SMA Solar System

"Operations Manual"

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PRINCIPLES

You are now the proud owner of a Stand Alone Solar Power (SAP) System. This means that you have reduced the amount of Green House gases your household produces. 1kWh of electricity from a coal fired power station produces about 1kg of Carbon Dioxide or about 207 m^3 by volume. Carbon Dioxide is only produced in the initial production of the individual components of a solar power system. After the manufacture of PV cells (Photovoltaic panels), the electricity generated by them produces no more Carbon Dioxide or other Green house gases.

This Battery/Solar based system is designed for 'Cyclic' use, which means that power should be taken out of the batteries and put back in every day, approximately 10-15%. Systems that have occasional use i.e. Standby/UPS systems have different charging requirements that may not be met by the default parameters of this system

A SAP system allows your household energy autonomy away from the mains power system. If power grid problems affect the surrounding area you will still have access to electricity. Most importantly by taking the effort and expense to change your lifestyle you are doing your bit for the planet and future generations.

Most components of the solar power system require little maintenance. The battery bank may require the most maintenance (if it is a 'Flooded lead acid' battery) and occasional replacement. The information in this folder will guide you through, even if you have no previous experience with electrical systems:

1.1 **Solar array**. The solar array produces your power from the sun's light. A solar array consists of a number of solar (photovoltaic) modules (panels). Each solar module is a sealed unit which encapsulates a number of solar cells.

1.2 **Batteries**. Your batteries are the 'heart' of the system and may need to be maintained to ensure their full life span. When using your batteries to provide power, care needs to be taken not to discharge them below 85% on a daily basis. With a few days of overcast weather, the batteries may not get enough of a full charge from the solar panels and so you will need to monitor the battery bank to ensure it does not get too deeply discharged, either by reducing power consumption or using another energy source such as a petrol or diesel generator with appropriate battery charger. You should ensure that the maximum 'Depth of Discharge' never goes beyond 50%. The less often the battery bank gets deeply discharged the longer its lifespan. If deep discharges are difficult to avoid on occasions then do not allow this to happen more than once a month, obviously the less the better.

1.3 **Sunny Boy**. an Inverter, it converts the DC of the PV array to 230V AC and feeds it into the grid, or in this case into the SUNNY ISLAND. This Inverter can also be used as a 'Grid Feed' inverter but in this situation it is being used as a 'Solar charge controller' (*refer to 'Sunny boy' manual*).

1.4 **Sunny Island** a bidirectional inverter/Charger (battery to inverter then house and charger to battery). The SUNNY ISLAND supplies loads to your house and charges the battery bank with the energy from the SUNNY BOY and PV. *(Refer to 'Sunny Island' installation manual p12 for a SMA system overview.)*

1.5 **Remote Control** Allows the user to view information and control the SUNNY ISLAND from a distance of 20m away*. (refer to 'Sunny Island remote control' manual)*

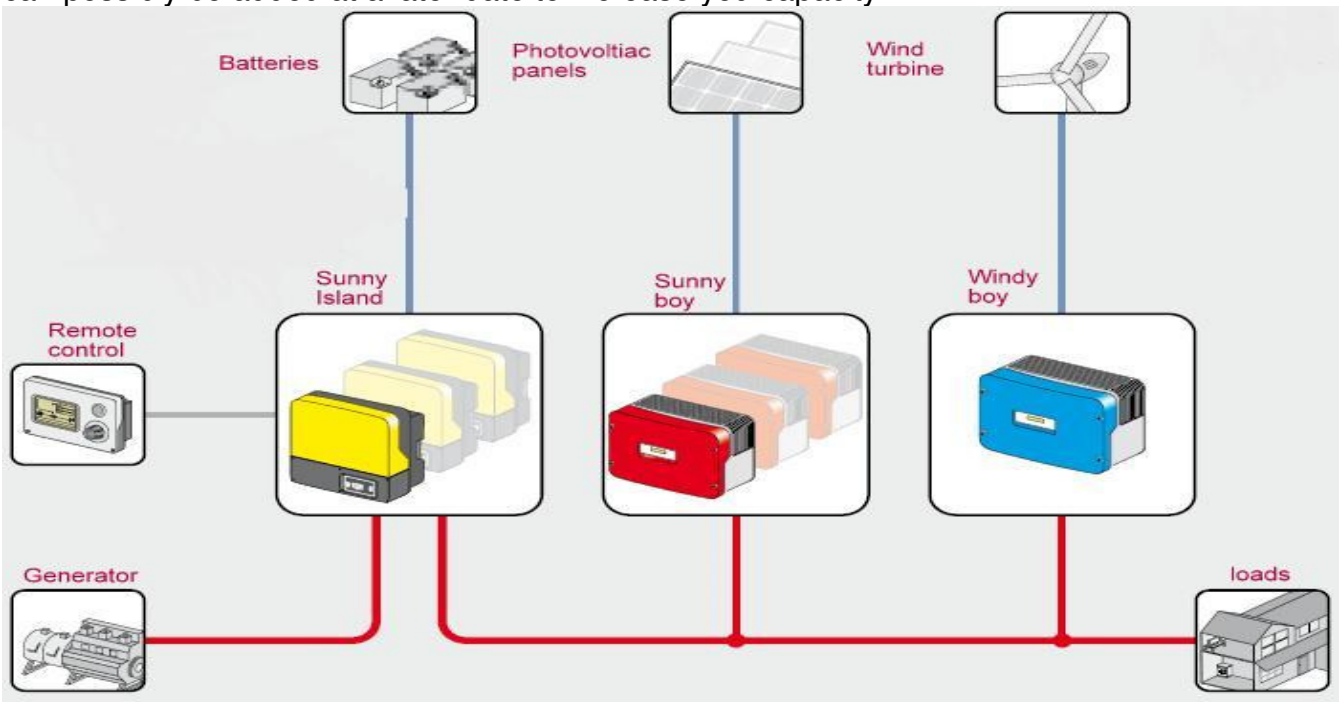
1.6 **Main HRC fuses**. These are industry standard fuses. These "High Rupture Capacity" (HRC) fuses are used in this instance as the main protection against battery short circuits. These fuses are located close to the battery bank in a single holder such that they can be pulled out in one single action in case of an emergency or to shut the entire system down.

1.7 **Circuit breakers**. These provide protection for you wiring. Although they are primarily for safety, they can also be used as a switch, allowing you to disconnect separate parts of the system manually.

1.8 **Earth Fault Alarm** Indicates an electrical connection between Positive or Negative of the PV and the PV metal framing. These should be electrically insulated from each other. If this occurs take not of any error message, turn of your Sunny Boy and call Rainbow Power Co. on (02) 6689 1430

It is recommended that you keep a log book of maintenance, regulator readouts and, if required, hydrometer readings. It would be a good idea to record all unusual events with your power system. It is also recommended to get a copy of the book "Energy from Nature" from Rainbow Power Company to give you a basic understanding of electricity and the components of your solar power system.

A brief rundown of the SMA Stand Alone system is as follows, below is a diagram of the how the SMA system is connected:
Sun shining on the PV panels is converted to DC (DIRECT CURRENT, similar to the power your car battery produces), which the SUNNY BOY then converts to AC (ALTERNATING CURRENT, which is what your household appliance run on). The AC power is sent to the SUNNY ISLAND which will send the electricity to you house or converts the AC to DC so that the batteries can be charged. The SUNNY ISLAND also convert the Batteries DC power to AC to be used by your appliances. As well a generator can be connected to the SUNNY ISLAND and be used to charge the batteries or run appliances. More PV & SUNNY BOYS can possibly be added at a later date to increase you capacity.



There are 2 manuals provided with the SUNNY ISLAND and SUNNY BOY. One is the 'installation' manual which has information on installation, technical information and error messages. The other is the 'user' manual which provides advice on day to day running of the piece of equipment. Please retain both manuals for future reference.

SAFETY

Earth Fault alarm: The LED lights and LCD screen on the face of the 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. When this LED is on a problem has occurred and you should shut down your SUNNY BOY per instruction below and call Rainbow Power Co.

It must be remembered that this system produces and uses electricity. If not treated responsibly it is potentially dangerous. Safety precautions and procedures must be followed at all times. **An electrician is required to install and repair this equipment.**

The system should be isolated (disconnected) from any item that is undergoing repair or maintenance.
This should be done using the shutdown that is provided with your system. Personal Protective Equipment should be worn at all times when maintaining your 'Flooded lead acid' batteries, eg Safety goggles, gloves, protective clothing.

Batteries.
No sparks or open flames near batteries.

! Safety goggles must be worn in case of explosion or electrolyte splashes.
! Battery terminals must have insulated covers over the terminals.
! Tools should have insulated handles to prevent sparks.
! When batteries are being worked on, all loads must be disconnected.
! Clean water should be readily available near the batteries in case of acid contact with skin or eyes.
! Bi-carbonate soda should also be available to neutralise any acid spills.
! No maintenance should be carried out if there is a strong smell of sulphuric acid. Seek advice.

The batteries are heavy and should be moved using good lifting techniques. Keep back straight, stomach muscles should be tightened and lifting should be done with your legs. If they are too heavy to lift by one person then two people or mechanical lifting aids will be required.

Photovoltaic Modules
Climbing on to the roof exposes you to the risk of falling off. A physical barrier (scaffolding) or a correctly supported safety harness is required when ever anyone climbs on to the roof.
A dramatic change of temperature can cause glass to shatter, so do not clean hot solar modules with very cold water or visa versa. If any maintenance on the solar array is required then call your solar installer

Gensets
240V gensets present a number of hazards including:

! Risk of electrocution.
! Accidents from moving parts.
! Inhalation of toxic exhaust gases.
! Flammable and/or explosive fuel.
! Burns from the exhaust pipe.
! Hearing damage from the noise.

Do not use temporary extension cables in long term situations. Use a licensed electrician to install any wiring that may be required. Follow the recommendations provided in the genset manual. If any maintenance is required, seek the services of a qualified technician. In some

installations the genset may start automatically and would need to be disconnected from the system before any maintenance is performed. Gensets should be housed in a childproof enclosure.

1. WARRANTY

It is important to be aware of your responsibilities to your system. If the procedures and precautions for using a Solar Stand Alone Power system are not adhered to then the warranties may be voided.

The following are important facts about your system that you should remember.

The Power System Sizing that was completed for you (Appendix B) will indicate how much energy (on average for each day and month of the year) is available from your solar power system. If this is exceeded and the batteries are allowed to discharge too deeply then the life and performance will be decreased. Be aware that if daily discharge regularly exceeds daily charge then it may take some time before any problems become apparent, but by that time you may have done damage to your battery bank.

When any extra appliances are introduced into your system you should ensure that they are used within the design load profile and to any other system requirements (eg that the inverter can handle the surge power and the battery bank can handle any extra discharge). Be aware of which appliances can be used at any one time. If this is exceeded then this could cause an overload and the Inverter should switch itself off. Even though the inverter has overload and over-temperature protection, it does not guarantee the inverter will survive frequent or serious overloads. A sudden overload occurs (such as turning on a pump) when the inverter is already approaching an excessive temperature may not cause a sufficiently rapid response to save it from damage. Despite the built-in protection, inverters overloads can thus still damage the inverter and/or cause the main battery fuse to blow.

A petrol or diesel generator with an appropriate battery charger is part of the supplementary system. This should be used if you have had insufficient sunshine for a number of days. This will protect the batteries from being discharged too deeply. The generator and battery charger should be used as a back up and should not be removed from the system.

INTRODUCTION TO SOLAR CHARGING

The SUNNY ISLAND stops your batteries from being over charged and over used. The SUNNY BOY works as the solar controller and the SUNNY ISLAND works as the charge controller, whether from the sun, generator or the electrical grid. In some instances there may not be enough Sun to fully charge your batteries and in those situations you may need to supplement the solar with a generator or use less power until the solar can properly charge the batteries.

How the SUNNY ISLAND controls the charge to your Battery Bank

Solar charge Regulators have different 'states' that change at different voltages to ensure the safest and most efficient charging of the battery, depending on how much sun is available.*(Refer to your SUNNY ISLAND 'installation' manual section 12 for a more detailed explanation on the SUNNY ISLAND charging process.)*

- **!** **Boost**. Is the most common charging process, it does this through a higher charging voltage over a short period of time. The boost charge process can charge the battery up to approximately 85% - 90%.
- ! **Absorption**. Absorption slows the charging process down. As the batteries reach full charge, the inverter/charger enables this function to prevent overcharging your batteries.
- ! **Float**. Once batteries are fully charged, the voltage is 'held' at a safe point and no extra charge is let through (unless it is needed).
- ! **Equalise**. Every 180 days, the SUNNY ISLAND slightly overcharges the batteries; this will leave your batteries at a 100%. This equalising charge allows the individual cells of the battery bank to reach an equal level of charge helping to prolong the life of your batteries. In 'Flooded lead acid' batteries this will cause bubbling, which indicates that mixing of the electrolyte is occurring.

2. GENERAL OPERATING PROCEDURE

Please refer to the relevant equipment manual to provide specific information on the operation of each piece of equipment.

Your system allows for a certain amount of power to be used at one time and over the 24 hour period. This limit is dictated by the continuous, intermittent and surge capability of your inverter as well as your battery capacity and the amount of PV available to replace the power taken out of your batteries daily. It is good practice to stay well within that limit. This means that you must be aware of how many appliances are on at one time and what they're power ratings are. The power rating, in Watts, is always written on the appliance, whether on the back, underneath or inside the lid or door. To keep the inverter cost down, it may not be designed to run every appliance at once. You will most likely not use every appliance in your home at once, so this is not a huge problem. Most problems will occur at night when all members of your household are home and using power and so is time when you will need to be aware of power use. You have discussed with the system designer the requirements of your system and you have been provided a 'LOAD PROFILE' (Appendix B), which shows you what your system was designed to do. It is an important fact that must be emphasised. Most problems occur in systems because of over use, i.e. Battery longevity problems, loss of power. So knowledge and understanding of your power use is important in order to prevent these problems.

When electric motors turn on they typically use 6 to 10 times their power rating for a few seconds. For example a fridge that uses approximately 100W on average will surge to 1400W for a fraction of a second. Inverters are made to deal with this, but if the inverter is running at

its limit, then the fridge turning may either shut the inverter down or cause damage to the inverter. If you have loads such as a fridge or a water pump that have large surge requirements, and may turn on at any time without warning, then you should either have spare capacity in the inverter to deal with such scenario or use a direct battery powered DC fridge and water pump. When you occasionally use large power appliances with high surge requirements (such as a microwave, hair dryer or iron) you might turn of the fridge or pump until you are finished, this could overcome that potential problem of overloads.

When buying any appliances you need to check their ratings and try to buy appliances that have the lowest power (watts) rating and are as energy efficient as possible, this will help to ensure you do not deplete you batteries and also give you more autonomy. You are now reliant on stored power, so this will be important.
Power over time equals energy. The daily energy consumption should, on average, be less than your daily energy production. The less charge is taken out of your battery bank, the longer it will last.

It is good to become aware of how much power and how much energy different appliances use. For example a medium sized domestic refrigerator requires roughly 120Wh of energy per day to run, depending on ambient temperature and how often the door is opened. These are rough figures and it will depend on the actual ratings of the appliance. So if you use your TV for 3 hours it will use 240Wh. A 60W incandescent light bulb will use 60Wh of energy to run in one hour whilst a 15W compact fluoro will produce an equivalent amount of light for one quarter of the energy.

The Energy (Watt-hour) rating of an appliance is equal to the amount of power (Watts) that the appliance uses multiplied by the number of hours it is used for. The energy used in one day is hence the measured Watts of the appliance multiplied by the number of hours for which it is used in one day.

Some appliances which use frequency to control clocks i.e. microwaves, ovens etc, may become inaccurate running on the SUNNY ISLAND AC output. The clock will run fast. The SUNNY ISLAND uses frequency to tell the SB to limit itself, so if you batteries have been fully charged early in the day the SI will raise the frequency from 50Hz to 52Hz and this will affect your appliance clock. The SI readjust the frequency every 12 hours to help keep the clock at the right time over a 24hr period but in this may mean that the clock is often out. RPC suggest that a battery operated clock or your mobile phone may be a safer source of time for important events.

3. MAINTENANCE

SOLAR PANELS require very little maintenance but they should be cleaned once or twice a year. Dirt and bird droppings may affect the ability of the panels to charge batteries as expected. Regular washing down of solar modules will improve their performance. This only needs to be done in dry dusty weather and can often be done with a hose from a distance without the need to climb up onto the roof and exposing yourself to the risk of falling off. Periodically it may be necessary to clean them with a cloth or sponge. Always use water that is at a ambient temperature. Hot water on cold panels or cold water on hot panels may cause the glass to shatter. It is recommended that the cleaning of solar panels be performed early in the morning. A physical barrier (scaffolding) or a correctly supported safety harness is required whenever anyone climbs onto the roof. If any maintenance of the solar array is required then call your solar installer.

BATTERY HOUSING should be regularly inspected. Check that the batteries have good ventilation to prevent build up of Hydrogen gas, and that no animals have destroyed wiring or are creating a short between the POSITIVE and NEGATIVE terminals. Signage has important information and needs to be left in place and intact.

BATTERIES should be **inspected monthly**.

FLOODED LEAD ACID BATTERIES

Before you carry out any battery maintenance, be sure to have the appropriate safety equipment and tools. Of all the components of a solar power system, the battery bank usually requires the most amount of maintenance and periodic replacement. Batteries also present a degree of hazard, both from the possibility of explosion with a spark or naked flame, and from skin and/or eye damage from being exposed to the electrolyte. It is very important to wear appropriate protective gloves and goggles. Battery acid will also destroy most fabrics, so don't wear your best and most expensive clothing. Always have free flowing water available close to your battery bank to wash acid from your skin, or eyes, if splashes occur.

We suggest that you mark the batteries i.e.: A, B, C or 1, 2, etc and then writing down the measurements, Specific gravity and cell voltage, made during maintenance. This will provide a history of your battery condition for you and for a technician if any problems occur.

The tools that you should have on hand include:

1. A multimeter to be able to check individual cell voltages,
2. A hydrometer to measure the specific gravity of the battery cells,
3. Baking soda mixed with water will neutralise spilled acid.
4. Correct size spanners and/or screwdrivers with insulated handles,
5. A plastic type dishwashing scourer for cleaning the batteries and terminals,
6. Hot water for cleaning battery terminal posts and connectors at the battery,
7. Anti-oxidant coating (petroleum gel) with which to coat the battery terminals and connectors.

Check the following:

! Check that the battery and battery terminals are clean. A relatively safe procedure is to pour hot water over the terminals if they have a build-up of oxidised material on them (usually blue, green and white coloured like oxidised copper).

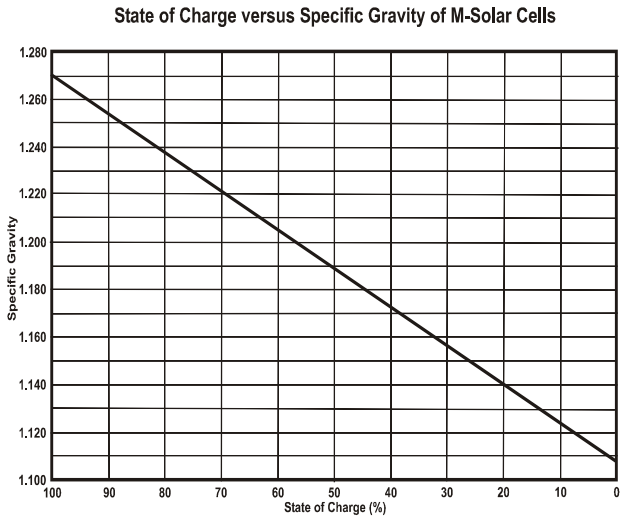
! Without over tightening check that the battery terminals are tightly connected with a spanner.

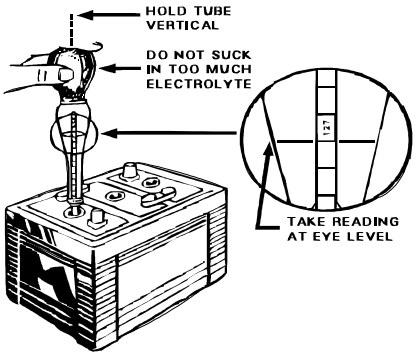
! Check the electrolyte level. In clear cased cells you can see the electrolyte level from the outside; otherwise you may need to remove the cap of each cell to look inside. Do not use a naked flame or anything that sparks as the battery will often contain an

explosive mixture of hydrogen and oxygen. The lead plates inside the battery must not be exposed to the air. They must remain submerged in electrolyte. There are often indicators (eg an embossed or painted line) on the battery to show the minimum and maximum electrolyte level of each cell. **Only add distilled or demineralised water**. Fill each cell to between 30 to 50mm below the top of the cell. **Do not** fill to the very top of the cell as it will spill out when the battery is charging. **Do not** use tap water, boiled tap water, bottled drinking water, creek water or rain water collected off a roof

! Check individual cell voltages with your multimeter.
A 100% charged cell should be about 2.12V. If the voltages are different from one another by more than 0.02 volts per cell, confirm that there is also a difference in the hydrometer readings. If so an equalising charge is required. If the cell voltages are all below 2 volts, check the hydrometer readings to confirm that the whole battery bank requires more charging.

! Electrolyte density (Specific Gravity or SG) measurements is a much more accurate and reliable way of checking state of charge than voltage measurements. A good SG reading for 100% charged batteries is about the 1270 mark. *(Refer to battery manufacturers' manual for more specific information relevant to your batteries.)*
Using a HYDROMETER, check the electrolyte density of individual cells, expel the air inside the hydrometer by squeezing the bulb and keeping it squeezed before inserting the hose at the base of the hydrometer into the electrolyte. Holding the hydrometer vertically, suck up the electrolyte of each cell that you wish to test by releasing the squeeze on the bulb and make sure that the float inside the hydrometer floats freely. If it doesn't float freely lift the hydrometer to just above electrolyte level and squeeze it again. The float has line markings and numbers printed on it. If you hold the hydrometer at eye level you can read the number which is level with the fluid. This number indicates the electrolyte density which directly correlates to state of charge. The deeper the float sinks in the electrolyte, the lower the battery's state of charge. It is recommended to number the cells, measure every cell of the battery bank and record the results for future reference. Take note of any cells which give consistently poorer results and label them as "pilot" cells. This allows you to only measure these cells if you are just checking the overall state of charge. If the pilot cell reads a low SG then you should measure all the cells to see how much the SG varies. A large variation (greater than 0.02) would indicate that an equalising charge is required.





SEALED OR GELL BATTERIES

Similar to 'Flooded lead acid' batteries except that no water is added to them and you cannot use a hydrometer to check specific gravity. These types are generally referred to as 'Maintenance free'.

! Check that the battery and battery terminals are clean. A relatively safe procedure is to pour hot water over the terminals if they have a build-up of oxidised material on them (usually blue, green and white coloured like oxidised copper).

! Without over tightening check that the battery terminals are tightly connected with a spanner.

REGULATOR

! Check that the regulator is still charging the batteries.

! Check that all connections are tight. If they are loose shut down or isolate the Solar Modules and the Batteries from the regulator and tighten or reconnect cables.

GENERATOR

! Check oil levels regularly.

! The generator should be run at least once a month. To help establish a routine it is a good idea to pick a particular day such as the first or the last Sunday of the month. Regular running will keep all internal parts lubricated with oil and so inhibit rust.

! Diesel and petrol have a life span of 6 months. If kept for longer than this, a fungus will start to grow and spoil the fuel. Write a use-by date on the container.

If any maintenance is required, seek the services of a qualified technician.

4. SHUT DOWN PROCEDURE

7.1 Turn off **all** APPLIANCES and SUNNY BOY at the AC Distribution box.

7.2 (if you have a SUNNY REMOTE CONTROL). Turn off SUNNY ISLAND by holding down the 'ENTER' button on the SUNNY REMOTE CONTROL. This will put the Sunny Island in 'STANDBY MODE' (bars on the display will show the remaining time).

7.3 Turn off the SUNNY ISLAND by pushing the 'O' (off).

7.4 Turn off PV ARRAY ISOLATOR and all other CHARGING SOURCES (genset, wind turbine, micro-hydro etc). WARNING: Solar Isolators will not de-energise PV ARRAY or PV CABLING.

7.5 Pull out MIAN BATTERY ISOLATOR. This will ISOLATE batteries from the system.

If necessary:

7.6 Disconnect BATTERY terminals.

Safety goggles should be worn and due care should be taken.

a. With an insulated spanner, making sure that the spanner does not touch the other terminal.

5. START UP PROCEDURE

The SUNNY ISLAND has two phases of 'start up' procedures. *(Refer to the SUNNY ISLAND 'Installation manual' section 10. p81 for detailed information on this)* The first phase asks if you want to initialise the system, this is just if you want to change system parameters. Don't change parameters on the SUNNY ISLAND unless directed by a qualified person. The second phase which asks you start the inverter is the one you want.

<u>If disconnected:</u>

8.1 Reconnect BATTERY terminals.

8.2 Reconnect MAIN BATTERY ISOLATOR.
8.3 Turn on PV ARRAY ISOLATOR. Make sure that all AC appliances are turned off.
8.4 To turn on the SUNNY ISLAND push the 'I' (on) button. When the screen displays "STNBY: To start INV hold <Enter>". Hold down the button.
8.5 (if you have a SUNNY REMOTE CONTROL) push the 'ENTER' button on the remote control. When the screen displays "STNBY: To start INV hold <Enter>". Hold down the button.
8.6 Switch on the SUNNY BOY at the AC distribution box.
8.7 Once the SUNNY ISLAND is on it is safe to turn on AC APPLIANCES.

6. BASIC FAULT FINDING

Earth Fault alarm: The LED lights and LCD screen on the face of the 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.

When this LED is on a problem has occurred and you should shut down your SUNNY BOY per instruction below and call Rainbow Power Co. An EARTH FAULT is a dangerous situation your roof may be live with several hundred volts DC. Because of this fault the SUNNY BOY will have already stopped providing a charge for your batteries and will not charge until the fault has been removed.

SHUTDOWN PROCEDURE OF SUNNY BOY

1. **Take note of the Error Message on the LCD screen.**
2. **Turn off CB marked 'S-Boy'.**
3. **Turn off 'PV array DC isolator'**
4. **Call Rainbow Power Co. on (02) 6689 1430**

You have turned off your main charge (SUNNY BOY) source until the fault condition has been rectified. It may be necessary to use you GENERATOR to charge your batteries until the SUNNY BOY can be turned back on.

Some faults with your system can be traced to usage. For example, if you switch on an appliance and the power suddenly turns off then you may have exceeded the amount of power you are able to use at one time. So the first thing to do is to check whether the inverter is still switched on. If it has switched itself off then, first switch off all appliances then manually turn off the inverter and. If the wattage of the appliances that you turned off is known, add up these wattages and compare that to the inverter rating. This will tell you if you have theoretically exceeded the inverter rating. Turn the inverter back on again and then turn on whatever appliances are required, one by one. If everything seems OK this could have been the problem, in which case you will have to be careful of how much power is being used at one time. As mentioned earlier, when a motor is turned on it will use 6 times the power rating for only a few seconds. The Inverter has an allowance for a power surge for a few seconds (see Surge rating in inverter specifications). The surge rating of an inverter will usually allow for surges of this type. Inverters will also turn off if the batteries are too low, in this case the SUNNY ISLAND will indicate that this has happened. The SUNNY ISLAND and SUNNY BOY provide error codes for some problems. Some of the codes description can be found in the equipments' 'Installation manual'. Other codes can only be interpreted by SMA technicians

If, when checking the cause of power failure, you find that the inverter is still on then a circuit breaker may be the problem in which case you may need to call a qualified electrician.

If the **battery** Specific Gravity (SG) and/or the voltage reading are low then they may be being discharged too deeply. This may indicate that too much power is being used and the charge rate is not keeping up with the usage. You may have to analyse your power usage and/or check that the system is still charging.

If you have any questions or the problems persist then please call RAINBOW POWER COMPANY or qualified solar technician. **An electrician will be required to do any repairs on the system.**

7. AUSTRALIAN STANDARDS

The following Australian Standards have been observed in the manufacture, design and/or installation of this Stand Alone Power System:

AS 1170.2-1989 –Minimum design loads on structure.
AS 1319-1994 –Safety signs for the occupational environment.
AS 1359.109-1998 –Rotating electrical machines- General requirements – Noise limits.
AS 1530.4-1990 –Methods for fire tests on building materials, components and structures.
AS 1768-1991 –Lightning protection.
AS 1940-1993 –The storage and handling of flammable and combustible liquids.
AS 2676.2-1992 –Guide to the installation, maintenance, testing and replacement of secondary system.
AS 3000-1986 –Electrical installations – Buildings, structures and premises.
AS 3010.1-1987 –Electrical installations – Supply by generating set.
AS 3595-1990 –Energy management programs.
AS 4086.2-1997 –Secondary batteries for use with stand-alone power systems.
AS 4509.1-1999 –Stand-alone power systems – Safety requirements.
AS 4509.2-2002 –Stand-alone power systems – System design guidelines.
AS 4509.3-1999 –Stand-alone power systems – Installation and maintenance.
AS/NZS 1044-1995 –Limits and methods of measurement of radio disturbances characteristics.
AS/NZS 3000-2000 –Electrical installations.
AS/NZS 5033-2012 –Installation of photovoltaic (PV) arrays.
IEC/TS 61836 Ed. 1. –Solar PV energy systems.

11. DEFINITIONS

AC, Alternating current-. In Australia the power from the electricity grid is set at 230V AC and used by household appliances.
Amps/current - is the measure of the flow rate of electrons through a conductor.
Amp-Hour - is the number of amps multiplied by the number of hours.
Amp-Hour Capacity - is the rating of batteries and indicates standard discharge rates; 10, 20 or 100 hour discharge. How much current can be used each hour till the battery is flat.
Boost Charge - is a charge which takes place at a voltage higher than the normal floating voltage. Is can be referred to as gas charge, refresher charge and equalising charge.
Charge - is the process of chemical change when a battery receives and stores energy from a charging source.
Cycle Operation - is the process of discharge and recharge. One cycle is one discharge and recharge.
Days of Autonomy – Refers to the amount of days without enough sun to charge you batteries before you would need to use an alternative battery charge source; i.e. a generator.
DC, Direct current – Batteries and Photovoltaic panels produce DC power.
Deep Cycle Battery - a battery designed large cycling without losing capacity. These batteries are built differently to your car battery.
Depth of Discharge (DOD) – Refers to the percentage of charge taken out of the batteries; i.e. 10% D.O.D. means that 10% of the battery charge has been used leaving 90% of the Battery charge still inside the battery.
De-sulphation - is the treatment given to a sulphated battery. See Sulphation.
Discharge - is the process of chemical change when a battery delivers energy to the load.
Earth Fault – is when there an electrical connection develops between the individual photovoltaic cells and the frame of the panel. This means that the Panel could be 'live' and give an electric shock. An Earth Fault alarm will indicate this and the system should then be turned off and your installer contacted to rectify.
Electrolyte - in the case of lead-acid batteries is a diluted, liquid solution of sulphuric acid that acts as the storage medium of the battery. 'Gel cell' and 'Sealed' batteries have a gel instead of a liquid and so do not need demineralised water added.
Equalising Charge - is a process which brings all cells of a battery to a fully charged state by correcting small irregularities in the state of charge of individual cells. It is a form of boost charge with the intent of bubbling and mixing the liquid solution of the battery. Sometimes called 'Gas charge'.
FLA - Flooded Lead Acid Batteries these are a similar design to the basic car battery in that they require water to be added periodically. Batteries for SAPs use are usually called 'Deep Cycle' and are a different construction than starter or car batteries.
Float Operation - is a method in which batteries are theoretically preserved in a fully charged state by maintaining all cell voltages above but close to the true open circuit voltage (OCV).
Gel batteries - sometimes called 'sealed' or 'maintenance free' batteries. These are completely sealed so that no water can be or is needed to be added. They do require minimal maintenance in the form of cleaning and checking the tightness of connections.
Open Circuit Voltage - The terminal voltage of a PV panel with nothing connected (neither charging nor discharging).
Recharge - is the restoration of the battery to its maximum amp hour capacity after a discharge.
Sediment Space - The space between the bottom of the plates and the bottom of the container. Also referred to as footroom.
Shallow Cycle - is a working cycle which does not discharge beyond 50% of the 10 hour rate capacity.

Shunt – A device that allows large currents to be measured through a circuit using a smaller sensitive meter.
Specific Gravity - is the ratio between the weight of equal volumes of a substance, sulphuric acid and pure water.
State of Charge (SOC) - Refers to the percentage of charge left in the batteries; i.e. 60% SOC means that 60% of the battery capacity is still theoretically available. Please note that it is not recommended to regularly discharge the battery beyond 50% SOC.
Sulphation - an undesirable process that takes place on the plates of a lead-acid battery as a result of the battery being left in a discharged or semi-discharged state for a long period of time, resulting in the seriously reduced capacity of the battery. The chemicals inside the battery have solidified at the bottom of the battery and are not available for the chemical reaction of discharge and recharge.
VRLA Batteries – Valve Regulated Battery are similar to 'Gel batteries' and are also called 'sealed and maintenance free'. These batteries have a pressurised valve system and so no water can be added, they can be installed in different orientations and release less gasses during normal operations. They do require minimal maintenance in the form of cleaning and checking the tightness of connections.
Volts - is the force that causes electrons to flow between two points of a conductor. Also referred to as electromagnetic force (emf) and potential difference.
Watts - is a measure of power - a combination of volts and amps. Watts = Amps x Voltage.
Watt-Hours - is the same as amp-hours multiplied by voltage.