

# SELECTRONIC AUSTRALIA

## SA21 OWNERS MANUAL

<b>Contents:</b>	<b>Page</b>
<b>INTRODUCTION</b> .....	2
<b>WARRANTY CARD</b> .....	2
<b>INSTALLATION</b> .....	2
CONNECTION OF AC AND DC WIRING.....	3
<b>OPERATION</b> .....	5
<b>ENERGY MANAGEMENT</b> .....	5
STATUS .....	5
READINGS .....	6
SETTINGS.....	8
CONTROLLER OUTPUTS .....	8
ALARM INPUTS .....	12
CURRENT SHUNT SETTINGS.....	12
<b>OVERLOAD SHUTDOWN AND ALARMS</b> .....	14
<b>FAULT FINDING</b> .....	15
<b>SYSTEM MAINTENANCE</b> .....	17
SA21 MAINTENANCE .....	17
BATTERY MAINTENANCE.....	17
<b>SA21 ELECTRICAL SPECIFICATIONS</b> .....	18
<b>RADIO FREQUENCY INTERFERENCE</b> .....	19
<b>HANDY HINT</b> .....	19
<b>APPENDIX I: DIAGNOSTICS</b> .....	20
<b>APPENDIX II: FLOW DIAGRAM FOR DISPLAYS AND SETTINGS</b> .....	21
READINGS .....	21
MINIMUM CHARGE DISPLAY .....	22
SETTINGS.....	23
<b>APPENDIX III: SA INVERTER OPTIONS</b> .....	25
GENERAL .....	25
SA-SB-01 INTERFACE KIT .....	25
SA-KP-01 OPTIONAL KEYPAD INSTALLATION.....	27
SA-S200 OPTIONAL CURRENT SHUNT INSTALLATION .....	28
<b>WARNING</b> .....	29
<b>PRODUCT WARRANTY CONDITIONS</b> .....	29
<b>MOUNTING TEMPLATE FOR SA-KP-01 KEYPAD</b> .....	30

# INTRODUCTION

Thank you for purchasing the Selectronic Sine wave inverter, model SA21 with ENERGY MANAGEMENT.

Your SA21 is a state-of-the-art high performance TRUE SINE WAVE DC to AC Power Inverter incorporating ENERGY MANAGEMENT, a unique energy monitoring and controlling system developed by Selectronic to enable you to maximise your limited energy resource.

**THE SA21 WILL AUTOMATICALLY CONFIGURE ITSELF TO OPERATE ON EITHER 12 OR 24 VOLTS, SO YOU MAY UPGRADE YOUR 12V SYSTEM TO 24 VOLTS WITHOUT CHANGING THE INVERTER.**

Thousands of hours of development time have been invested in the SA21 to provide you with a reliable, high quality product. The output from your SA21 is as good as, if not better than mains power and if looked after properly, the SA21 will give you many years of reliable service.

## WARRANTY CARD

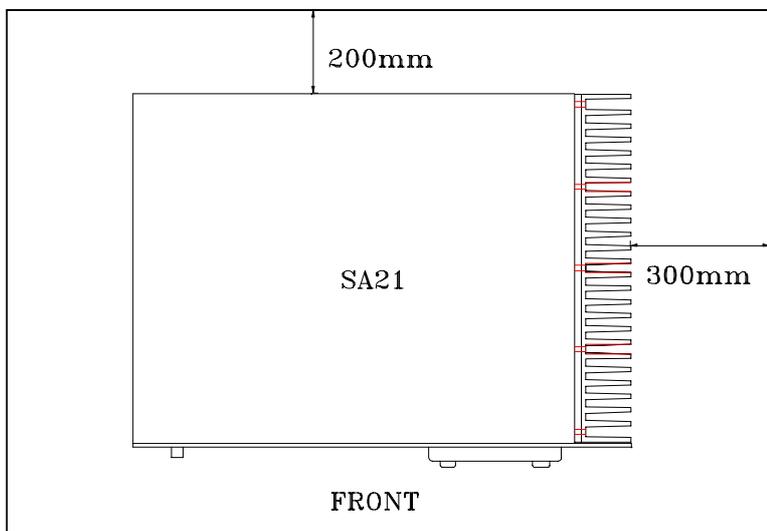
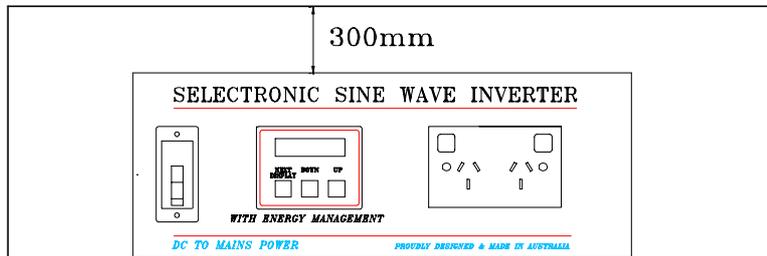
**Before proceeding any further, it is extremely important that you complete your warranty card NOW. This will enable us to immediately register your 24 month warranty period, and also make you eligible for our free warranty extension option. Six months after the purchase date of the SA21, Selectronic will send you a questionnaire. Simply complete and return the questionnaire to us and we will extend your warranty, free of charge, for a lifetime. By accurately completing your warranty card and questionnaire, you will provide us with valuable information that will assist us in keeping up with your alternative energy needs. Please take a few moments to fill in the warranty card. Your efforts will be greatly appreciated.**

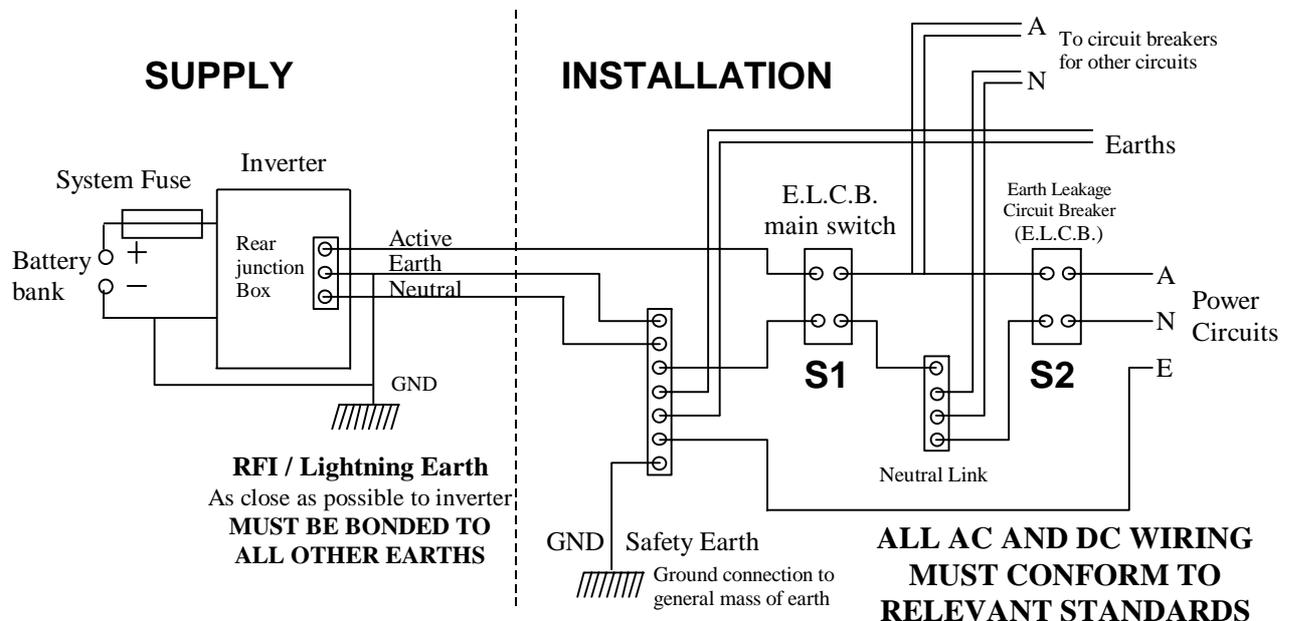
## INSTALLATION

The installation of your inverter is extremely important. Failure to follow the recommended installation instructions may void your warranty. If in doubt, ask your supplier.

After unpacking the SA21, check for any damage which may have occurred during transit. If there are any signs of damage, contact your supplier immediately.

The inverter must be installed in a dry, cool, dust-free environment. Please leave at least 300mm clearance at the right hand side (Black heatsink fins), 300mm above the inverter and approx. 200mm at the rear as this will aid the natural cooling of the inverter. The air vents on the underside of the SA21 also need to be kept clear of obstructions.





We suggest that you house your inverter along with other power generating equipment in a remotely sited purpose built area. Also make sure that the exhaust from your generator or other sources of heat or fumes are kept well away from the SA21. SEIAA (Solar Energy Industries Association Of Australia) installation guidelines must be followed.

You must have a suitable 12V or 24V DC battery bank which is maintained and operated to the battery manufacturer's recommendation. To ensure operation to SA21 specification, the battery bank should have a minimum capacity of 500 ampere hours for 24V or 900 ampere hours for 12V, at the 100 hour discharge rate (ask your supplier if in doubt). Smaller capacity batteries can be used but may result in degraded performance of the SA21 under heavy surge conditions.

## CONNECTION OF AC AND DC WIRING

**IMPORTANT:** Before making any wiring connections, check that the circuit breaker located on the front panel is in the OFF position, i.e. LEVER DOWN.

Your electrician should firstly connect the AC wiring via the three terminal rear junction box. Carefully observe the correct connections. Please refer to the rear panel view of the SA21 on the following page.

BROWN	ACTIVE	(red dot, top connector)
GREEN/YELLOW	EARTH	(E, centre connector)
BLUE	NEUTRAL	(Bottom connector)

The lid of the junction box has knockouts to allow conduit entry. Make sure the connections are tight and safe. Re-fit junction box cover.

**NOTE:**  
**ALL AC WIRING MUST BE CARRIED OUT BY A LICENSED ELECTRICIAN  
AND MUST CONFORM TO AS 3000 WIRING REGULATIONS,  
OR RELEVANT STANDARDS.**

Verify that the circuit breaker on the front panel is in the **OFF** position, **LEVER DOWN**.

Now connect the battery cables:

RED = BATTERY POSITIVE (+)  
BLACK = BATTERY NEGATIVE (-)

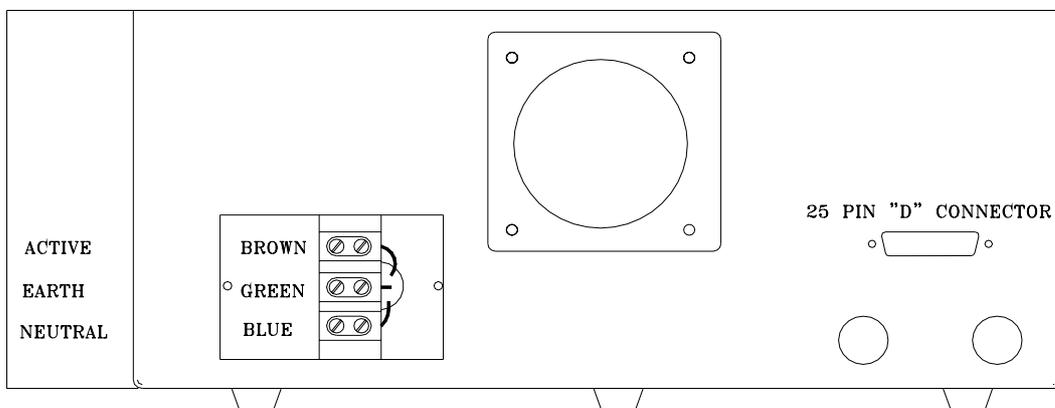
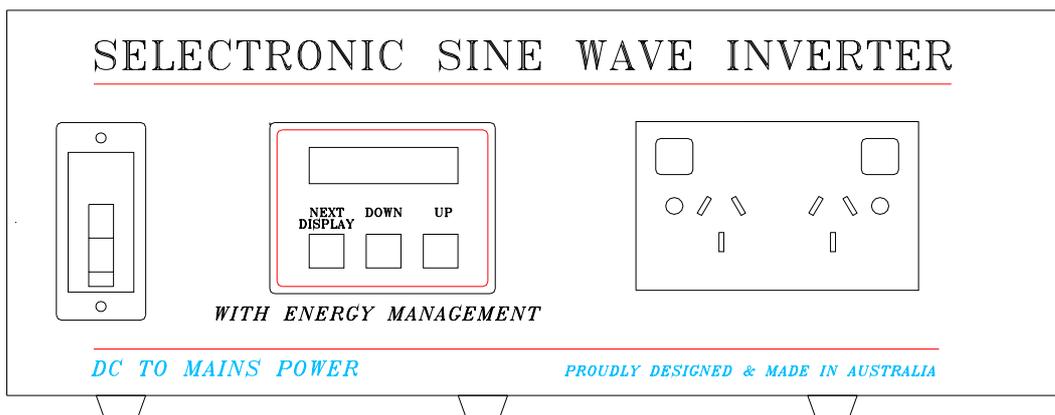
These connections should be tight. If using nuts, bolts and washers, they should be stainless steel. At this point re-check the connections before proceeding any further.

**NOTE:**

IF THE SA21 EMITS A PULSING BUZZER SOUND, THE BATTERY LEADS HAVE BEEN CONNECTED IN REVERSE. IMMEDIATELY DISCONNECT THE LEADS AND RECONNECT WITH THE CORRECT POLARITY. **DO NOT** UNDER ANY CIRCUMSTANCES TURN ON THE BREAKER WHEN THE BUZZER IS PULSING AS PERMANENT DAMAGE TO THE SA21 WILL RESULT.

If all is well, turn the breaker ON, i.e. switch lever UP. If after two (2) attempts the circuit breaker does not turn on, then check that the battery voltage is between 10 and 17V, or between 20 and 34V DC. If the breaker still won't switch on, refer to the FAULT FINDING section of this manual.

## FRONT PANEL



## REAR PANEL

## OPERATION

To gain more understanding of these operational notes, it is suggested that they be read in conjunction with hands on access to an inverter with DC power applied.

When you first apply power to the SA21 with default factory settings, the SA21 should be in **STANDBY** mode. There may be a quiet pulsing sound and the red neons on the power point will flash if turned on. The SA21 is now ready for use with no further adjustments necessary, using the factory settings.

If the display shows **TIME**, the default settings have been changed, and the day and time will need to be set before the display will return to **STATUS**.

## ENERGY MANAGEMENT

The SA21 incorporates **ENERGY MANAGEMENT**, which allows you to monitor and control your energy system by displaying information on the Liquid Crystal Display. Settings can be adjusted via the front panel keys.

## STATUS

Status : <b>STANDBY</b> Inverter : <b>OFF</b>
--------------------------------------------------

Status : <b>CONT</b> Inverter : <b>ON</b>
----------------------------------------------

Status : <b>RESET</b> Inverter : <b>OFF</b>
------------------------------------------------

The first screen will display the Status of the SA21. There are three status conditions: **STANDBY**, **CONT** (continuous) and **RESET**, which are explained in more detail below.

When this screen is displayed, the Status can be changed by pressing the **UP** or **DOWN** keys. Each time the **UP** key is pressed, the status will change from **STANDBY** to **CONT** then **RESET** and back to **STANDBY** whereas the **DOWN** key will change the Status in the reverse order.

The second line indicates whether the inverter is **ON** or **OFF**, i.e. if there is 240V available from the 3 pin outlet or not. During pulsing, **OFF** is displayed on the second line, reverting to **ON** when a load is connected and the inverter starts.

The **STANDBY** mode means that the SA21 is producing pulses of power while waiting for an appliance to be switched on. This is frequently called the “demand start” because as soon as the appliance is operated, the SA21 will turn on and remain on until the appliance is switched off. After a 10 second delay, the SA21 will return to **STANDBY** mode, awaiting another load.

This feature is extremely important as it conserves valuable battery power when no appliances are on.

**CONT** mode (continuous) means the inverter will be on at all times regardless of the load. This situation is useful if you have small loads such as VCRs or digital clocks that require 24 hour power, or if loads are too small to be sensed in the **STANDBY** mode. The only disadvantage is that when no appliances are operating, the SA21 will be drawing more power than it would in **STANDBY** mode.

**RESET** mode electronically shuts down the inverter. When placed in this mode, any overload or shutdown conditions are also reset.

## READINGS

The SA21 ENERGY MANAGEMENT has six "Readings" displays to give you vital information about your inverter and your batteries. By pressing the 'NEXT DISPLAY' key on the front panel, the screen information rotates through displays of inverter Status, Time, AC Volts, AC Amps and Battery Volts. When the optional current shunt (SA-S200) is installed, four additional readings are available; these being Nett DC Current, Peak Charge Current, Nett Daily Amp Hours and Battery percentage Charge.

### TIME

Mon : 15:06  
--- Readings ---

Displays the Current Time (as a 24Hr clock) and day. This time is set as described in "Settings" (see Page 8).

### AC VOLTS

AC Volts : 240V  
---Readings---

This screen gives an approximate indication of the AC voltage produced by the inverter. The AC volts would normally read between 230V and 245V except under high load or low battery conditions.

### AC AMPS

AC Amps : 2.5A  
---Readings---

The AC current reading shows the total current drawn from the AC output by the appliances connected to the inverter.

### BATTERY VOLTS

Batt Volts: 24.6V  
---Readings---

Displays the DC Battery volts. This provides you with an indication of the condition of your battery bank.

## WHERE THE OPTIONAL 200 AMP CURRENT SHUNT IS INSTALLED:

### DC CURRENT

Amps : 23.6A OUT  
---Battery---

This reading gives a nett current; i.e., either charging the battery (IN) or being taken out of the battery (OUT). The range for this reading is 0-100A IN and 0-200A OUT continuous or 0-400A OUT intermittent.

### PEAK AMPS

Pk Amps : 45.6 IN  
---Battery---

This reading gives the peak nett charging current into the batteries for the present day (today). If no load has been present for the entire day, this will indicate the peak combined charging current from your solar panels, wind generator or other charging sources, thus allowing you to monitor their operation. During the first day after the inverter is turned on at the circuit breaker, this screen will display a meaningless figure.

## NETT AMP HOURS TODAY

Net AH : 69 IN  
---Today---

This reading gives a Nett figure of Amp Hours since midnight last night. A Nett AH reading of IN indicates more Amp Hours have gone into the battery than have been used. The opposite applies for a Net AH reading of OUT.

1 Amp Hour = 1 amp for 1 hour, or 2 amps for ½ hour, etc.

## BATTERY CHARGE

Charge : 87%  
---In Battery---

This reading shows the amount of charge present in you battery bank at any given time. i.e. 100% means a fully charged battery.

## MINIMUM CHARGE

With the optional current shunt (SA-S200) installed, the minimum charge in your batteries today, this week or for a number of weeks or days can be logged (Minimum daily discharge). Minimum charge readings are accessed by pressing the UP and DOWN keys together for 1 second.

These vital readings give you the information you need to maximise your battery life. This is done by managing your loads to maximise this figure, e.g. using heavier loads later in the day or at other times when the battery charge is high.

## MINIMUM CHARGE TODAY

MIN CHARGE : 76%  
In Batt Today

The minimum charge in the battery since midnight last.

## MINIMUM CHARGE THIS WEEK

MIN CHARGE : 76%  
In Batt This Wk

The minimum charge in the battery since midnight last Saturday.

## MINIMUM CHARGE WEEKLY LOG

Weeks ago : 1  
Min Charge : 76%

This displays a log of the minimum weekly charge in the battery for up to 52 weeks. The logged weeks may be stepped through by pressing the UP or DOWN key. The weeks that have not logged AH as yet will display 255%.

## MINIMUM CHARGE DAILY LOG

Days ago : 1  
Min Charge : 76%

This displays a log of minimum daily charge in the battery for up to 30 days. The logged days may be stepped though by pressing the UP or DOWN key. The days that have not logged AH as yet will display 255%.

## SETTINGS

There are a number of settings within the SA21 that can be changed via the front panel push keys (push buttons). These allow you to tailor the SA21 inverter and ENERGY MANAGEMENT sections to suit your system requirements.

Settings are accessed by holding down the NEXT DISPLAY key for at least 1 second whilst in any "Readings" display. The value of the parameter displayed can be modified by pressing the UP or DOWN keys.

Pressing the NEXT DISPLAY key will take you to the next parameter to be set. Pressing the NEXT DISPLAY key after the last parameter is displayed will take you back to the "Readings" displays.

**Please note:** If DC power is disconnected from the inverter, the "Settings" which have been entered will be saved and held in permanent memory. However these settings are not saved until the display is returned to "Readings".

## CONTROLLER OUTPUTS

The SA21 ENERGY MANAGEMENT has 2 control outputs, as mentioned on page 25, each of which can be activated with time, inverter cutout and/or low ampere-hours. The six settings are displayed as **OFF**, **ON**, **TIME**, **INV CO**, **LO A/H** and **CO+LAH** respectively

For simplicity, the displays shown are for control output 1 only. Control output 2 settings are identical to control output 1. Pressing the UP or DOWN keys will change the setting.

On with : OFF  
[Set Control 1]

The control 1 output will remain off at all times.

On with : ON  
[Set Control 1]

The control 1 output will remain on at all times.

On with : TIME  
[Set Control 1]

The control 1 output will come on at the Start Day, Start Hour and Start Minute that is set in the three screens below.

The Start Day can be set to ALL which will turn the output on every day at the set time. Pressing the UP or DOWN keys will change the setting.

The output will remain on for the time set in "Duration". (see next page)

Start Day : SUN  
[Set Control 1]

Start Hour : 16  
[Set Control 1]

Start Min : 30  
[Set Control 1]

On with : INV CO  
[Set Control 1]

(Inverter Cut out) The control 1 output will turn on when the inverter shuts down due to overload, over temperature or low or high voltage. The output will remain on for the time set in "Duration", below. The output will not come on if the front panel circuit breaker is tripped.

On with : LO A/H  
[Set Control 1]

(Low Amp-Hours) If the charge in the batteries falls below the level set in the "Minimum Charge" setting (see page 13), then the control output will come on, for the time set in "Duration", below.

On with : CO+LAH  
[Set Control 1]

(Cutout or Low Amp-Hours) This setting combines the previous two, bring the output on with low amp hours, or with the inverter cutting out. The output will stay on for the time set in "Duration", below.

Note that the controller can only be set to **LO A/H** and **CO+LAH** if the optional external current shunt kit (SA-S200) is used. Each controller output is capable of switching an external relay or contactor which can be used to switch AC or DC loads.

If the controller is set to **INV CO**, **LO A/H** or **CO+LAH** and the condition still exists after the "Duration" time, the output will stay on until the condition ends. Also with these settings a "Lockout" option can be set ON or OFF. (See lockout below and on page 11)

## LOCKOUT

Lockout: ON  
[Set Control 1]

If set to ON, lockout prevents the controller output coming on during the lockout period. (See notes on lockout on page 11.) Pressing the UP or DOWN keys will change the setting.

## DURATION

Duration : 4 Hrs  
[Set Control 1]

This screen sets the duration hours the control 1 output will stay on. Pressing the UP or DOWN keys will change the setting.

Duration : 30 Min  
[Set Control 1]

This screen sets the duration minutes the control 1 output will stay on. Pressing the UP or DOWN keys will change the setting.

## BUZZER ON / OFF

Buzzer : ON  
[Set Parameters]

This display allows you to select whether the audio alarm sounds during an overload or other alarm conditions. If set to OFF the buzzer will not sound during an alarm condition. The alarm condition will still be displayed. Pressing the UP or DOWN keys will change the setting.

## BUZZER LOCKOUT

Buzz Lockout:OFF  
[Set Parameters]

If set to ON, lockout prevents the buzzer from sounding during the lockout period. See lockout on page 11. Pressing the UP or DOWN keys will change the setting.

## MORE SETTINGS

Any key to end  
or DOWN for more

Pressing NEXT DISPLAY or UP keys will save the settings entered and go back to 'Displays'. If the DOWN key is pressed, more settings will be displayed.

## SET DAY

Day : MON  
[Set Parameters]

Sets the current Day. Use the UP and DOWN keys to set the value.

## SET HOUR (TIME OF DAY)

Hour : 15  
[Set Parameters]

Set the hours in the current time of day (24 hour time). Use the UP or DOWN keys to set the value.

## SET MINUTE (TIME OF DAY)

Minute : 30  
[Set Parameters]

Sets the minutes in the current time of day. Use the UP or DOWN keys to set the value.

## DEMAND START SENSE

DS Sense : 6W  
[Set Parameters]

This sets the minimum load which will bring the SA21 ON when the inverter Status is set to STANDBY mode (demand start or pulsing). See page 5. In most cases the default setting of 6W would be suitable. If there is a load which the SA21 won't sense then reduce this value until the SA21 starts. Alternatively if there is a small load that keeps the SA21 on then increase this value. You may need to try a few different settings to find the most appropriate value for your installation. Use the UP or DOWN keys to set the value.

## LOCKOUT

Lockout is a feature which ensures that you are not disturbed during a specified period of time, e.g. you do not want to start a generator in the middle of the night. When set to ON, lockout prevents the controller outputs coming on, or the buzzer sounding during the lockout period.

The lockout start and finish times below affect both controller lockout, and buzzer lockout. (See Buzzer Lockout on page 10.) Buzzer lockout and controller lockout may be set ON or OFF individually.

### SET LOCKOUT START TIME

Lockout on: 22:00  
[Set Parameters]

This is the time the lockout for the controllers and buzzer commences. After this time, the buzzer will not sound and the controlled outputs will not come on. If a control output is already on, lockout will not turn it off. Use the UP or DOWN keys to set the time.

### SET LOCKOUT FINISH TIME

L'out off: 6:00  
[Set Parameters]

This is the time the lockout for the controllers and buzzer ends. Use the UP or DOWN keys to set the time.

### LOW VOLTAGE TRIP

Lo Volt Trip: YES  
[Set Parameters]

When set to YES, the circuit breaker on the front panel will trip to completely disconnect the inverter from the batteries when the DC battery volts remains below the '**Lo DC Volts**' setting (described below) for more than 2 minutes. Use the UP or DOWN keys to change the setting.

### LOW DC VOLTS CUTOUT

Lo DC Volts: 20.0  
[Set Parameters]

The SA21 will cut out (not tripping the breaker) and a message displayed if the battery voltage falls below this setting for more than 10 seconds, regardless of the setting of '**Lo Volt Trip**'. The inverter will restart if reset or when the battery volts rise above the '**Lo DCV On**' setting (next setting).

Please note that if the battery volts drop below 17V for a 24V system or 8.5V for a 12V system (regardless of the '**Lo DC Volts**' setting) then the breaker will trip instantly, disconnecting the SA21 from the battery.

### LOW DC VOLTS ON

Lo DCV on: 24.0  
[Set Parameters]

The SA21 will restart after a Low Battery Volts cut-out when the battery volts rise above this setting. Use the UP or DOWN keys to set the value.

### HIGH DC VOLTS CUTOUT

Hi DC Volts: 34.0  
[Set Parameters]

When the battery volts exceeds this setting, the SA21 will cut out instantaneously. Please note that if the battery volts rise above 35V for a 24V system or 18V for a 12V system (regardless of the '**Hi DC Volts**' setting), the breaker will instantly trip and the inverter will be totally disconnected.

## AC VOLTS SETTING

AC Volts : 240V  
[Set Parameters]

Allows the output voltage to be set from 220V to 240V if an output voltage other than 240V is required. Use the UP or DOWN keys to set the value. NZ users should set this to 220VAC.

## ALARM INPUTS

The ENERGY MANAGEMENT has 2 alarm inputs (shown on pages 25 and 26) which can be set to trigger an alarm condition. (See page 15).

Use the 'Lo' setting if the input is connected to a normally closed set of contacts (see fig 2.1 on page 26), or when the voltage falls below 1V on alarm (see fig. 2.4).

Use the 'Hi' setting if the input is connected to a normally open set of contacts (see fig. 2.2 on page 26), or when the voltage rises above 3V on alarm (see fig. 2.3).

### ALARM INPUT 1

Alarm1 active: Hi  
[Set Parameters]

Set alarm input 1 to HI or LO active. Use the UP or DOWN keys to change the setting.

### ALARM INPUT 2

Alarm2 active: Hi  
[Set Parameters]

Set alarm input 2 to HI or LO active.

## EXTERNAL KEYPAD

Ext. Keypad: YES  
[Set Parameters]

This is set to YES if an optional external keypad (SA-KP-01) is connected. Otherwise this is set to NO. See page 27. Use the UP or DOWN keys to change the setting.

## CURRENT SHUNT SETTINGS

### EXTERNAL SHUNT

Ext. Shunt: YES  
[Set Parameters]

This is set to YES if an optional external current shunt (SA-S200) is connected. Otherwise this is set to NO. See page 28. Use the UP or DOWN keys to change the setting.

If the current shunt is set to YES the following settings will be displayed.

## ZERO DC AMP READING

Zero DC Amps: OFF  
[Set Parameters]

This setting is used to zero the current reading from the external current shunt. See installation notes in Appendix III on page 28. Use the UP or DOWN keys to change the setting. Note: when this setting is set to ON, a zero DC amps is performed taking about 1 to 2 seconds, after which the display returns to OFF.

## BATTERY CAPACITY

Capacity : 500AH  
[Set Parameters]

This is the capacity of the batteries in ampere-hours at the system discharge rate. For example, a solar powered system will generally use the C/100 (100 hour rate), but a diesel recharge system may use a discharge rate of C/20 (20 hour rate). Your system designer will advise you on this figure. Use the UP or DOWN keys to set your battery capacity.

## CHARGE IN BATTERY

AH IN Batt : 445  
[Set Parameters]

This setting is used at setup to enter the initial charge in the battery in Ampere Hours, or during use to bring the readings back in line. Use the UP or DOWN keys to set the value.

## MINIMUM CHARGE IN BATTERY

Min Charge: 60%  
[Set Parameters]

If the charge in the battery bank drops below this level, an alarm will sound if the low charge alarm (the next setting) is set ON. Use the UP or DOWN keys to set the value.

## LOW CHARGE ALARM

Lo Chg Alarm: OFF  
[Set Parameters]

If set to ON, an alarm will sound if the charge in the batteries drops below the Min Charge setting above. Use the UP or DOWN keys to change the setting.

## BATTERY CHARGE EFFICIENCY

Batt Effic.: 95%  
[Set Parameters]

This setting is determined by the system design and the type and age of the batteries used. If the battery efficiency is unknown, then we suggest that you use the default setting of 95% initially, and adjust if the ampere-hours in the batteries differs from the readings.

## END SETTINGS

End Settings  
[Set Parameters]

Press NEXT DISPLAY key to return to "Readings".

# OVERLOAD SHUTDOWN AND ALARMS

The SA21 has eight alarm and overload conditions. These result from high or low battery volts, high AC volts, AC output overloaded, transformer too hot, heatsink too hot, either of the two alarm inputs being active, or low battery charge. If any of these conditions occur, a message will be displayed. If there is more than one alarm condition the display will alternate between messages.

The alarm message will remain on the display until a key is pressed, even if the alarm condition ends. (i.e. after a high voltage condition the battery volts comes back down again) This allows you to determine the cause of the shutdown even if the inverter comes on again before you are able to read the display. To reset the inverter after it has shutdown, set the inverter Status to RESET, and then back to STANDBY. (See page 5.)

## DC VOLTS HIGH

Hi DC Volts: 16.5  
\*\*Press a Key\*\*

This message is displayed and the inverter shuts down if the battery voltage rises above the **'Hi DC Volts'** setting. The inverter will automatically restart when the battery voltage drops below this value. The present battery voltage is also displayed.

## DC VOLTS LOW

Lo DC Volts: 9.5  
\*\*Press a Key\*\*

This message is displayed and the inverter shuts down if the battery voltage drops below the **'Lo DC Volts'** setting for more than 10 seconds. The inverter will automatically come on again when the battery voltage rises above the **'Lo DCV ON'** voltage or if the inverter is manually reset (via the STATUS display, see page 5). The present battery voltage is also displayed.

## AC VOLTS HIGH

AC Volts Hi: 0  
\*\*Press a Key\*\*

If a system fault causes the AC voltage to go too high, then this message is displayed.

## INVERTER OVERLOAD

Inverter O/L: 0  
\*\*Press a Key\*\*

An AC current overload or a short circuit on the AC output will cause the inverter to shut down and display this message. If the shutdown was due to an overload, the SA21 will automatically reset after 1 minute. If the shutdown was due to a short circuit, the SA21 will have to be reset (via the STATUS display, see page 5) on the front panel.

## TRANSFORMER TOO HOT

TX Too Hot: 122C  
\*\* Press a Key \*\*

If the transformer reaches its maximum operating temperature, the SA21 will shut down to protect the internal components. The SA21 will restart again only when the temperature drops to a safe level. The present temperature of the transformer is also displayed.

## HEATSINK TOO HOT

HS Too Hot: 82C  
\*\*Press a Key\*\*

If the heatsink reaches its maximum operating temperature, the SA21 will shut down to protect itself. The SA21 will come on again only when the temperature drops to a safe level. The present temperature of the heatsink is also displayed.

## ALARM 1 ACTIVE

Alarm 1 Active :  
\*\*Press a Key\*\*

When the Alarm 1 input on the SA21 is activated, (see "Settings" on page 12) this message is displayed and the buzzer sounds. The buzzer will continue to sound as long as the input is active.

## ALARM 2 ACTIVE

Alarm 2 Active :  
\*\*Press a Key\*\*

When the Alarm 2 input on the SA21 is activated, (see "Settings" on page 12) this message is displayed and the buzzer sounds. The buzzer will continue to sound as long as the input is active.

## LOW CHARGE ALARM

Lo Charge : 59%  
\*\*Press a Key\*\*

If the battery charge drops below the '**Min charge**' setting, and the '**Lo chg alarm**' setting is set to 'ON' then this alarm will sound. You are then able to take appropriate action such as removing loads or starting a generator to prevent further discharge and possible damage to your batteries.

## FAULT FINDING

### 1. INVERTER STAYS ON EVEN WHEN NO APPLIANCE IS BEING USED.

This can be a common problem known as a "phantom load", but can be easily overcome with ENERGY MANAGEMENT. Some appliances will need to be switched off at the power point as they may still represent a small load despite being switched off at the appliance. Check again to make sure there are no appliances left on, then sequentially switch off appliances at the wall and by watching your night light (as described in "Handy Hint" on page 19), check to see if the SA21 returns to pulsing mode (after a 10 second delay). Once you have found the offending appliance, adjust the sensitivity of the demand start up (see set parameters) until the inverter turns off. Once this is done re check that small loads will still bring the inverter on when required.

### 2. INVERTER WILL NOT COME ON WHEN SMALL APPLIANCE IS SWITCHED ON.

This means that your demand start sensitivity is set too high. With the appliance in question switched on, adjust the demand start sensitivity until your SA21 turns on. See Demand Start Sense on page 10.

### **3. INVERTER SHUTS DOWN DURING MIDDLE OF THE DAY, AND COMES BACK ON LATE IN THE AFTERNOON.**

This is more than likely caused by high battery volts during peak charging times from solar panels. To overcome this, adjust the high voltage cutout of your SA21 (see High DC Volts Cutout on page 11); the maximum voltage allowable being 34 Volts for a 24 Volt system or 18 Volts for a 12 Volt system. If this is still not high enough you may have a problem with either your batteries or your regulator. This could be potentially dangerous so we advise you to consult your system designer immediately.

### **4. INVERTER SHUTS DOWN WITH LOW VOLTS.**

If your SA21 has shut down because of low DC volts it could be due to the following:

- (1) A sustained large load could be causing the battery volts to drop to a low enough point to cause the SA21 to cut out. This is not normally a fault with the SA21 but could be due to the following:
  - (a) Battery bank is too small - consult your system designer.
  - (b) A bad connection between the batteries and inverter due to a loose or corroded terminal. In this case, please refer to the maintenance section of this manual.
  - (c) One or more battery cells could be faulty - consult your installer.
- (2) If your battery volts are below 23.0V on a 24V system or 11.5V on a 12V system with no loads connected, the batteries may require charging. Use a hydrometer to check the specific gravity of each cell. Consult your battery manual for the correct specific gravity (SG) readings.

### **5. INVERTER SHUTS DOWN DUE TO HEATSINK TOO HOT**

This is likely under heavy sustained load conditions since the SA21 shuts down to protect its internal components. If you believe that the load is not excessive, check around the inverter case and heatsinks for obstructions to air flow as this will cause the inverter to heat up much quicker and shut down sooner than normal. Also check that the clearances around the SA21 are as specified in INSTALLATION on page 2.

### **6. “CHARGE IN BATTERY” APPEARS INCORRECT**

It is possible that this figure can accumulate errors, as battery charging / discharging is a very complex procedure with many variances; a hydrometer is always the most accurate method of determining a battery's state of charge. If your system regulator is showing FLOAT then you should be able to presume your batteries are close to, or actually, 100% charged. You can confirm this with a hydrometer. If the “CHARGE IN BATTERY” figure is not reading correctly, adjust it by the method shown in page 13. If the figure is consistently too low, (e.g. 90% when the system shows FLOAT) you should increase the battery charge efficiency figure as described in page 13. Alternatively, if your system is not in float and the reading is already 100%, you should reduce the battery efficiency.

### **7. INVERTER PULSER SLOWER THAN NORMAL WHEN IN STAND-BY**

This means that the inverter has not been switched on for approximately 20 minutes and has gone into a power saving mode, thus pulsing at about half the normal rate.

### **8. “NETT AMP HOUR” APPEARS INCORRECT**

This could be caused by one or both of the following:

- (a) The clock is not adjusted correctly, see page 8.
- (b) The “DC Amps” reading is not correct. Adjust this by zeroing the meter, see pages 13 and 28.

## SYSTEM MAINTENANCE

To get the optimum performance from your SA21 power inverter, particularly under heavy appliance loads, it is essential that the battery bank and the DC wiring are all in good condition. The small amount of time spent on the suggested maintenance tasks that follow will maximise the reliability of your system.

### SA21 MAINTENANCE

Periodic maintenance of the SA21 inverter involves little more than checking for unobstructed operation of the cooling fan, which is located at the rear of the inverter. Note that cooling air is drawn in through vents underneath the inverter.

Suggested inverter maintenance should include:

1. Check for unobstructed fan operation. Clear away any dust or foreign matter from the fan grill using a soft bristled brush. (Do not direct high pressure compressed air at the fan blades)  
Note that the fan is designed to come on during heavy power demand.
2. Check between fins of the heatsinks and clean out any accumulated foreign objects, for example, insect nests.
3. Verify that the air flow beneath the chassis is not restricted.
4. Clean external surfaces of the SA21 using a soft, lint free cloth, with polish and wax. e.g. Mr. Sheen.

### BATTERY MAINTENANCE

1. Every week, carry out a thorough visual inspection of all battery wiring, taking particular note of the condition of inter-connections between cells.

#### **IMPORTANT:**

**When working on batteries of such high capacity, it is essential that you wear protective clothing, some form of eye protection and rubber-soled work boots. Please regard your batteries with a great deal of caution, and if in any doubt, entrust this work to your installer.**

2. Check that the stainless steel inter-connecting bolts are tight and have minimal corrosion. If corrosion is evident, carefully follow the following procedure.
  - (a) Disconnect the system battery fuse before working on the battery bank.
  - (b) Unbolt the stainless steel bolts and nuts of any corroded connections and thoroughly clean the joint with a wire brush or file, taking extreme care not to short circuit any battery cells with any tools.
  - (c) Re-assemble and smear a small amount of Vaseline or similar grease over the surface of the joint to slow down any future corrosion.
3. Every month: measure the specific gravity (SG) of each cell using your hydrometer, to ensure that all cells are performing correctly. Any serious imbalance should be reported to your system designer in case remedial action needs to be taken.

# SA21 ELECTRICAL SPECIFICATIONS

**INVERTER TYPE** PWM Full bridge power stage, with true sine wave AC output.

## DEMAND START SECTION

Type:	Pulsing AC
Minimum Load Power to start (User adjustable):	3W to 20W
Maximum response time:	1 sec
Standby current from battery (Average):	75mA @12V; 60mA @ 24V

## BATTERY VOLTAGE RANGE

	12V	24V
Low DC Volts Disconnect (Instantaneous):	8.5V	17V
Low DC Volts Cutout (Delayed, User Adjustable):	9.5-11V	19-22V
Low DC Volts Cut-in (Delayed, User Adjustable):	11.2-13V	22.2-26V
High DC Volts Cutout (Instantaneous, User Adjustable):	15-17	30-34V
High DC Volts Disconnect (Instantaneous):	18V	35V

## TOTAL APPLIANCE RATING AT 25°C 40°C

	25°C	40°C
Continuous:	1200W	1100W
30 Minute rating:	1500W	1300W
5 Minute rating:	2200W	1900W
1 Minute rating:	2900W	2500W
Surge rating:	3600W	3600W

## INVERTER EFFICIENCY

Peak (at 200W):	91% (12V)
No load power consumption (CONT mode):	0.65A @ 12V; 0.75A @ 24V

## MISCELLANEOUS SPECIFICATIONS

Output Frequency Accuracy:	50Hz ± 0.001 %
Output Voltage Accuracy (0 - 2000W)	240V ± 6 %
Total Harmonic Distortion (THD)	< 4 %
Control Outputs 1 & 2, max DC sinking current:	50 mA
Alarm Inputs 1 & 2, input switching level:	HI > 3 V LO < 1 V

DC Input is Electrically Isolated from AC Output

**Note:** Through a policy of continued development, specifications are subject to change without notice.

The above specifications are based on unity power factor.

## **RADIO FREQUENCY INTERFERENCE**

For many years, Radio Frequency Interference (RFI) has been an annoying problem for owners of Inverters. RFI in a domestic situation causes noise or interference on a radio or TV receiver. Most of the problems with RFI in a Remote Area Power Supply (RAPS) installation involve AM radio reception.

Considerable development time has resulted in a reduction of the RFI produced by the SA21 to a level that complies with Australian Standard AS1044. Compliance to this standard means RFI is low but how well the inverter performs in a particular installation can vary. Below are some suggestions to help reduce the effects of RFI in your installation.

It is recommended that the power system including the inverter is housed at least 15 metres from the home.

Ensure a good earth stake is placed as close to the inverter as possible. See installation on page 3 for wiring.

Avoid running DC wiring into the home, if at all possible. If this cannot be avoided, run DC and AC in separate conduits separated by as much distance as practicable. All DC wiring should also be kept as short as possible.

To further reduce the effects of RFI, it is important that your AM radio has good signal strength. This will enable your radio to reject any noise being produced by your inverter, regulator, controllers or DC lighting. If possible, try moving the radio around to improve signal strength or use an external aerial. Some of today's building materials such as steel roofs and foil insulation may form a barrier to incoming radio signals. If an external aerial is required, it should be on the outside of the home, mounted as high as practicable and as far from the battery shed as possible. Connection from the aerial to the radio should be via a low loss coaxial cable.

**PLEASE NOTE:** The aerial must be an AM RADIO type. A TV aerial will not work.

## **HANDY HINT**

It is very important that you become familiar with the functioning of your inverter. Since most Inverters are remotely sited from the home, it is not always easy to know if the inverter is ON or pulsing. An easy way to determine this is to plug a small child's night light (neon type) into a power point which is easily visible, or replace the power point with a safety type with a neon indicator. This will indicate the inverter's operation by flashing when the inverter is pulsing and remaining on when the inverter is brought on by a load.

# APPENDIX I: DIAGNOSTICS

The "Diagnostics" is a special set of displays that give additional information about the SA21. These are normally only used when advanced troubleshooting is undertaken. The "Diagnostics" section displays the transformer and heatsink temperature, demand start current and software version information.

"Diagnostics" is accessed by holding both UP and DOWN buttons together twice, for at least 1 second each time, during the display of any "Readings" screen with the exception of "Status". The NEXT DISPLAY key takes you through the "Diagnostics" displays, eventually returning to the "Readings" display. See page 22 for more information.

## TRANSFORMER TEMPERATURE

```
TX Temp : 75C
** Diagnostics **
```

This display is the operating temperature of the transformer inside the SA21 in degrees Celsius.

## HEATSINK TEMPERATURE

```
HS Temp : 34C
** Diagnostics **
```

This displays the operating temperature of the heatsink.

## DEMAND START CURRENT

```
D/S Current : 48
** Diagnostics **
```

This gives a reading of the value read by the demand start sense circuit and can be useful during advanced demand start troubleshooting.

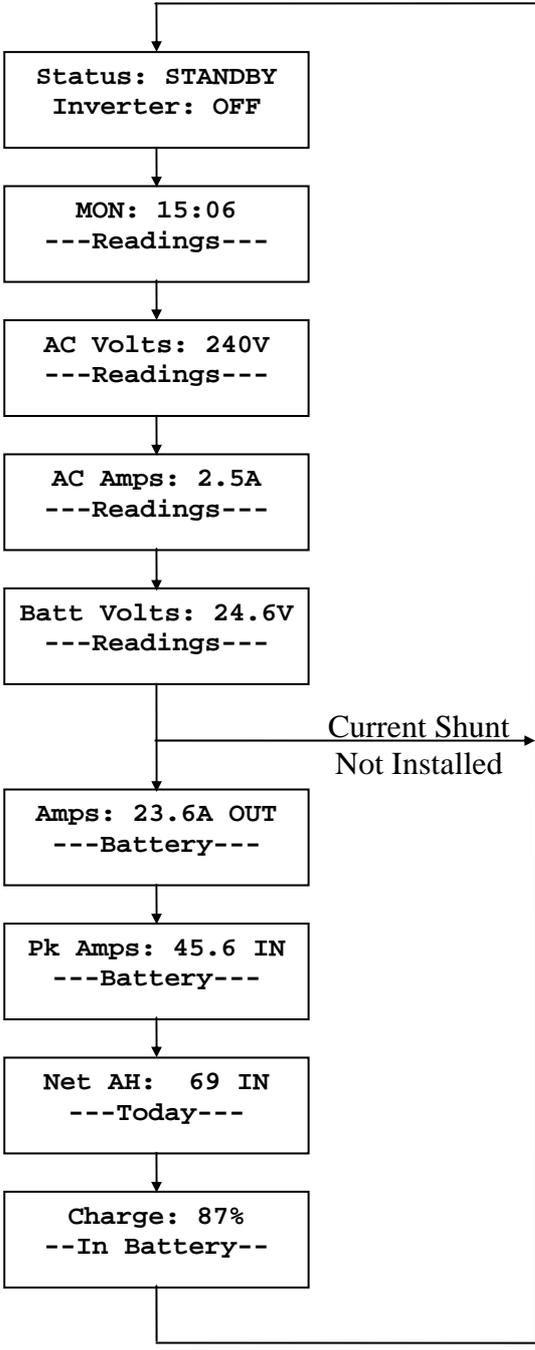
## SOFTWARE VERSION

```
SELECTRONIC C
SA21 1.02 1995
```

This displays the revision of the software running your SA21. Please note that this software is Copyright to SELECTRONIC AUSTRALIA P/L and it is an offence to copy or duplicate any part of this program. This is the last screen in the "Diagnostics" and pressing the NEXT DISPLAY key once more will return you to the readings.

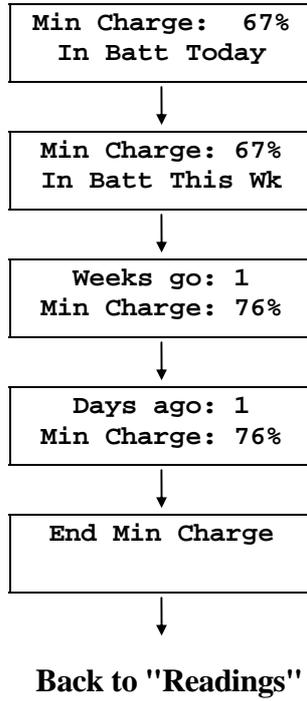
# APPENDIX II: FLOW DIAGRAM FOR DISPLAYS AND SETTINGS

## READINGS

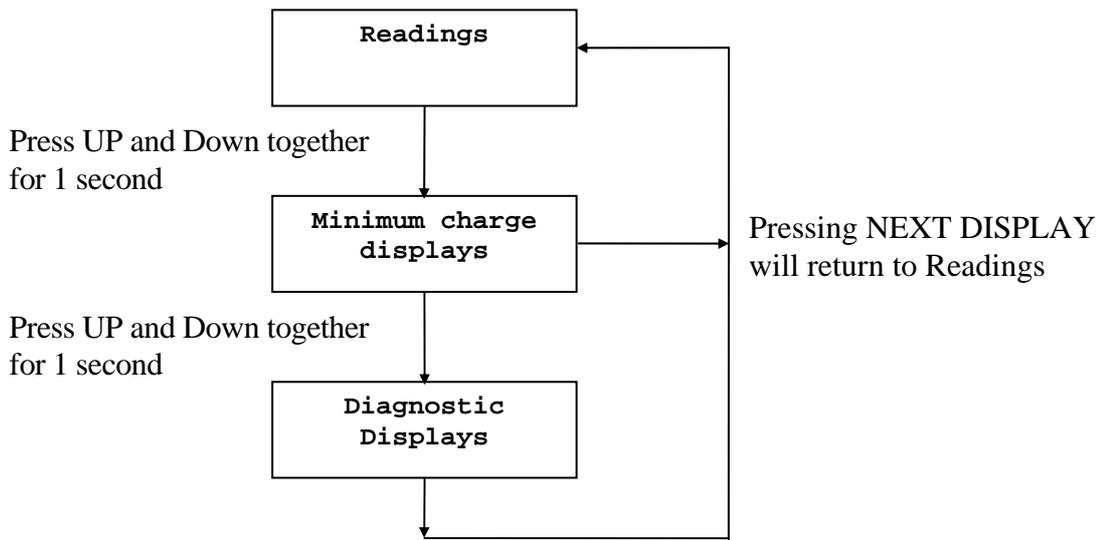


## MINIMUM CHARGE DISPLAY

Access to the next 5 screens is from the "Readings" screen.  
Hold the "Down" and "Up" keys simultaneously for approximately 1 second, then release the keys.



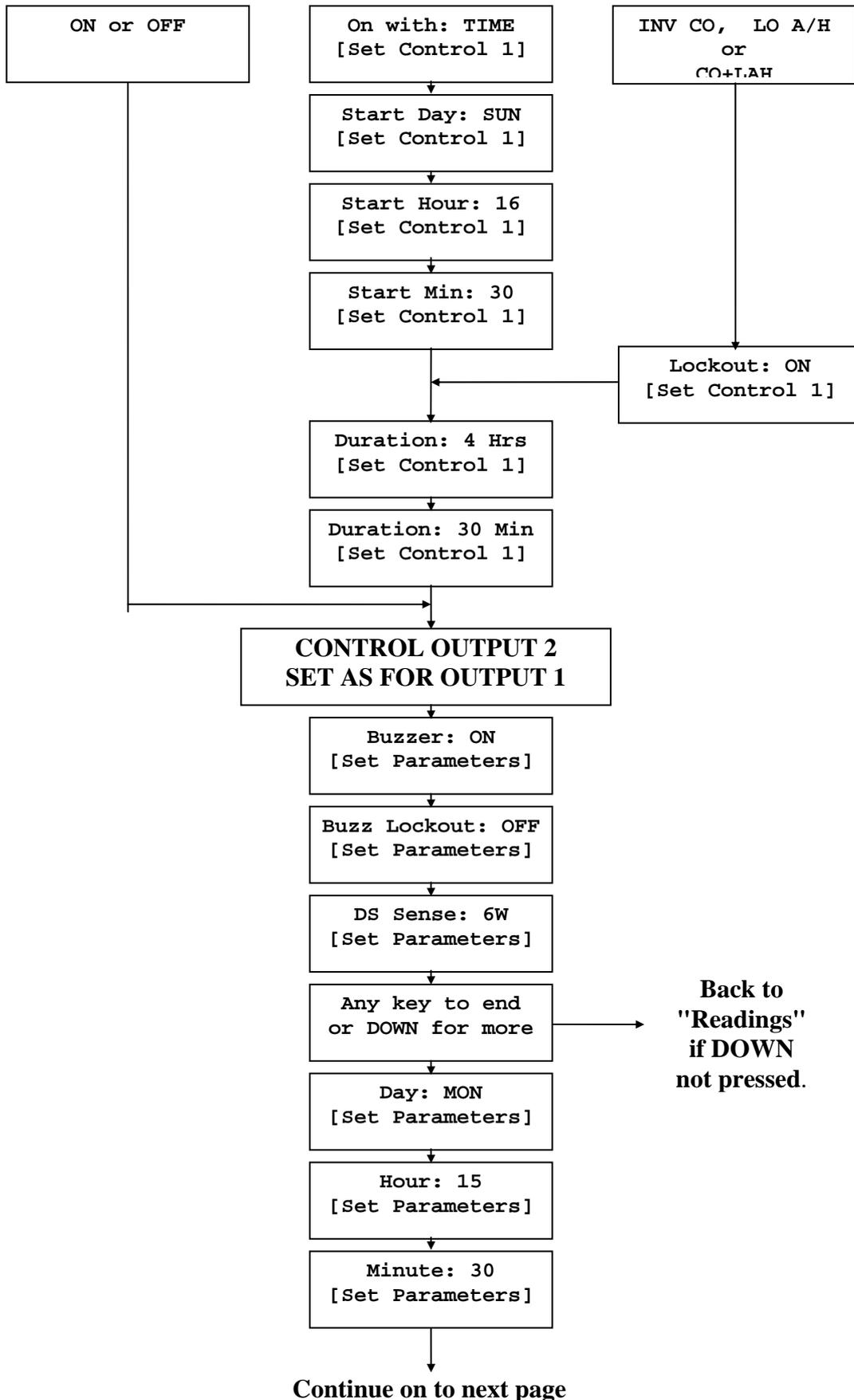
## SWITCHING BETWEEN READINGS, MINIMUM CHARGE, AND DIAGNOSTICS



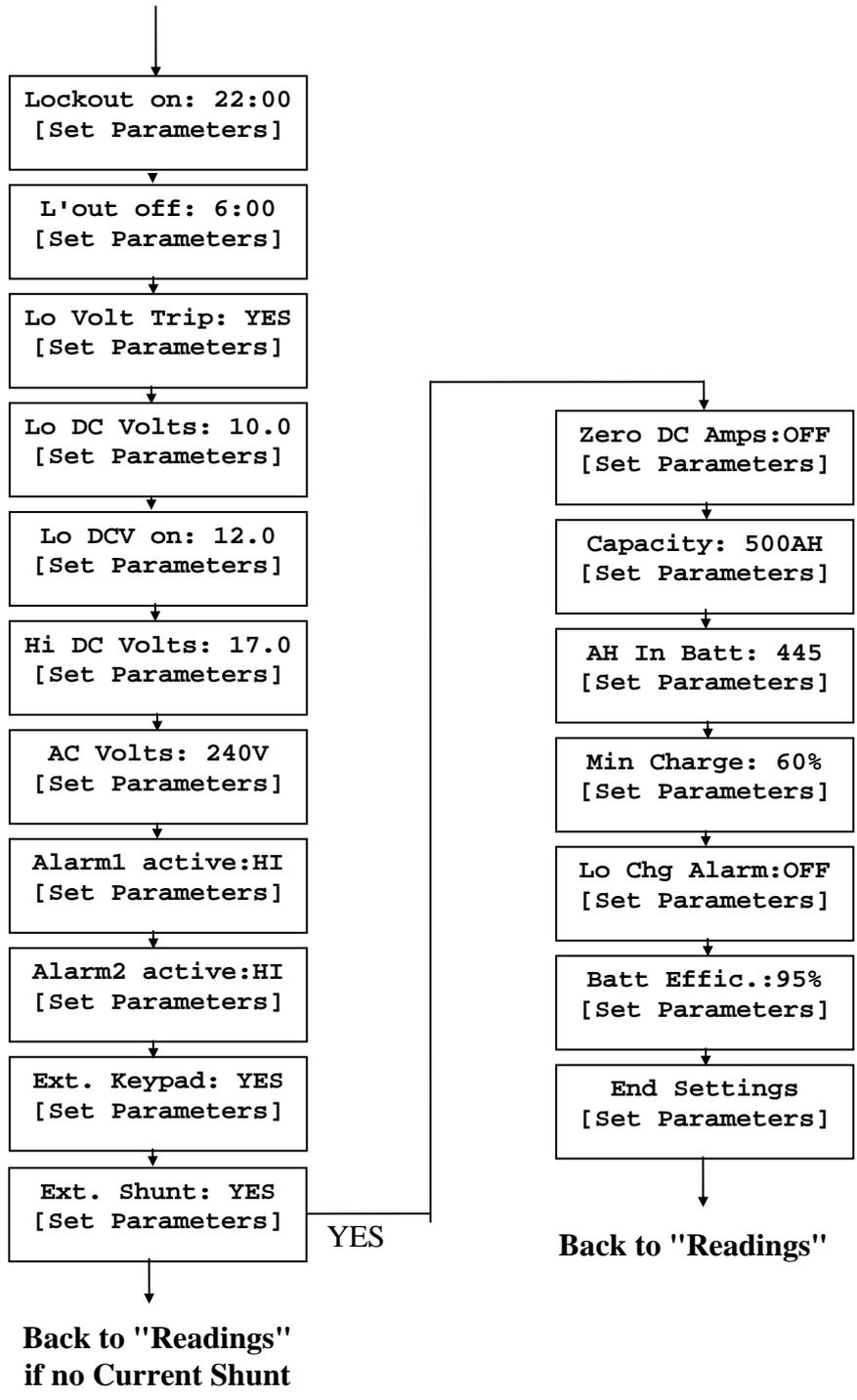
# SETTINGS

Access is from "Readings" screen.

Hold down "Next Display" key for approximately 1 second.



From previous page



## APPENDIX III: SA INVERTER OPTIONS

### GENERAL

The SA21 employs a rear chassis-mounted 25-pin connector, which allows you to add a selection of optional features to your power system. Note that the software for these functions is already installed within the SA21 microcontroller.

The full range of features are:

- (a) Remote Keypad: A low profile keypad with 2-line Liquid Crystal Display, which can be located up to 500 metres from your SA21.  
Wiring requirements - 6 conductor shielded cable.
- (b) DC Current Shunt: Consists of a 200 Amp 75mV current shunt, mounted on an insulated base, and a twin flex loom for current sensing.
- (c) Controller Outputs: Two external relay or contactor coils can be energised for various AC or DC switching applications.
- (d) Alarm Inputs: Two digital inputs that can be programmed to monitor switch contact status or voltage levels (refer to following circuits for examples)

### SA-SB-01 INTERFACE KIT

The Interface Kit SA-SB-01 plugs into the rear of the SA21 and provides a convenient termination point for the various options outlined above. The screw terminals are numbered from 1 to 14 and the connections are as follows:

TERMINAL NO	DESCRIPTION
1 & 14	+12/+24V with 1A internal fuse
2	Alarm input 2
3	Alarm input 1
4	0V
5 - 8	Keypad data lines
9	Keypad +12V
10 & 11	200A current shunt connections
12	Controller output 2
13	Controller output 1

Please refer also to Figure 1 overleaf.

# SA-SB-01 INTERFACE CONNECTIONS

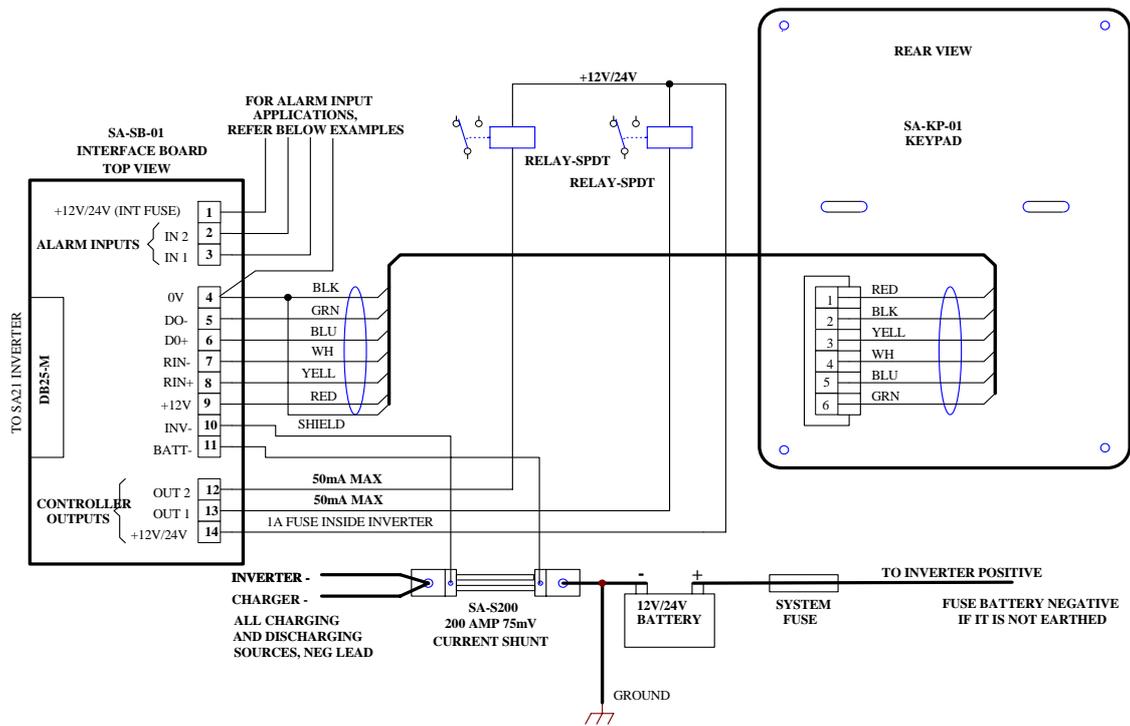
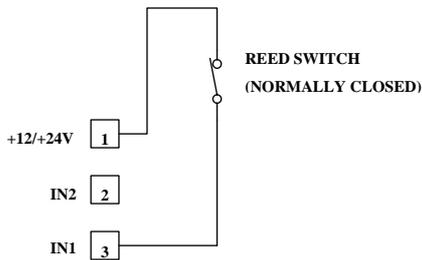


Figure 1

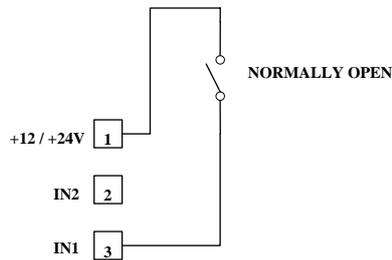
## ALARM INPUTS - Examples (Alarm input 1 shown only)

ALARM FITTED TO BATTERY ROOM DOOR



SET ALARM INPUT 1 = LO

Figure 2.1

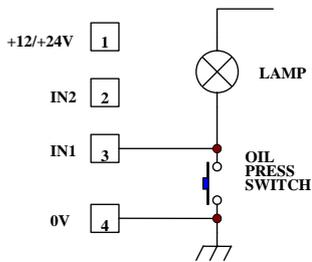


SET ALARM INPUT 1 = HI

Figure 2.2

## Figure 2

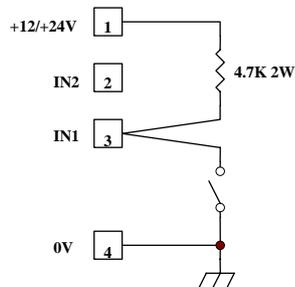
GENERATOR OIL PRESSURE MONITOR



SET ALARM INPUT 1 = HI

Figure 2.3

MONITORING OF SWITCH CLOSURE  
WHERE ONE SIDE COMMITTED TO EARTH



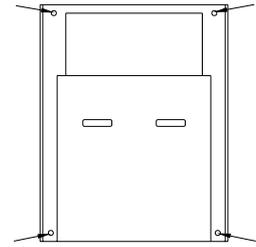
SET ALARM INPUT 1 = LO

Figure 2.4

## INSTALLATION OF SA-KP-01 OPTIONAL KEYPAD

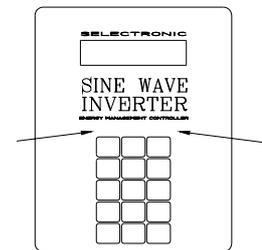
Installation of the optional keypad requires the interface board (SA-SB-01) plus a suitable length of 6 conductor (3 pair) shielded 7 / 0.2 data cable.

1. Carefully unpack the Keypad Kit. The front cover has been left loose to allow access to the 4 mounting holes as shown.



2. Prior to attaching the keypad to the wall, bulkhead, etc., complete the electrical connections to the user screw connector as shown in Diagram 1 on page 26. Please take careful note of the orientation. Plug the screw connector into the back of the keypad and secure the keypad chassis in its intended location

3. Clip the grey plastic front cover over the chassis, applying firm pressure at the points shown at right.



4. At the SA21 end of the shielded cable, connect the 6 wires to the SA-SB-01 Interface Board, using screw terminals 4 to 9, as shown in Diagram 1. Connect the cable shield to the 0V terminal (No. 4, Black) to reduce radiated electrical noise from the cable.
5. Ensure that the SA21 is switched off at the front panel circuit breaker.
6. Plug the SA-SB-01 Interface Board into the rear DB25 connector of the SA21.
7. Switch on the SA21 at the circuit breaker. The keypad will not display any information at this stage.
8. Via the SA21 front panel, access the "Settings" menu as described in Page 8 of the manual. Scroll slowly through the screens until the following display is seen:

```
Ext. Keypad: NO  
[Set Parameters]
```

Select YES using the "UP" key. Scroll through the remainder of the "Settings" screens until the "Readings" screen is reached.

9. The external keypad will now display the same information as appears on the SA21 front panel.

## INSTALLATION OF SA-S200 OPTIONAL CURRENT SHUNT

**Installation of the current shunt requires the SA-SB-01 interface board.**

1. The 200 Amp 75mV precision current shunt must be fitted between the negative (black) lead of the SA21 and battery negative, as shown on diagram 1. Please ensure that cables are kept as short as possible. At least 120 Amp continuously rated battery cable should be used.
2. Attach the shunt and insulated base securely to a solid structure.
3. Using the twin flex supplied, wire up the current sensing wires to the SA-SB-01 Interface Board as shown in Diagram 1, terminals 10 and 11 being used for the current sensing. Take careful note of the polarity.
4. Ensure that the SA21 Status is in "RESET" mode, which ensures that the SA21 is not drawing any DC current through the shunt. Also, disable all charging sources, such as Solar Panels and wind generators.
5. Via the SA21 front panel, access the "Settings" menu as described on Page 8 of the manual. Scroll slowly through the screens until the following display is seen:

```
Ext. Shunt: NO
Set Parameters]
```

Select YES using the "UP" key.

6. Scroll to the next screen and the following display will be seen:

```
Zero DC Amps: OFF
[Set Parameters]
```

Select ON using the "UP" key. Note: when this setting is set to ON, a zero DC amps is performed taking about 1 to 2 seconds, after which the display returns to OFF.  
Scroll through the remainder of the "Settings" screens until the "Readings" screen is reached.

7. Scroll through the "Readings" screen until the following screen is displayed:  
Note that when the battery current is zero, the screen may flicker between **IN** and **OUT**; this is quite normal.

```
Amps: 0.0A OUT
----Battery----
```

8. Apply an AC load to the inverter's output and verify that the DC current reading is "OUT".  
If not, then reverse the sensing wires to the current shunt.

## **WARNING**

### **THE OUTPUT VOLTAGE FROM AN INVERTER IS AS LETHAL AS LANDLINE POWER.**

It is therefore absolutely necessary for your safety to ensure that all Remote Area power installations meet and comply with the relevant provisions and requirements of wiring standards.

It is imperative that you ensure that only Electrical contractors are permitted to install any AC wiring in your system.

## **PRODUCT WARRANTY CONDITIONS**

Selectronic Australia Pty Ltd warrants your SA21 inverter to be free from defects in materials and workmanship under normal use and service, for two (2) years.

This warranty is applicable from the date of original purchase. All parts will be replaced or repaired free of charge within this period. Travelling time for field service personnel is not covered under this warranty. The unit shall be returned at no cost to the owner, if no authorised field service personnel are available.

After you have completed our post-installation questionnaire, you will receive a lifetime warranty, applicable to the original purchaser only.

The provision of this warranty shall not apply if the unit has been subject to misuse, neglect, accidental damage, damage from external influences e.g. corrosion, used for a purpose it is not intended, acts of God or has not been installed in accordance with the manufacturers latest installation requirements. (Any installation updates will be mailed to your last known address.) Lifetime warranty is dependant on the supply of raw materials from suppliers, above and beyond Selectronic Australia's legal obligation.

Freight charges to the point of purchase and the cost of any repairs resulting from damages occurring during this freighting will be borne by the owner.

Any alterations or repairs by unauthorised parties will void your warranty.

To ensure fast efficient handling of any warranty claims, please complete and return your reply paid warranty card within 30 days from date of purchase. If service is required, please return your inverter in its original carton with proof of purchase and a brief description of the fault, to your point of service or any of the following service centres:

Selectronic Australia  
25 Holloway Drive  
Bayswater  
Victoria 3153  
Australia  
Ph: 03 9762 4822  
Fax: 03 9762 9646

Burley TV Service  
278 Edmondson Ave  
Austral  
NSW 2171  
Australia  
Ph: 02 606-0279

Reid Technology Ltd  
3-5 Auburn Street  
Takapuna  
North Shore City  
Auckland NZ  
Ph: 9 489-8100  
Fax: 9 489-8585

RF Analysis  
Harness Cask Road  
Dorrigo  
NSW 2453  
Australia  
Ph: 066 57 8003  
Fax: 066 57 8002

## MOUNTING TEMPLATE FOR SA-KP-01 KEYPAD

Use this template when marking and cutting holes in plasterboard, etc., for the SA-KP-01 keypad.

