



**samlexsolar**  
A Division of Samlex America Inc.

**Solar Panel Kit**

SSP-100-KIT  
SSP-150-KIT

**Owner's  
Manual**

Please read  
this manual  
before  
operating  
your kit



### Warnings

Please read the Owner's Manual carefully before attempting to carry out any installation and wiring. Contact your RV dealer or Technical support at Samlex America (1-800-561-5885) for any questions concerning the installation.

## Installation and Wiring Compliance

Installation and wiring must comply with the local and National Electrical Codes and must be done by a certified electrician.

1. Disconnect all power sources before carrying out the installation.
2. Make sure correct polarity is observed when making connections between the solar panel, Charge Controller and the battery. Damage due to reverse polarity connection is not covered by warranty.
3. Make sure all wire connections are secure as loose connections may cause sparks.
4. Wear appropriate clothing and safety gear including protective eyewear when performing any electrical installation.

## Preventing Fire and Explosion Hazards

Working with electronic/electrical equipment may produce arcs or sparks. Thus, such equipment should not be used in areas where there are inflammable materials or gases requiring ignition protected equipment. These areas may include spaces containing gasoline powered machinery, fuel tanks, battery compartments, etc.

## Precautions When Working With Batteries:

- Batteries contain very corrosive diluted Sulphuric Acid as electrolyte. Precautions should be taken to prevent contact with skin, eyes or clothing.
- Batteries generate Hydrogen and Oxygen during charging resulting in evolution of explosive gas mixture. Care should be taken to ventilate the battery area and follow the battery manufacturer's recommendations.
- Never smoke or allow a spark or flame near the batteries.
- Use caution to reduce the risk of dropping a metal tool on the battery. It could spark or short circuit the battery terminals or other electrical parts and could cause an explosion.
- Remove metal items like rings, bracelets and watches when working with batteries. Batteries can produce a short circuit current high enough to weld a ring or the like to metal and thus, cause a severe burn.
- If you need to remove a battery, always remove the Ground Negative terminal from the battery first. When connecting the battery, connect the Ground last. Make sure that all the accessories are off so that you do not cause a spark.
- Use properly insulated tools when making battery connections.

## Precautions When Working With Solar Panels

With the incidence of sunlight or other light sources on solar panels, a voltage appears at the output terminals of the solar panel turning it into a source of electricity. To avoid a shock hazard, make sure the solar panel is covered with an opaque (dark) material such as paper/cloth during installation. Do not make contact with the terminals when the panel is exposed to sunlight or any other light sources.

# 2

## DESCRIPTION & COMPONENTS

Solar Panel Kits SSP-100-KIT and SSP-150-KIT provide clean, green, silent and sustainable source of solar-based DC power to charge 12V Lead Acid batteries. Each kit comes with the following:

- High efficiency solar panel with MC-4 Connectors
- Connecting Wires with mating MC-4 Connectors
- Mounting Brackets
- Installation Hardware

### Details of Solar Panel

#### Design Features

- High Conversion Efficiency generates more energy per square meter
- Protective Bypass Diodes avoid effects of partial shading
- Weatherproof Junction Box and Connectors, Optical Low Iron Tempered Glass, EVA Resin and Aluminum Frame for operation in outdoor, wet and marine applications
- Highest manufacturing standards - Test ID for each panel
- Strong frame withstands high wind force

#### Applications

- Residential Roof-top Systems
- Commercial / Industrial Building Roof-top Systems
- Rural area applications
- Other on-grid and off-grid applications
- Automotive, RV and Marine

Parameter	150W Panel with SSP-150-KIT	100W Panel with SSP-100-KIT
Nominal Maximum Power at STC, Pmax	150 W $\pm$ 3%	100W $\pm$ 3%
Maximum Power Voltage, Vmp	18.38V	19.29V
Maximum Power Current, Imp	8.16A	5.18A
Open Circuit Voltage, Voc	22.68V	22.93V
Short Circuit Current, Isc	8.82A	5.81A
Module Efficiency	15.42%	15.10%
Type of Cells	Polycrystalline	Monocrystalline
No of Cells	36	36
Maximum System Voltage	UL-1703: 600VDC; IEC-61215 / 16730: 1000VDC	
Series Fuse Rating	15A	10A
Terminal Box	IP-65 with 3 Bypass Diodes; Cable 4mm <sup>2</sup> with MC4 Compatible Connectors	
Operating Temperature	- 40°C to + 85°C / - 40°F to +185°F	
Dimensions	660 x 1474 x 35.2mm / 26 x 58.03 x 1.39 in	552 x 1200 x 35.2mm / 21.73 x 47.25 x 1.39 in
Weight	12 Kg; 26.4 lb.	8 Kg; 17.63 lb.
STC	Irradiance Level: 1000 W/M <sup>2</sup> ; Spectrum: AM 1.5 Cell Temperature: 25°C / 77°F	
Temperature Coefficient of Current, Isc	+ 0.08% / °C	+ 0.04% / °C
Temperature Coefficient of Voltage, Voc	- 0.34% / °C	- 0.33% / °C
Temperature Coefficient of Power, Pmax	-0.43% / °C	-0.37% / °C

Details of components included in the Kits are given below:

<b>Serial No</b>	<b>Description</b>	<b>100W KIT SSP-100-KIT</b>	<b>150W KIT SSP-150-KIT</b>
1	100W Solar Panel	1	0
2	150W Solar Panel	0	1
3	Solar Panel Connecting Wires Kit Model SCW-20-2 consisting of:		
3-1	Positive (+) PV Extension Wire: • 20 ft. length, AWG #12 • Male MC-4 Connector on one end and bare on the other	1	1
3-2	Negative (-) PV Extension Wire: • 20 ft. length, AWG #12 • Female MC-4 Connector on one end and bare on the other	1	1
4	5-Hole Mounting Bracket for fixing Panel to RV Roof / other structure	4	4
5	Flange Bolt (1/4-20 x 3/4"): Hex, Stainless Steel - For fixing panel frame to Mounting Bracket (Srl. 5)	4	4
6	Flat Washer (1/4"): Stainless Steel - Under Flange Bolts (Srls. 6 and 10)	8	8
7	Locknut (1/4"): Hex, Stainless Steel, Nylon Insert - For Flange Bolt (Srl. 6)	4	4
8	Well Nut (Nut size: 1/4-20; Length 1"; Shank Dia 1/2") - For fixing Mounting Bracket (Srl. 5) to RV roof / other structure	4	4
9	Flange Bolt (1/4-20 x 1 1/4 ") : Hex, Stainless Steel - For fixing Mounting Bracket (Srl. 5) to Well Nut (Srl. 9)	4	4
10	Cable Clamp - For PV Extension Wires (Srls. 4-1 & 4-2)	6	6
11	Self Tapping Screw (#8), Philips - For Cable Clamp (Srl. 11)	6	6
12	Cable Tie for PV Extension Wires (Srls. 4-1 & 4-2)	6	6
13	Insulated Battery Ring Terminal, Stud Size 5/16", Wire Size AWG #10 to #12 - For crimping to wiring from Charge Controller to the battery	2	2
14	Owner's Manual for the Kit	1	1

# 3

## CONNECTOR SYSTEM FOR CONNECTING SOLAR PANELS

The Positive and Negative outputs of the solar panel are fed through a water tight Junction Box. Appropriate size of wires are connected to the Junction Box for further connections. The solar panels supplied with these kits are provided with approximately 3 ft. each of Positive & Negative wires that are pre-connected to the Junction Box. The free ends of the wires are terminated with special mating type of connectors for ease of extending these wires for further connections. The special mating type of connectors used for the 3 ft. wires provided with the solar panels and also for the separate extension wires are as follows:

- "SolarLine - MC4" Series manufactured by Multi Contact or compatible

### General Information on MC4 Connector System

MC4 Connector System consists of male and female connectors. This type of connector system is easy to install and uses "snap-in" type of safety locking clips to lock the two mating connectors, thereby, avoiding unintentional disconnection. Also, the mating contacts are sealed against ingress of dust and water.

Specifications are as follows:

- Contact diameter  $\varnothing$  4 mm
- Maximum rated current - 30A
- Maximum system voltage - 1000 V
- Degree of ingress protection when connected and properly locked - IP67
- Temperature range 40°C to +90°C

### MC4 Connectors (Figs 3.1, 3.2)

The MC4 Connectors mentioned in this manual have been designated "Male" and "Female" based on the characteristics of the mating contact inserts inside the terminals.

In the MC4 Male Connector (Fig. 3.1), the internal mating contact insert (1, Fig. 3.1) is a male pin. It has two slots (2 of Fig. 3.1) for insertion of the two "snap-in" type of locking tabs (5 of Fig. 3.2) of the MC4 Female Connector (Fig. 3.2) for firm mating connection. This connector is marked "-".

In MC4 Female Connector (Fig. 3.2), the internal mating contact insert (4 of Fig. 3.2) is a female cylindrical socket. It has two "snap-in" type of locking tabs (5 of Fig. 3.2) that are inserted into the two slots (2 of Fig. 3.2) in the MC4 Male Connector (Fig. 3.1) for firm mating connection. Wire is crimped to the contact inserts (1 and 4 of Fig. 3.2) using a special purpose crimping tool designed for MC4 connectors. After the wire has been crimped, the contact insert is required to be seated securely inside the housing and the strain relief / seal (3 of Fig. 3.1 & 3.2) is to be tightened fully to provide a water-tight seal.

#### LEGEND

##### Fig. 3.1

1. Male Contact Insert
2. Slots for accepting "snap-in" type of locking tabs (5) of the mating MC4 Female Connector (Fig. 3.2)
3. Strain Relief & Seal

Fig. 3.1: MC4 Male connector (marked "-")



#### LEGEND

##### Fig. 3.2

3. Strain Relief & Seal
4. Female Contact Insert
5. "Snap-in" type of locking tabs that slide inside locking slots (2) of the mating MC4 Female Connector (Fig 3.1)

Fig. 3.2: MC4 Female connector (marked "+")



## CONNECTOR SYSTEM FOR CONNECTING SOLAR PANELS

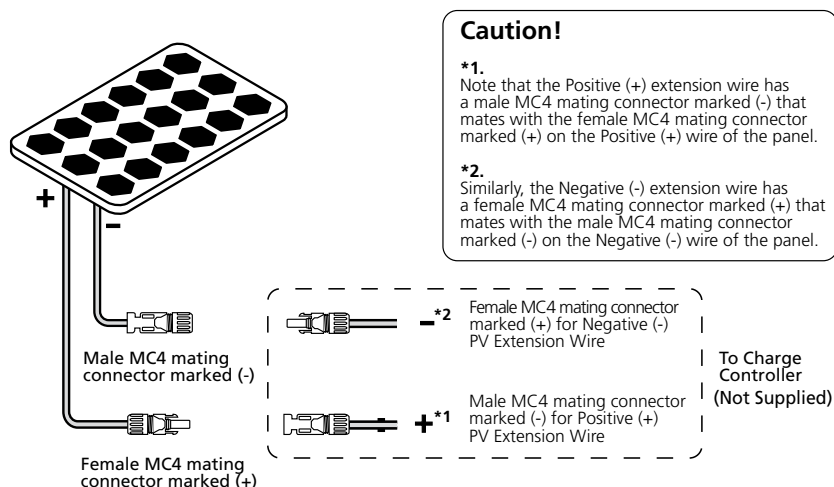
## Output Wires and Connections on the Solar Panel

Fig. 3.3 shows the output wires and connections on the solar panel. The output wires from the junction box of the solar panel are terminated with the help of MC4 connectors. The Positive (+) wire is terminated with a MC4 Female Connector (marked "+") and the Negative wire is terminated with a MC4 Male Connector (marked "-").

**Warning!**

When the surface of the solar panel / array is exposed to sunlight, a DC voltage appears at the output terminals turning it into a live voltage source. For example, a 24 V nominal solar panel may put out an open circuit voltage of around 45 VDC that may produce electrical shock. Multiple solar panels connected in series (to increase the output voltage) will put out higher lethal voltages. To avoid any electrical shock hazard during installation, make sure that the solar panel / array is covered with an opaque (dark) material to block solar irradiation.

## Extending to the Output Wires of the Solar Panel (Fig. 3.3)

**Caution!**

\*1. Note that the Positive (+) extension wire has a male MC4 mating connector marked (-) that mates with the female MC4 mating connector marked (+) on the Positive (+) wire of the panel.

\*2. Similarly, the Negative (-) extension wire has a female MC4 mating connector marked (+) that mates with the male MC4 mating connector marked (-) on the Negative (-) wire of the panel.

Fig 3.3. Connecting extension wires to the output wires of solar panel

1. The Positive (+) wire of the solar panel is terminated with a MC4 Female Connector (marked +). Connect this to the MC4 Male Connector (marked -) that is attached to the Positive PV Extension Wire. Make sure that the locking tabs "snap in" for a firm connection. *The bare end of the Positive extension Wire will now be of Positive polarity. Use a piece of red sleeve or red tape near the bare end for identification as the Positive (+) wire.*
2. The Negative (-) wire of the solar panel is terminated with a MC4 Male Connector (marked -). Connect this to the MC4 Female Connector (marked +) that is attached to the Negative extension wire. Make sure that the locking tabs "snap in" for a firm connection. The bare end of the Negative PV Extension Wire will now be of Negative polarity.
3. Connect the two PV Extension Wires to the Charge Controller (not supplied).

**Warning!**

Ensure that the polarity (+ or -) of the wires is identified correctly before connecting to the Charge Controller. Damage due to wrong polarity may not be covered under warranty.

# 3

## CONNECTOR SYSTEM FOR CONNECTING SOLAR PANELS

### Connecting Second Adjacent Solar Panel in Parallel (Fig. 3.4)

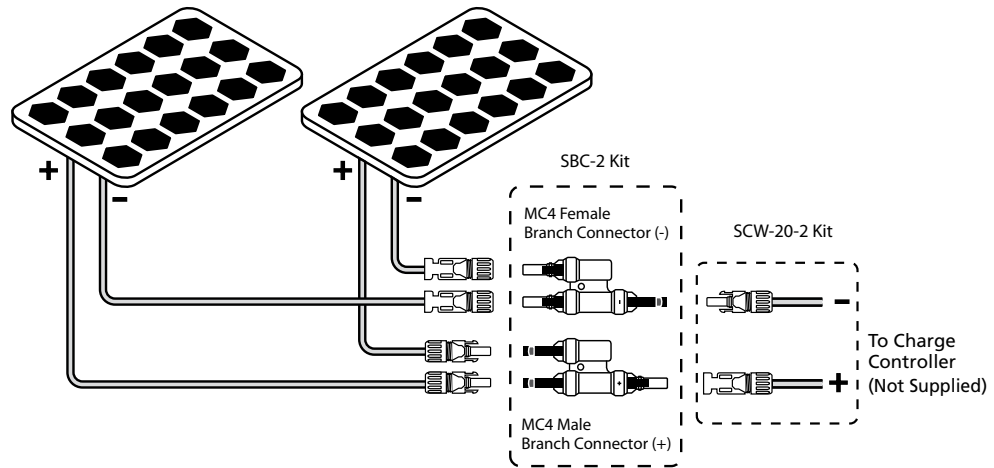


Fig. 3.4. Connecting two adjacent solar panels in parallel

A second solar panel can be connected in parallel with the panel provided in the kit to increase the current output at the same output voltage. Fig. 3.4 above shows the arrangement for connecting the second solar panel in parallel using the Solar Panel Connecting Wire Kit Model SCW-20-2 supplied with this kit, and MC4 Branch Connector Kit (SBC-2), sold separately. This arrangement is applicable if the two solar panels are to be connected in parallel and are mounted adjacent to each other.

The output wires of the two solar panels are first connected in parallel using the MC4 Male and Female Branch Connectors. The outputs of the Branch Connectors are then connected to the SCW-20-2 wires for connecting to the Charge Controller (not supplied).

### Connecting Second Solar Panel in Parallel When Separated by a Distance (Fig. 3.5)

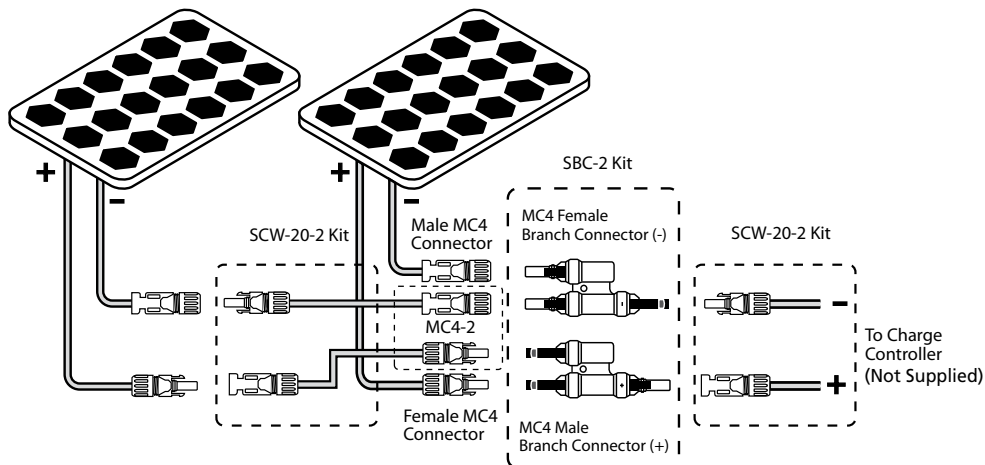


Fig. 3.5. Connecting two solar panels in parallel that are separated by an extended distance

# 3

## CONNECTOR SYSTEM FOR CONNECTING SOLAR PANELS

Fig.3.5 above shows an arrangement for connecting second solar panel in parallel that is separated by an extended distance. In this case, the following will be required:

- SCW-20-2 Connecting Wires Kit - 2 sets (one set is provided with this kit. Second set has to be ordered separately)
- One MC4 Male Branch Connector and one MC4 Female Branch Connector sold separately as an optional kit – Model No. "SBC-2" Kit
- One MC4 Male Connector and one MC4 Female Connector sold separately as an optional kit – Model No. "MC4-2"

In this case, one Connecting Wire Kit "SWC-20-2" and the optional MC-4 Connectors Kit "MC4-2" are first used to bridge the extended distance between the panels. The optional Branch Connector "SBC-2" Kit is used to parallel the two solar panels. The second Connecting Wire Kit "SWC-20-2" is used to connect to the Charge Controller (not supplied).



# 4

## INSTALLATION OVERVIEW



### Warning!

Please read Section 1: General Safety before starting installation.

### Block Diagram of Typical RV Installation (Fig 4.1)

**NOTE:** Solar Charge Controller and battery shown in Fig. 4.1 are shown as part of a typical 12V Solar Charging System installation. The Charge Controller and battery are not supplied as part of the kit.

1. Read the manual in detail and understand the installation procedure.
2. Open the packaging and check to make sure that all parts have been received as per the List of Components (page 5).
3. Arrange for the required tools to carry out the installation. A sample list of tools (not exhaustive) is provided in Section 4.
4. Determine the mounting location of the solar panel(s) on the roof of the RV.
5. Mount the Charge Controller at the desired location (see Section 6).
6. Pass the cable from the solar panels to the interior of the RV (See Section 7).
7. Wire the battery to the Charge Controller through fuse and then the solar panel to the Charge Controller ensuring correct polarity is observed (See Section 7).
8. Secure the solar panel to the RV roof (See Section 7).

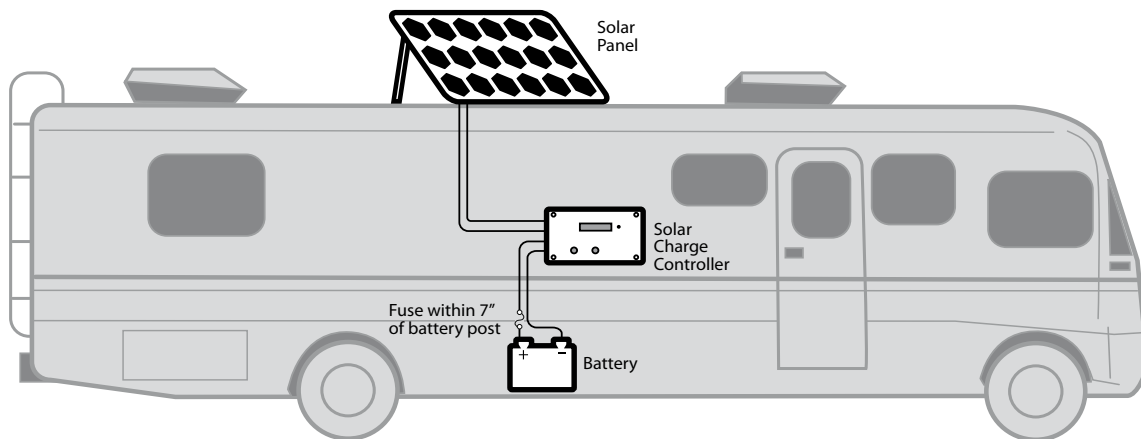


Fig. 4.1. Installation Block Diagram

# 5

## TOOLS & MATERIALS REQUIRED FOR INSTALLATION

### Required Tools

1. Philips drive screw driver
2. 7/16" wrench
3. 3/8" wrench
4. Wire Stripper
5. Wire Crimping Tool
6. Hand Drill
7. 1/2" drill bit
8. Jig-saw or suitable cutting tool
9. Pliers
10. Punch or Awl

### Required Materials

1. Silicone or any suitable roof sealant. Contact your local RV dealer or RV store for a recommendation on a sealant to suit your specific RV roof material.
2. Anti-galling lubricant to prevent "thread galling" of all stainless steel fasteners exposed to outdoor environment. This should be available at most hardware or auto-parts stores. If anti-galling lubricant is not available, any standard lubricant will minimize the occurrence of "thread galling".
3. If wiring distances are longer than 20 ft. length of wire provided with the kit, extra stranded copper wire will be required. Wires should be 12 AWG or thicker, single conductor, Type UF (Underground Feeder - marked as sunlight resistant), Type SE (Service Entrance) or Type USE/USE-2 (Underground Service Entrance). Alternatively, the following may be ordered for additional 20 ft. extension:
  - Solar Panel Connecting Wires Kit "SCW-20-2"
  - Solar Panel Multi Contact Connectors "MC4-2"

# 6

## CHARGE CONTROLLER INSTALLATION

The output from the panel is fed to the selected Solar Charge Controller (not supplied with this kit). Please refer to Installation Instructions provided with the selected Solar Charge Controller. Minimum recommended Charge Controller capacity is as follows:

- Single 100W Panel – 8 Amps
- Single 150W Panel – 10 Amps

# 7

## SOLAR PANEL INSTALLATION

1. Stainless steel can be subject to a process called “thread galling” in which bolts can twist off and/or the bolt threads seize to the nut’s thread. Apply Anti-galling Lubricant available at most hardware or auto-parts stores to all the stainless steel fasteners before installation. If anti-galling lubricant is not available, any standard lubricant will minimize the occurrence of “thread galling”.
2. Fix the mounting brackets (Fig. 7.2) to the frame of the previously positioned solar panel using the slotted opening and the 1/4”-20 x 3/4” Flange Bolt, Nylon Locknut and flat washer (Fig. 7.1).
3. Using a 7/16” wrench, tighten the nuts to secure the mounting brackets to the PV panel. Recommended tightening torque is 15 lbs.
4. Position the panel with the attached mounting brackets at the desired location on the RV roof and mark the position of the desired mounting hole using a suitable marker by tracing the hole on the mounting bracket. Please ensure that the mounting surface on the RV roof is strong enough to support the mounting hardware, solar panel and wind loads.
5. The centre and end holes on the mounting brackets (Fig. 7.2) are sized to accept the 1/4” hardware supplied with the unit. If the use of larger sized hardware is desired, 3/8” holes can be used.

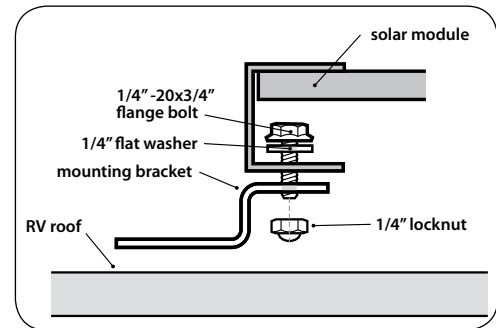


Fig. 7.1. Attaching solar panel to 5-hole mounting bracket.

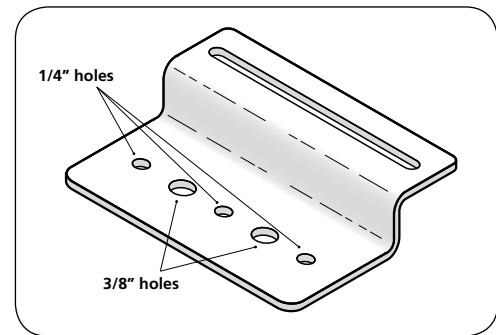


Fig. 7.2. 5-Hole Mounting Bracket.

### **Well Nut for anchoring Solar Panel to RV Roof**

6. A Well-Nut is a bushing of tough Neoprene rubber with a flange at the top end and a captive brass nut mounted within the bore at the bottom end (Fig. 7.3). Tightening a conventional machine bolt or screw engages the captive nut thereby causing the bushing to expand outwards. This fastens securely to thinner RV roofs by bulging up and against the bottom surface of the roof (Fig. 7.6). If used in a blind hole in a solid surface material, the rubber will expand outwards to create a secure fastening (Fig. 7.7). The Neoprene and brass resist most environmental conditions.

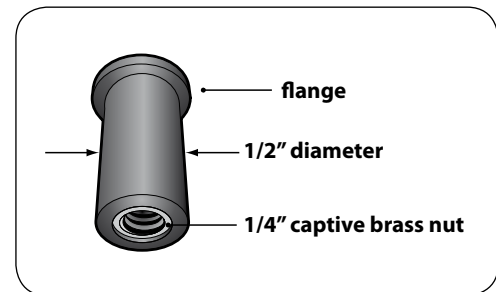


Fig. 7.3. Construction of a Well Nut

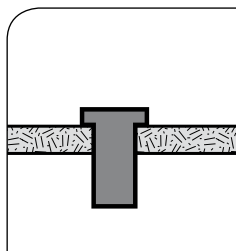
**Typical Installation of a Well-Nut**

Fig. 7.4. Well-Nut is inserted into a pre-drilled hole with its flange against the outer surface. There is no need for access to the inner side.

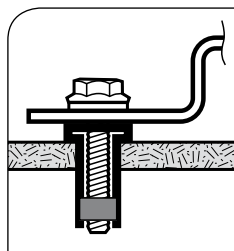


Fig. 7.5. The 5-hole mounting bracket is placed against the flange of the Well-Nut and is secured by the bolt engaging the captive brass nut.

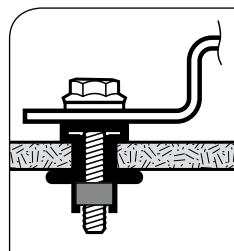


Fig. 7.6 . As the bolt is tightened, the neoprene body of the Well-Nut is compressed and expanded, forcing it tightly into the bolt's threads and against the inner surface of the thin RV roof material.

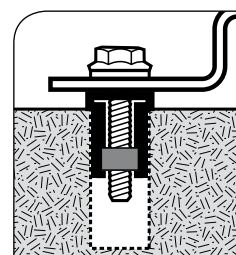


Fig. 7.7. Installed in a blind hole in a solid material, the body of the Well-Nut expands tightly against the walls of the hole, effecting a secure, dependable fastening.

7. To install the Well-Nuts, drill holes 1¼" deep at the marked positions using a ½" size drill bit. Make sure that drilling does not interfere with pre-existing wiring installations.
8. Apply silicone or any appropriate sealant recommended by your RV dealer generously to the drilled holes for water-proofing.
9. Insert the ¼" Well-Nut into the drilled holes so that only the flange section remains above the roof surface (Fig. 7.4).
10. Fasten the mounting brackets to the roof surface by inserting the ¼ x 1¼" serrated flange bolt into the Well-Nut (Fig. 7.5). Tighten using a 3/8" wrench to a recommended torque of 15 lbs. When the serrated flange bolt is screwed into the Well-Nut, the material surrounding the well nut bulges slightly securing the structure to the RV roof (Fig. 7.6 & 7.8).
11. Make sure all bolts and mounting brackets are covered by good amounts of suitable RV sealant recommended by your local RV dealer.

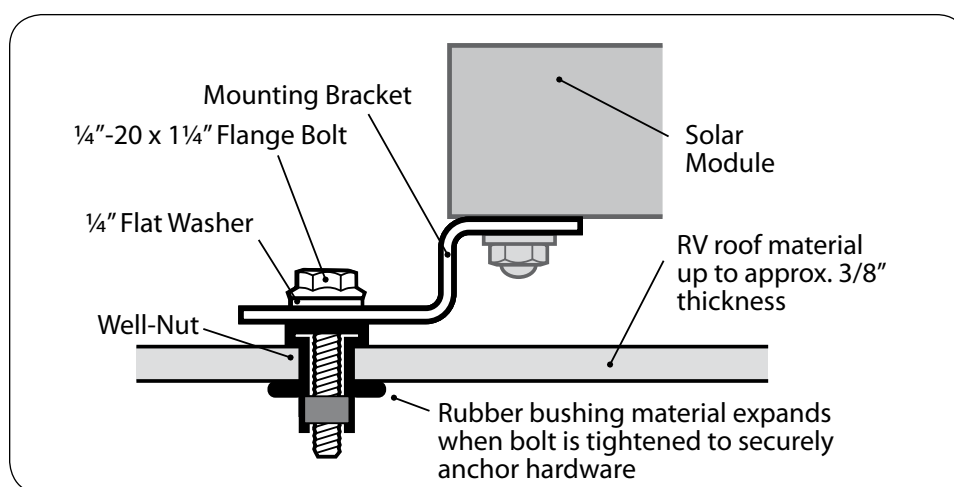


Fig. 7.8 Attaching 5-hole mounting bracket to RV Roof

# 8

## WIRING

Typical wiring using a single 150W/100W panel to charge 12V battery is considered and shown in Fig. 8.1. Minimum recommended Charge Controller capacity is as follows: Single 100W Panel – 8 Amps; Single 150W Panel – 10 Amps. **NOTE: Wiring and Fuse sizes recommended below are based on use of a single 100/150W solar panel with maximum current handling capacity of 10A.**



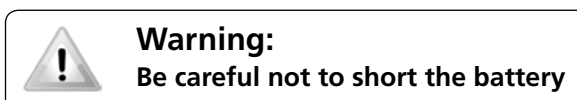
### Caution!

1. The battery must be wired to the Charge Controller before the solar panel is connected to the Charge Controller.
2. Use appropriate size of fuse in battery Positive Cable to protect against fire hazard due to short circuit in the battery cables.

A pair of 20 foot, AWG#12, pre-assembled cables with Multi-Contact (MC4) Male and Female Connectors is provided to connect the solar panel to the Charge Controller. After making sure that sufficient length is available to wire the solar panel to the Charge Controller, any excess wire may be used to wire the battery to the Charge Controller. Please refer to wiring layout at Fig. 8.1 below.

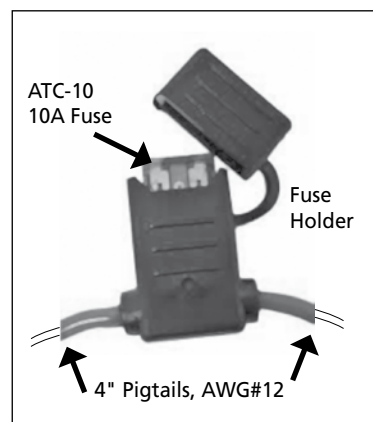
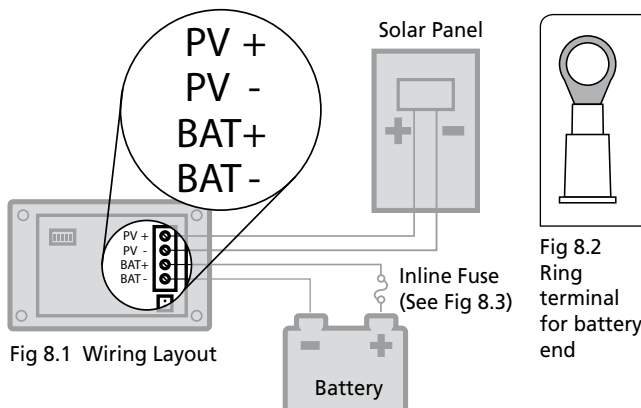
### Wiring from Battery to Charge Controller

- Use AWG#12 for up to 6 ft. and AWG#10 for up to 10 ft. to limit voltage drop to 2% at maximum 10A.
- Mark the cables to differentiate between Positive and Negative.
- Make sure the Positive terminal (marked '+') of the battery is connected to the Positive terminal (marked "BAT +") of the Charge Controller and the Negative terminal (marked '-') of the battery is connected to the Negative terminal (marked "BAT -") of the Charge Controller (Fig. 8.1). If you are not sure, use a DC voltmeter to determine the polarity of the battery bank. **Reverse polarity connection may damage the Charge Controller and the resulting damage will not be covered by warranty.**
- 2 pieces of Ring Terminals (Fig 8.2) have been provided for crimping on the wire ends on the battery side.
- Use Inline ATC style Fuse Holder of 10A ATC-10 fuse on the battery end of the Positive cable (Fig 8.1; NOT SUPPLIED). The Fuse Holder comes with 4", AWG#12 pigtails. Splice one pigtail to the Positive wire end and use the other pigtail for battery connection.



### Warning:

Be careful not to short the battery



Use inline, 10A ATC Type Fuse with ATC Fuse Holder (Fig. 8.3) as close to the battery as possible.

## Wiring From Solar Panel to Charge Controller

1. Determine the position of the solar panel on the RV roof. While positioning panels, avoid shading of the solar panel by neighbouring obstacles such as vents, air-conditioners, TV antennas etc. As far as possible, position the panels to minimize wiring distance between the solar panel and the Charge Controller. Place the panel at least 8-10 inches away from the RV roof edges and leave sufficient space to walk around the panel and access the mounting hardware.
2. Make sure the thickness of the roof at the installation location is at least ½" thick and the material is strong enough to provide mechanical support to the solar panel and mounting hardware against possible wind loading. Place the panel length-wise to reduce the effects of wind loading on the RV.

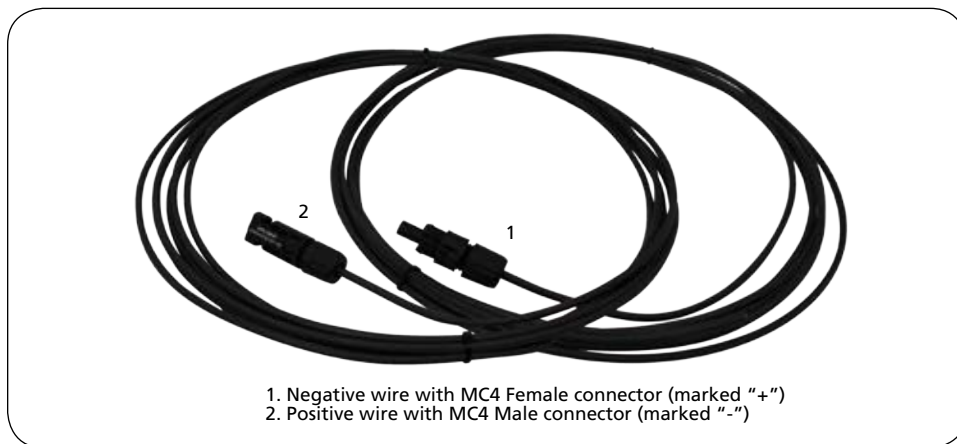


Fig. 8.4. Solar Panel Connecting Wires kit "SCW-20-2"

3. Solar Panel Connecting Wires kit "SCW-20-2" consisting of 2 pre-assembled, 20 ft, AWG #12, Positive (+) & Negative (-) PV extension wires have been provided (see Fig. 8.4). The wires have MC4 mating connectors on one end for connecting to the solar panel & bare ends on the other side for connecting to the Charge Controller. The wires are marked (+) & and (-) for identification of the polarity.
4. Please read Section 3 on connecting PV Extension Wires to the panels.

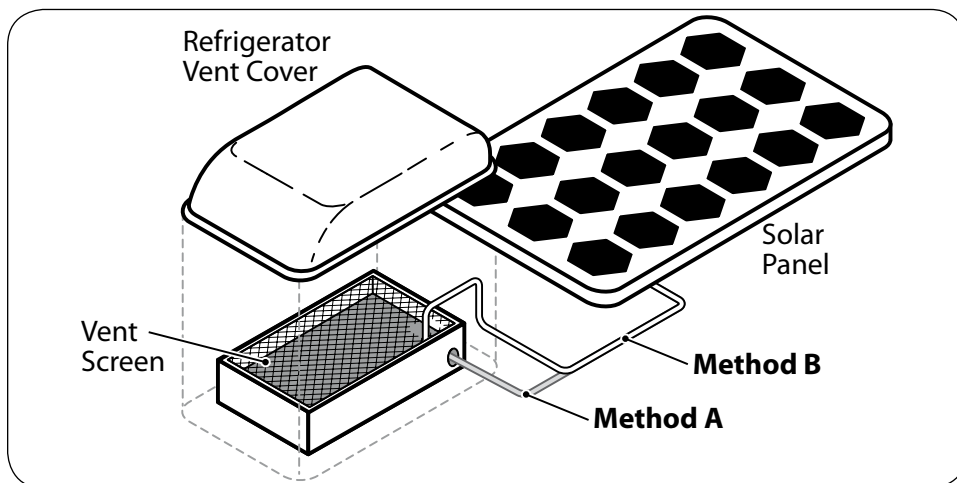


Fig. 8.5 PV Wire Entry Through RV Vent

# 8

## WIRING

5. The wire pair from the solar panel can be routed to the interior of the RV through the roof-top refrigerator vent. Find where the refrigerator vent is located on the roof of the RV. See Fig. 8.5.
6. Select a suitable mounting location for the solar panel, preferably as close to the vent as possible. The mounting surface should be strong enough to support the mounting hardware, the solar panel and wind loads.
7. Take off the vent cover to gain access to the duct opening and keep the vent fastening hardware safely as the vent cover will have to be replaced after the wires have been routed.
8. The wires from the solar panel can be routed by either of the two following methods:
  - A. **Hole in the side of the vent:** Drill a suitable hole in the side of the vent and insert a rubber grommet (not provided). Route the wire pair carefully to the Charge Controller through the hole. Use appropriate sealant as recommended by your local RV dealer to ensure the penetration at the side of the vent is watertight.
  - B. **Through the vent screen:** Route the wire pair through the vent screen grid holes. Widen the screen grid holes if necessary.
9. Use the cable clamps with #8 self-tapping screws and tie wraps at regular intervals of the wire route from the solar panel to the Charge Controller to hold the cables in place for a neat finish. Tuck any excess wire under the refrigerator vent cover.



**Warning:**  
Avoid sharp, heated or abrasive material on the cable route.

10. Replace the refrigerator vent cover and secure with the retained hardware.
11. Crimp the bare end of the wires with the fork terminals provided (Fig 8.3).
12. Insert the terminals into the appropriate terminal on the Charge Controller (Fig 8.1): Positive PV lead is connected to the Positive terminal (marked "PV +") of the Charge Controller and the Negative PV lead is connected to the Negative terminal (marked "PV -") of the Charge Controller. ***Reverse polarity connection may damage the Charge Controller and the resulting damage will not be covered by warranty.***

### Series Connection of Batteries

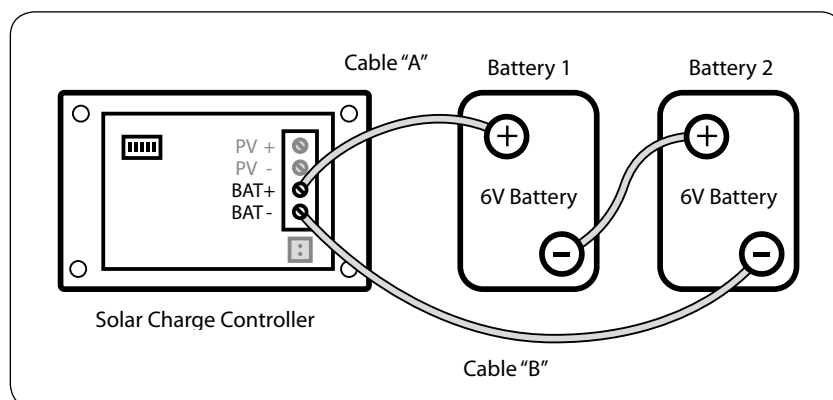


Fig. 9.1: Series Connection

When two or more batteries are connected in series, their voltages add up but their Ah capacity remains the same. Fig. 9.1 above shows 2 pieces of 6V, 200 Ah batteries connected in series to form a battery bank of 12V with a capacity of 200 Ah. The Positive terminal of Battery 1 becomes the Positive terminal of the 12V bank. The Negative terminal of Battery 1 is connected to the Positive terminal of Battery 2. The Negative terminal of Battery 2 becomes the Negative terminal of the 12V battery bank.

### Parallel Connection of Batteries

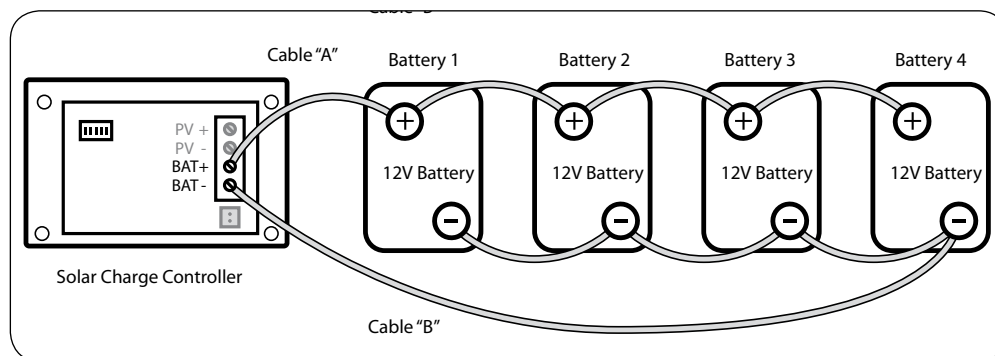


Fig. 9.2: Parallel Connection

When two or more batteries are connected in parallel, their voltage remains the same but their Ah capacities add up. Fig. 9.2 shows 4 pieces of 12V, 100 Ah batteries connected in parallel to form a battery bank of 12V with a capacity of 400 Ah. The four Positive terminals of Batteries 1 to 4 are paralleled (connected together) and this common Positive connection becomes the Positive terminal of the 12V bank. Similarly, the four Negative terminals of Batteries 1 to 4 are paralleled (connected together) and this common Negative connection becomes the Negative terminal of the 12V battery bank.



# 9

## TYPICAL BATTERY CONNECTIONS

### Series – Parallel Connection of Batteries

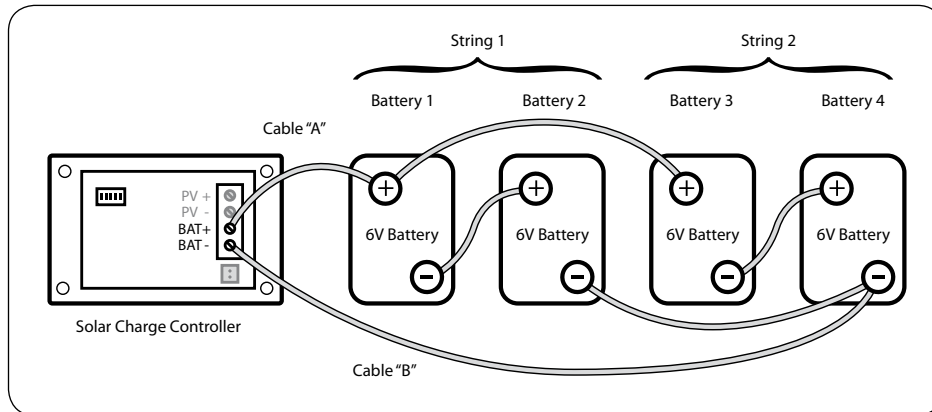


Fig. 9.3: Series-Parallel Connection

Figure 9.3 above shows a series – parallel connection consisting of four 6 V, 200 Ah batteries to form a 12 V, 400 Ah battery bank. Two 6 V, 200 Ah batteries, Batteries 1 and 2 are connected in series to form a 12 V, 200 Ah battery (String 1). Similarly, two 6 V, 200 Ah batteries, Batteries 3 and 4 are connected in series to form a 12 V, 200 Ah battery (String 2). These two 12 V, 200 Ah Strings 1 and 2 are connected in parallel to form a 12 V, 400 Ah bank.



#### CAUTION!

When 2 or more batteries / battery strings are connected in parallel and are then connected to the Solar Charge Controller (See Figs. 9.2 and 9.3 given above), attention should be paid to the manner in which the Solar Charge Controller is connected to the battery bank. Please ensure that if the Positive output cable of the Solar Charge Controller (Cable "A") is connected to the Positive battery post of the first battery (Battery 1 in Fig. 9.2) or to the Positive battery post of the first battery string (Battery 1 of String 1 in Fig. 9.3), then the Negative output cable of the Solar Charge Controller (Cable "B") should be connected to the Negative battery post of the last battery (Battery 4 as in Fig. 9.2) or to the Negative Post of the last battery string (Battery 4 of Battery String 2 as in Fig. 9.3). This connection ensures the following:

- The resistances of the interconnecting cables will be balanced.
- All the individual batteries / battery strings will see the same series resistance.
- All the individual batteries will charge at the same charging current and thus, will be charged to the same state at the same time.
- None of the batteries will see an overcharge condition.

If the Positive output cable of the Solar Charge Controller (Cable "A") is connected to the Positive battery post of the first battery (Battery 1 in Fig. 9.2) or to the Positive battery post of the first battery string (Battery 1 of String 1 in Fig. 9.3), and the Negative output cable of the battery charger (Cable "B") is connected to the Negative battery post of the first battery (Battery 1 as in Fig. 9.2) or to the Negative Post of the first battery string (Battery 1 of Battery String 1 as in Fig. 9.3), the following abnormal conditions will result:

- The resistances of the connecting cables will not be balanced.
- The individual batteries will see different series resistances.
- All the individual batteries will be charged at different charging current and thus, will reach fully charged state at different times.
- The battery with lower series resistance will take shorter time to charge as compared to the battery which sees higher series resistance and hence, will experience over charging and its life will be reduced.

# 10

## ROUTINE MAINTENANCE

### **Please carry out the following routine maintenance:**

- Inspect the solar panels and make sure the surface is free from dust, dirt and other debris.  
Clean with a wet cloth or glass cleaner, if necessary.
- Check to make sure all structural components, mechanical fasteners and electrical connections are secure, clean and corrosion-free.
- Check and maintain battery electrolyte levels at regular intervals as per battery manufacturer's recommendations if flooded/wet cell Lead Acid batteries are used.
- Check and replace damaged components, if necessary.