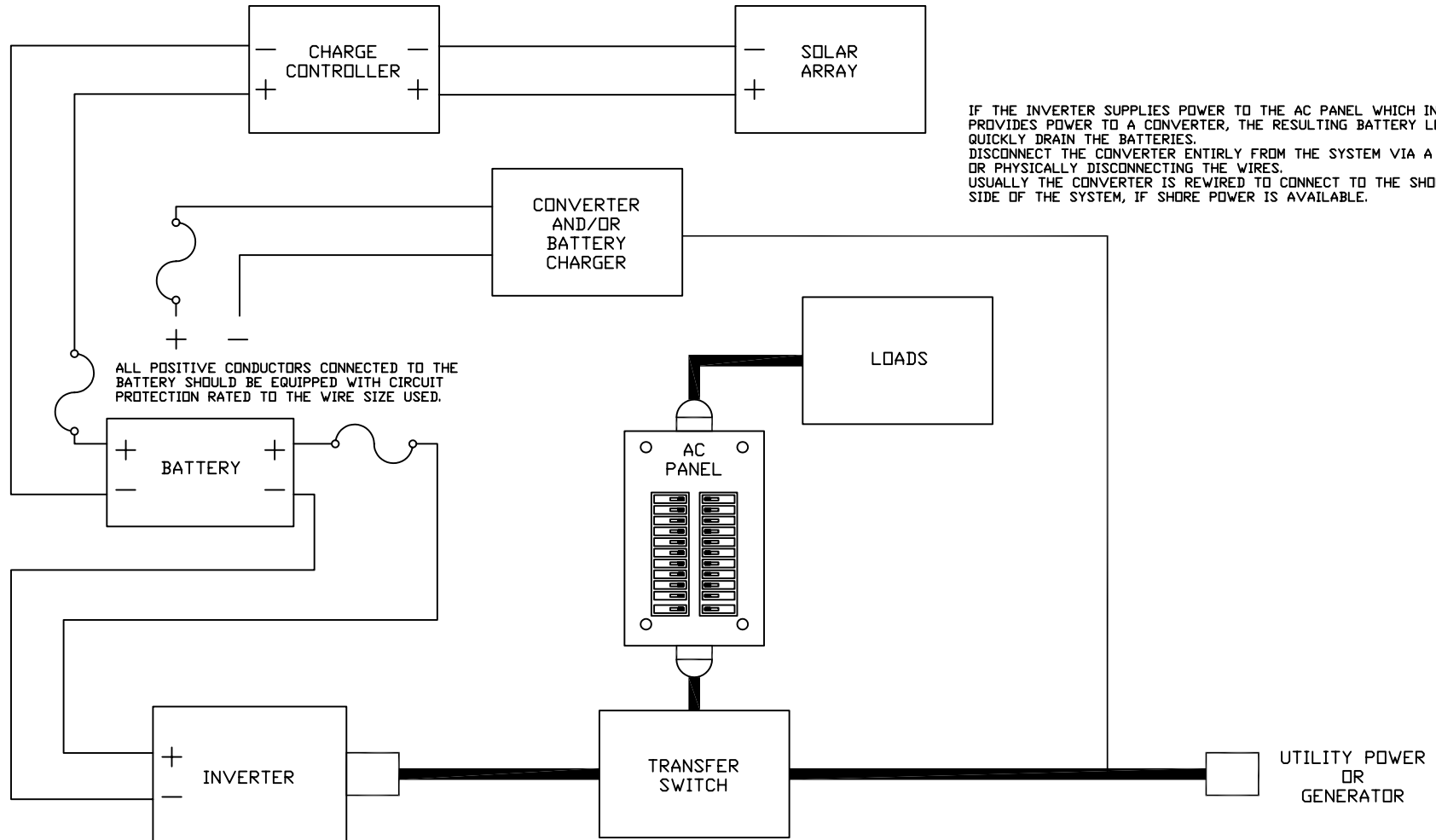


DIAGRAM IS RECOMMENDED WIRING ONLY. COMPLIANCE WITH GOVERNING ELECTRICAL CODE IS ASSUMED.

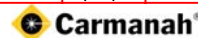
IN NO EVENT WILL CARMANAH BE LIABLE TO ANY PARTY OR FOR ANY DIRECT, INDIRECT, SPECIAL OR OTHER CONSEQUENTIAL DAMAGES RESULTING FROM USE OF THIS DIAGRAM.

**GO POWER!™**

A wholly owned subsidiary of Carmanah Technologies Corp.

COPYRIGHT 2007 CARMANAH TECHNOLOGIES CORP. ALL RIGHTS RESERVED

DRAWN BY	APPROVED BY	DATE	SCALE	UNITS
KK	JT	02/24/07	NTS	



GO POWER!  
RV SYSTEM  
ELECTRICAL LAYOUT - AUTOMATIC POWER SWITCHING

DWG #:

8

REV 1.2

