SMA Solar System

"Installation Manual"

Introduction

The Rainbow Power Distribution Board is designed to allow Electrician/installers to connect solar panels and batteries to a pre-wired board containing a Regulator, Inverter and Battery charger with appropriate fusing.

This *"Installation Guide"* aims to provide a basic overview of the installation process of your system and should be used in conjunction with the individual product manuals provided.

An additional *"System Operation Manual"* has been provided to explain the general operation of your system.

A custom *"Wiring Diagram"* has been supplied with your system. This schematic explains the overall electrical connections made by the Distribution Board.

All wiring and fusing has been chosen specifically for the equipment supplied on the Rainbow Power Distribution Board. This system must comply with the requirements of ASNZ 3000:2007. No changes should be made unless specified by Rainbow Power Co. or a suitable qualified person.

The Rainbow Power SMA Distribution Board requires an Electrician to complete the installation. This system should be installed to ASNZ 3000:2007, ASNZ 4509:2009, ASNZ4081.1:1993.

If after reading these manuals you or your electrician have any questions relating to the installation or operation of your system please contact RPC on 0266891430. You will need your electrician on site when you ring.

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General System Configuration.

The RPC renewable Energy System has 3 major system components that are required to be installed and connected:
1. Distribution Board
2. PV Panels and Framing System
3. Batteries

Correct positioning of these components is vital for the efficient and safe operation of your renewable energy system.

The Distribution Board has all the major electronic components such as the Inverter, Inverter / Charger and fusing. The board should be mounted in easily accessible dry and cool place as close as possible to Batteries (less than 1.5m), but not directly over the Batteries.

The PV Panels and Frames need to be installed in a sunny position that maximizes solar access. The PV Array needs to be as close as feasibly possible to the distribution board to reduce wire losses due to voltage drop. PV array cabling should be designed to limit voltage drop to less than 5%.

The Batteries should be contained in a purpose built battery box within 1.5m of the distribution board. The battery box should be vermin proof and have ventilation holes to allow Hydrogen gas to escape safely.

Installation Safety

Renewable Energy System produces energy in the form of electricity. Care is required during installation to avoid sparks, and the associated risks of burns and fires. Installation quality is essential for safe and long lasting operation of your system.

A suitably Qualified Electrician is required to connect the PV Array, Sunny Boy Inverter, Sunny Island Inverter and Genset. Suitable earthing, MEN, RCD and circuit protection are required to be installed for safe operation of your system.

Wiring Diagrams have been provided for your electrician's reference. All installation instructions located in product manuals should also be referred to prior to installation. If your electrician has any further questions please contact RPC for further clarification.

Please take note of the **!Warnings!** Identified throughout this manual that relate to the individual components you are installing. Safe work methods must be followed at all times.

!Warning!

ALL DC wiring above 110VDC should be carried out by a licensed electrician to AS 3000:2007 standards.

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!Warning!

Rainbow Power Co. takes no responsibility for any faults that may occur due to incorrect installation or use of this equipment

RPC Distribution Board

The Rainbow Power Distribution Board has the electronic components pre wired and configured for easy installation.

The Distribution Board consists of 5 major components:

Sunny Boy Inverter

Converts Solar DC into 240v AC for distribution on the stand alone grid

Sunny Island Inverter

The Sunny Island supplies consumers on the stand-alone grid side and charges battery banks with the energy from grid-feeding units connected on the AC

HRC Fuse Holder

Provides connection point and fusing for batteries

DC Isolator

Isolates the PV Array

AC Distribution Box

Distribution point for all AC Circuits

PV Panels and Framing System

The PV array should be positioned to maximise the sites solar resource. The PV array should be positioned in a sunny spot preferably facing true north (true north differs from magnetic north). The angle of the array usually aims to optimizes the winter sun angle (Nimbin 40 degrees from horizontal)

RPC Systems use a variety of solutions to mount the PV array. Installers should consult the appropriate product manual for detailed description of mounting system assembly.

Please refer to "*Solar framing Installation Manual*"

!Warning!

Working at heights exposes you to the risk of falling. A physical barrier (scaffolding) or a correctly supported safety harness is required for working at heights.

Earth Fault Alarm

The LED lights and LCD screen on the face of the SB (SUNNY BOY) indicate operational conditions of the inverter.
The middle red LED indicates fault conditions, when a fault condition occurs a fault message will also appear on the LCD screen of the REMOTE DISPLAY. When this LED is on a problem has occurred and you may need to shut down your SB per SHUTDOWN instruction and call your installer or Rainbow Power Co. on (02) 6689 1430.

An Earth fault is an electrical connection between the live cells of the PV panel and the frame and so can result in hundreds of volts DC running through your roof sheets and PV framing.
The EARTH FAULT ALARM is requirement of AS 5003:2014 and must be installed in a place that will be seen every day. If your SMA REMOTE MONITOR is not next to the SB you will need to install an external EARTH FAULT ALARM or connect the SB to the Web continuously.

For an external alarm you will require a SMA MULTIFUCTION RELAY, which will need to be installed by your electrician into the SB and be run on 230V AC through a 2A CB and then to a visual alarm, possibly a red light or audible alarm. RPC can supply the MULTIFUCTION RELAY, external alarm and information on installation. If you are going to connect your system to the web then SMA Australia has advice on how to register your system on the web and set up a web based Earth Fault alarm.

PV Array Wiring

All PV array wiring should be protected from environmental damage and if in the confines of a building, i.e. wall or roof cavity, needs to be inclosed in Heavy duty conduit. Protection from UV, Water and Vermin needs to be considered. RPC recommends the use of conduit or other protective measures to alleviate these risks.

PV Panels come in a range of voltages. Your installation may require a combination of series and parallel connections to achieve the correct solar voltage for your system. Please consult you custom *"Wiring Diagram"* for correct configuration details.

A Series Connection will increase the VOLTAGE of solar panels without affecting the current. This is done by connecting the +POS from panel 1 to the -NEG of panel 2, until you have reached the desired solar voltage. The -NEG from panel 1 and the +POS from panel 2 will then be used to connect back to the Rainbow Power Distribution Board.

A Parallel Connection will increase the current of the solar array without affecting the voltage. This is done by connecting panels +POS wires together and -NEG wires together separately.

Many solar panels these days come with pre-wired cables and connectors (MC4 & MC3) to make panel connection easier. Branch plugs/sockets are used to make parallel connections. PV manufacturers all use different types of connectors with small variations. It is important that different brand connectors are not connected together.

Please Note: Refer to your custom *"Wiring Diagram"* for individual connection configuration.

PV Array Isolator

LV solar arrays are required to have a PV array isolators installed adjacent to the solar array and solar inverter. These Isolators are required to disconnect both the positive and negative poles of the array simultaneously. Please consult the installation Instructions supplied with the product.

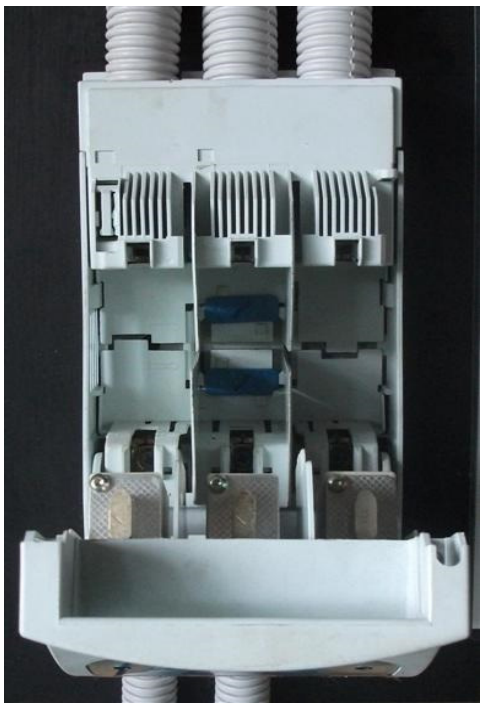
It is also important to ensure the waterproof IP rating of the rooftop isolator is maintained at all times. The switch face should be mounted on its side to stop water pooling and all conduit entries should occur from the bottom of the isolator.

!Warning!

Ensure PV array wires are terminated in solar Array isolator before connecting panels.

HRC Fuse Holder

The HRC Fuse Holder provides a robust and safe connection point to the Main Battery Leads coming from the batteries. Two HRC Fuses are supplied BAT+, BAT-. The fuses have been selected to protect main system wiring before it is distributed by the DC Distribution Box.



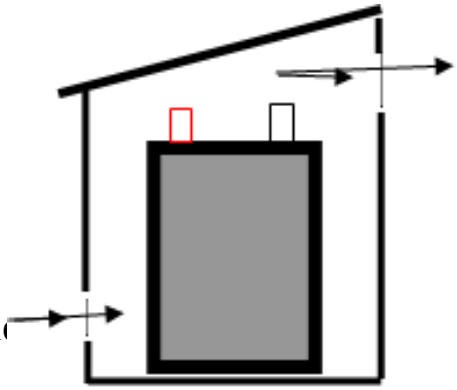
To Remove the HRC Fuses

1. Turn off all connected load and charge sources
2. Pull firmly outward on the handle of the fuse holder.
3. Lift upward to remove handle completely from holder
4. Remove individual fuses by sliding up and out of handle

Batteries

The Batteries need to be housed in a safe place, which allows adequate ventilation for any explosive gases to dissipate. The batteries ideally should be located in a lockable box with vermin proof ventilation holes. The Battery Box needs to ensure escaping hydrogen gas will not be exposed to sparks, naked flames or electrical equipment. Appropriate Battery warning signs have been supplied to be fitted. Figure 1 provides a guide to ventilation placement.

Figure 1: Placement of Battery ventilation in box to stop build up of explosive gases.



Battery Configuration

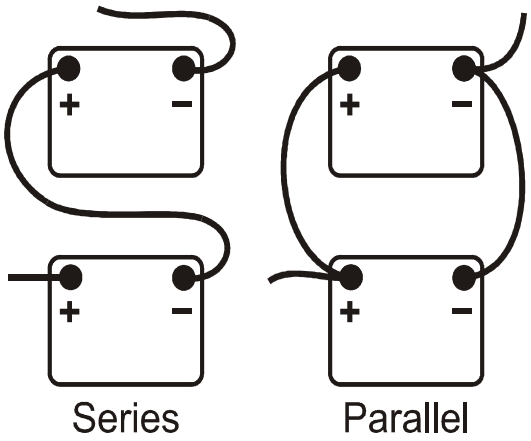
Battery banks are made up of multiple cells. Cells are assembled into individual batteries of 4, 6 or 12V. These units are combined in series to attain the designed system voltage of 48 VDC.

To make a Series connection the +POS from one battery will be connected to the -NEG of the second battery and so on until the desired voltage is achieved.

To make a Parallel connection the +POS from one battery will be connected to the +POS of the second. The –NEG is then connected to the –NEG of the second battery. The Positive and Negative battery leads leading to the HRC fuse leads should be taken off opposite corners of the paralleled battery bank. This ensures batteries remain balanced with equal paths of resistance.

Figure 2: Series and Parallel connection of Battery Banks. We suggest that no more than 2 batteries are wired in parallel.

2 x 100 Ah 12v cells wired in series to form a 100 Ah 24v battery bank



2 x 100 Ah 12v cells wired in parallel to form a 200 Ah 12 v battery bank

Batteries should be the last item of the system to be connected. The wire connected to the battery terminal should be lugged and soldiered to provide a robust connection. The terminals of the batteries should have protective shroud to stop accidental contact.

To Connect the Batteries,

1. Remove Main HRC Fuse handle from holder
2. Remove bottom protection plate from holder.
3. Connect the “Main Battery Leads” into the ‘HRC FUSES’ holder Battery POS+ and Battery NEG-
4. Connect Main Battery Leads to Battery bank BAT + and BAT –
5. Connect Remaining battery interconnect cables in the correct configuration as shown in your “Wiring Diagram”
6. Make sure all connections are tight.
7. Smear Petroleum jelly or a similar product onto the battery terminals to protect the terminals from corrosion.
8. Place temperature sensor between two batteries within 100mm of the top of the battery.
9. Check Polarity before reconnecting HRC BAT Fuse

Battery Temperature Sensor

Batteries are effected by temperature extremes. Battery charge characteristics change and so the SI needs to know what the actual battery temperature is to provide the right charging parameters. The BATTERY TEMPERATURE SENSOR needs to be installed for the SI to work properly.

<u>Installing Temp. sensor.</u>

1. *Turn off power as per 'Shut down Procedure'.*
2. *Break through the cable feed-through plate at a suitable position using a sharp object.*
3. *Feed both wires through into the SI.*
4. *Connect the wires to the BatTmp terminal using the 4-pole terminal. The polarity does not matter.*

Section 6.16 in the SUNNY ISLAND installation manual

Battery !Warning!

Batteries are heavy and should be moved using safe moving techniques. If they are too heavy to lift by one person then two people or mechanical lifting aid may be required. Personal protective equipment is required.

When batteries are being worked on, all charge/loads must be disconnected.

Batteries can produce thousands of amps under fault conditions and may explode. Potential fault current are 10 times batteries operating current. A 600Ah Battery has a 6000A fault current.

Never Short out between + and – battery terminals. Tools should have insulated handles to prevent this from occurring. Battery terminals must have insulated covers over the terminals for protection.

Flooded Lead Acid Batteries produce Hydrogen gas, which is explosive as well as corrosive and should be vented away from electrical equipment. No sparks or open flames are allowed near batteries, and warning signs should be installed appropriately.

Batteries contain corrosive electrolyte. Safety goggles must be worn in case of explosion or electrolyte splashes.

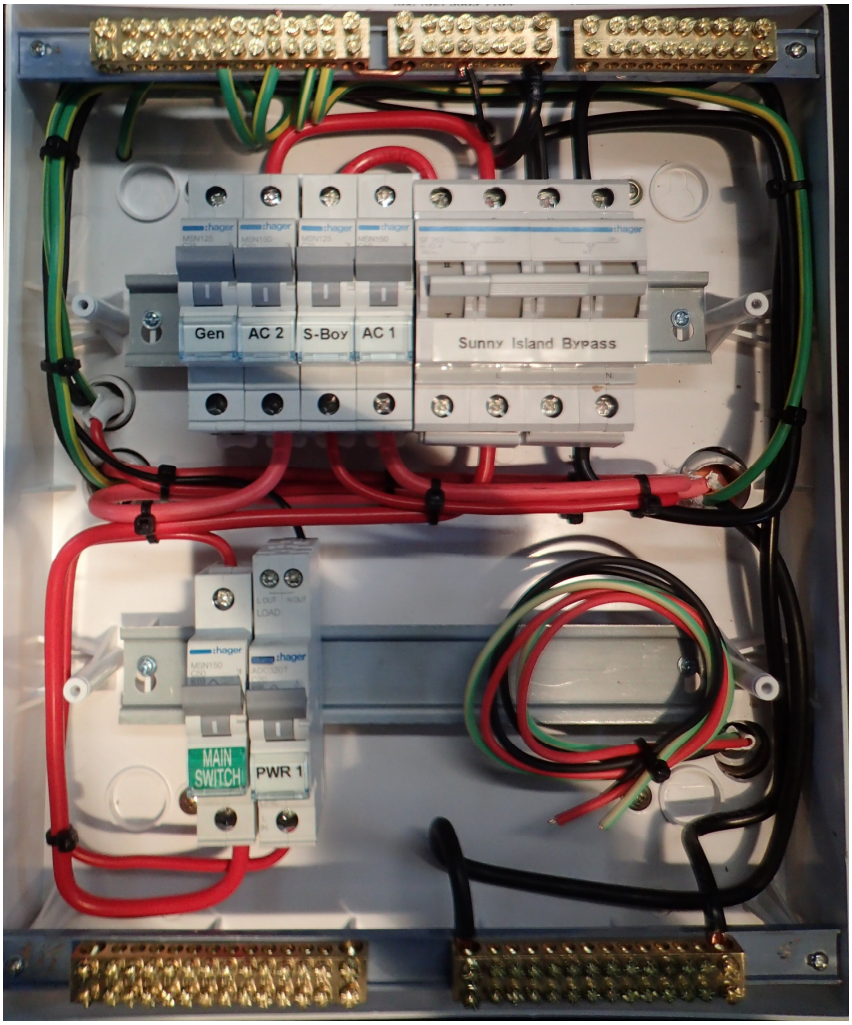
Clean water should be readily available near the batteries in case of acid contact with skin or eyes. Bi-carbonate soda mixed with water should also be available to neutralise any acid spills. .

Please Note: If spillage occurs. Water mixed with Bi-Carb Soda should be liberally poured over the spilled liquid.

AC Distribution Board

The RPC SMA Kit comes with a pre wired AC switchboard. The AC Switchboard aims to facilitate easy connection of the components on the SMA Stand Alone Grid. The switchboard consists of the following elements.

1) 25 amp Generator Switch (MCB)
2) 25 amp Sunny Boy Inverter Switch (MCB)
3) 50 amp Sunny Island/Sunny Boy AC1 Switch (MCB)
4) 50 amp Loads/Generator AC2 Switch (MCB)
5) 50 amp Load Main Switch (MCB)
6) 63 amp Transfer Switch



The Sunny Island has an internal 25 amp transfer switch. The Generator shall to be hardwired into the system as per AS/NZS 4509:2009. The AC switchboard has been designed to cater for the connection of the maximum load current of 50 amps. All AC circuits need to be suitably protected by circuit protection to meet *AS/NZ 3000:2007.* Please consult your supplied AC wiring diagram for further details.

System Commissioning

A check should also be conducted to ensure **all** wires are tightly secured, that **all** bolts and screws are tight. This includes wires that were installed by RPC

Once all equipment has been checked, the polarity of the panels and batteries should be confirmed using a multi meter prior to fuses being inserted and circuit breakers turned on.

Only now is it safe to energise or turn the system on.

!Warning!
Test the polarity of all connections with a meter before turning system on.

!Warning!
Check that all electrical connections are secure and tight before turning system on. Loose connections can heat up causing power loss, arcing and in extreme conditions melting.

Turning the System On

The Rainbow Power Distribution Board will have a 'SHUTDOWN PROCEDURE'. To energise the system the 'SHUTDOWN PROCEDURE' should be followed in reverse,

Consult *"System Operation Manual"* for further general information and the specific installation and operations manuals for specific equipment.

Notes