PS1 Sinewave Interactive Inverter Charger

User Manual

Document: PC0004
Revision 05

Foreword

Thank you for purchasing a Selectronic PS1 Sinewave Interactive Inverter Charger. The PS1 has been designed and manufactured to exacting ISO9001 standards, by people with many years experience in providing solutions to alternative and remote power needs.

Combined with a suitable generator and batteries the PS1 will provide you with reliable power 24 hours a day. The quality of power the PS1 produces is as good as, if not better than normal grid electricity. A powerful microprocessor combined with low RDS ON MOSFETS utilises Pulse Width Modulation to develop a low distortion precise Sine Wave output.

Componentry used within the PS1 has been generously proportioned to ensure safe and reliable operation for many years.

If not understood the PS1 can appear to be a very complex product, please read this document thoroughly before attempting to use the PS1 or request service.

It is extremely important that you and your installer follow all of the instructions set out in this document; failure to do so may void your warranty.

Ensure you return your warranty information promptly and complete all details.

The PS1 has been thoroughly tested before leaving our factory, however should any damage have occurred during transit please inform your installer/supplier immediately.

We trust you will get many years of trouble free operation from your PS1.

Warranty

Your Selectronic PS1 product is warranted by the manufacturer for a period of 12 months from date of purchase to the original purchaser only. The manufacturer will bear the cost of parts and labour to repair any faults found within the terms and period of this warranty. Faulty product or parts must be returned to Melbourne Australia for claim under warranty. No allowance is made for installers labour or travelling time required to disconnect or reinstall faulty parts. Cost of freight to return parts to the customer within Australia only, will be paid by the manufacturer; method of freight used will be determined by the manufacturer.

Unless otherwise specified to the purchaser the benefits conferred by this voluntary warranty are additional to all other conditions, warranties, guarantees, rights and remedies expressed or implied by the Trade Practices Act in your state or territory.

All installation and user conditions as set down in the instruction manual must be strictly adhered to, failure to do so may void your warranty.

Any faults caused by lightning, water or moisture ingress, faulty installation, using the product in a manner which it is not intended, vermin infestation, improper voltage, alteration which affects the reliability or performance of the unit but not attributable to faulty manufacture, or faulty generator sets will not be covered under warranty.

In the event of the product being out of service the manufacturer shall bear no responsibility for any consequential losses or expenses.

The manufacturer will not be held responsible for any misleading or incorrect information conveyed by the salesperson or installer.

A separate Warranty Registration form is included and in part must be completed by the installer.

If your installation is signed off by a Selectronic Accredited PS1 installer your 12 month warranty will become 24 months and you will have the option to purchase extended warranty.

If you wish to extend your warranty further please see the warranty registration form for details or contact your accredited installer.

About This Manual

This User Manual (PC0004) describes the operation of the PS1 Sinewave Interactive Inverter Charger family. The indicated values are for a PS1 10/48. Refer to Appendix A for a list of applicable models and to Appendix D for document and software revision information.

A PDF copy of this manual may be downloaded from the Selectronic web site www.selectronic.com.au PDF copy includes many cross-reference hotlinks (underlined) to facilitate moving around within the document. (If you have clicked one of these links and wish to return to the place where you were previously reading, click on the "Go to Previous View" symbol on the Acrobat Reader toolbar at the top of the document.)

In this manual, the symbol ⚠ indicates important information such as hazards and warnings.

If you have any suggestions for improvements to either this manual or any Selectronic Australia product please contact us (see Manufacturers Details below).

A Technical Manual (PC0009) provides information for PS1 installation, maintenance and troubleshooting by suitably qualified and trained personnel only.

Warning

⚠ The equipment described in this manual may be hazardous. Before operating the equipment please see 1 Precautions and Safety and ensure that you understand the relevant information in the manual. No procedures in this manual require the PS1 front door to be opened. Only suitably qualified and trained installation, commissioning and maintenance personnel should open the PS1 door or disturb the PS1 wiring.

Selectronic Australia shall have no obligation as to any equipment which has been improperly installed, stored, or handled, or which has not been operated or maintained according to this manual, nor for any operating mistakes and consequences arising therefrom.

This product is not to be used for Life Support equipment.

Service and Support

In the event that you require support or have questions regarding the operation of your PS1, please contact your Accredited Installer. Your Accredited Installer has direct knowledge of the system components, the load profile and PS1 configuration which affect the behaviour and operation of the PS1. Accredited Supplies have been trained in the operation of the PS1 and the configuration of the units to meet the requirements of each installation.

Manufacturers Details

Selectronic Australia Pty Ltd
Suite 5, 20 Fletcher Rd
Mooroolbark VIC 3138
Australia
Ph +61 3 9727 6600
Fax +61 3 9727 6601
sales@selectronic.com.au
www.selectronic.com.au/

Contents

1 Precautions and Safety

1.1 Multiple Hazardous Energy Sources

Hazardous voltages and energy are generated by the PS1, are fed into the PS1 by external wiring from multiple sources, and may be stored in capacitors after the PS1 is switched off and disconnected from external wiring.

Do not operate with the door open. No procedures in this manual require the PS1 door to be opened. All PS1 operations by users are performed with the door closed. This includes the front panel operation of all PS1 pushbuttons, displays and circuit breakers.

Only suitably qualified and trained personnel should open the PS1 front door.

1.2 Installation

The PS1 requires adequate ventilation, away from hot equipment. Do not obstruct the airflow through the ventilation holes in the PS1 case (sides, rear and door top). Ensure when installed in an enclosed space that there is adequate ventilation.

The PS1 must be located in a dry place away from water, electrolyte and corrosive aerosols.

The PS1 contains arcing contacts so must not be located where explosive gas mixtures could occur, such as hydrogen from batteries or diesel fuel fumes. The PS1 must never be installed above the battery bank.

The PS1 may be floor, shelf or wall mounted. Installation requirements are defined in the PS1 Technical Manual.

1.3 Maintenance

Ensure that all energy sources are isolated before working on connected wiring. The generator may start or power may be restored by the inverter at any time

Never work on equipment or investigate a problem without following appropriate safety isolation procedures. Procedures are defined in the PS1 Technical Manual.

1.4 Inverter or Generator may Start Automatically

The PS1 automatically starts and/or restarts and may restore power or start the generator at any time.

If a fault or overload is detected the PS1 will shutdown and automatically attempt to restart at varying intervals of up to several hours.

1.5 Battery

Batteries are very dangerous. Please read the safety information provided by the battery supplier.

Battery acid is dangerous.

Batteries can emit hydrogen gas, which is explosive.

Batteries connected in series can produce hazardous voltages.

Disconnecting a DC power connection (even on one battery cell) can cause dangerous high-energy DC arcs, which can cause serious burns and eject hot particles, and can be difficult to extinguish.

Disconnecting a DC power connection (even on one battery cell) can cause renewable sources to produce large voltages (much larger than the battery voltage) on battery terminals and DC wiring. Such voltages can be lethal. They can also damage the PS1. Only suitably trained and qualified personnel should disconnect any DC power connection, including battery cell connections, and only with suitable procedures and safety precautions. See the PS1 Technical Manual.

2 PS1 - Power System Overview

PS1 Sinewave Interactive Inverter Chargers are typically used in applications where no mains grid is available. The diagram below shows a typical power system comprising a PS1 inverter, battery, generator and renewable sources.

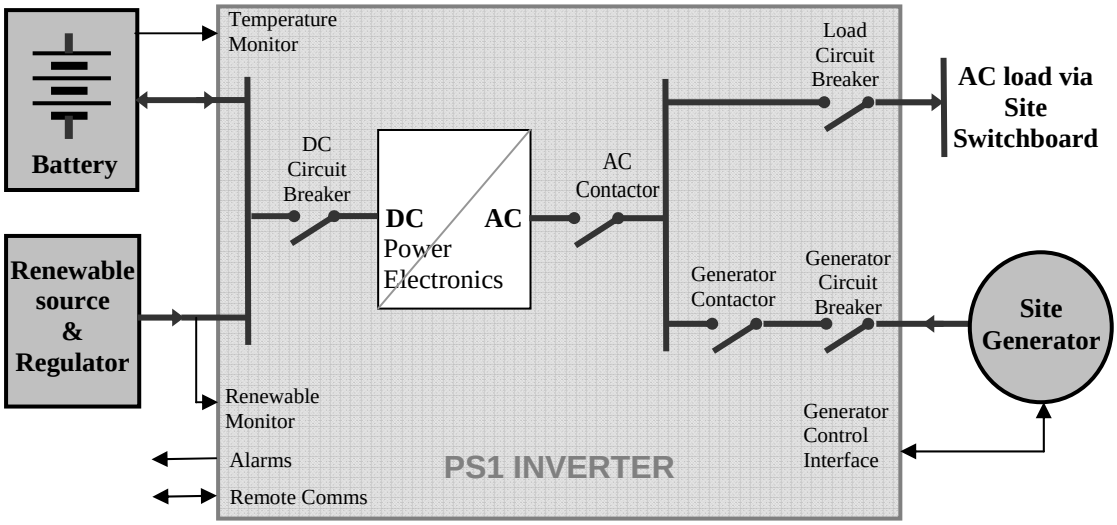


Figure 1 PS1- Power System

The PS1 is the heart of your power system. It quietly provides AC power from the battery bank and renewable sources. The PS1 monitors battery state of charge and load conditions and automatically starts the generator only when required to charge the batteries and efficiently utilise the generator to supply the site load.

2.1 Inverter Standalone Function

The PS1 provides mains quality voltage and frequency regulated AC power to the site load from the battery bank and renewable sources. The highly efficient conversion ensures that the maximum battery power is available for use over the full output power range.

The PS1 can supply short-term overloads larger than its continuous load rating and continues to supply fault over-current for up to 10 seconds to trip external circuit breakers.

2.2 Inverter Power Save Function

To minimize battery drain at very low load, the PS1 can be configured to go into Power Save mode. The PS1 will automatically switch to and from Power Save mode when the unit senses sufficient AC load.

2.3 Inverter Sync/Generator Interactive Function

The PS1 can be configured to automatically start and stop the generator. When the generator is running, the PS1 will use the generator to power the site load plus use any additional generator capacity to charge the batteries. If the site loads are greater than the generators output, then the PS1 will add its power to the generator, when the site loads are reduced the PS1 will return to battery charging. The above operation will happen automatically, whilst always maintaining “no break” power to the site.

2.4 Charging Function

With the generator running, the PS1 will automatically charge the battery bank. The PS1 charges the batteries in 5 stages (Initial, Bulk, Absorb, Float and Equalise) to ensure maximum energy is stored in the battery bank in the shortest possible time. The PS1 will periodically perform an equalise charge after the completion of the normal charge cycle to keep the battery bank in good condition.

The charging parameters are automatically compensated for battery temperature. It is important that the included battery temperature sensor be fitted to the battery bank and that the temperature is reading correctly.

The PS1 contains one internal 100A/50mV shunt (Shunt 1) and an optional external shunt (Shunt 2) to monitor renewable power sources and loads connected to the battery bank. This allows the PS1 to include all sources of charge and load to be taken into account ensuring the batteries are correctly charged.

2.5 System Monitoring and Control

The LCD displays system readings and settings and is used to adjust PS1 settings. System status, fault and abnormal conditions are displayed on the front panel LEDs. Pushbuttons control which readings and settings are displayed and allow the user to start and stop the generator from the PS1 and request that the next time the generator is started that the unit performs an equalise charge.

The PS1 periodically (every 15 minutes) logs (records) the power, voltage and current variables, and time/date-tagged events (alarms, generator start/stop, etc) for analysis of system operation and troubleshooting.

The PS1 provide a serial communication port which allows for the collection of logged data, plus monitoring and controlling the inverter and connected generator. The remote LCD function emulates the LCD display and front panel pushbuttons to allow full remote control of the PS1.

The PS1 continuously monitors itself for abnormal operating conditions such as DC over-voltage and over-current, AC overload and over temperature. The PS1 will attempt to compensate but will shutdown and indicate the reason for the shutdown if the problem cannot be corrected. The PS1 on start-up will perform a comprehensive self-test for internal faults. If a fault is detected the unit will report an error code and will not start operating.

2.6 Cooling System

The PS1 uses natural convection and ducted forced air cooling to maintain the internal temperature. Under light conditions the unit relies on convection cooling. As the internal temperature of the unit rises the two internal fans switch on and off as required to maintain the internal temperature. Under extreme conditions whereby the two fans are unable to control the temperature the unit will automatically reduce the peak overload available or start the generator to shed load or reduce battery charging power to ensure the unit does not shutdown and continues to power the site.

2.7 Inverter Bypass

When the PS1 is switched off or shutdown, the internal Generator Contactor automatically closes whenever generator voltage is present, allowing the manually started generator to supply the load without the need for any external bypass switches or contactors

2.8 Generator Control

The PS1 generator control interface provides two control outputs plus five control inputs. The two control outputs provide the flexibility to connect the inverter to many generator controllers with no external hardware. The five control inputs allow for monitoring of status outputs from the generator controller ensuring the inverter does not incorrectly attempt to start or continue to run the generator under fault conditions such as fuel empty or low oil pressure.

3 Operation

This section contains procedures required to perform the most fundamental PS1 functions. Users should read section 1 and section 2 prior to performing these procedures.

3.1 User Interface

The PS1 Front panel includes a Liquid Crystal Display (LCD), eight LED indicators, four configuration pushbuttons 

and one **ON/OFF**  pushbutton.

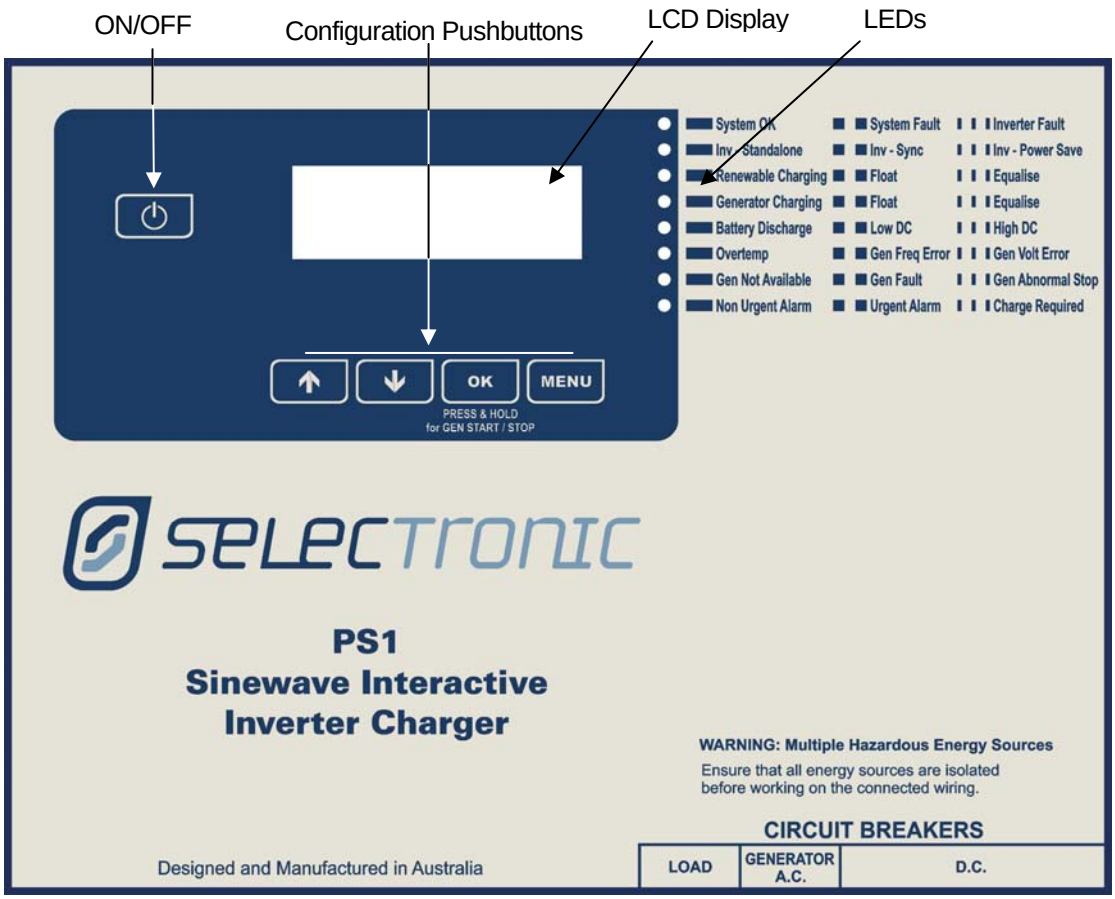


Figure 2 Inverter Pushbuttons

The LEDs provide the current status of the PS1 showing normal and abnormal conditions.

The LCD display and pushbuttons allow you to:

- View measured and calculated values such as battery voltage and load power readings (see 4.2 View Readings).
- View Summary Readings of measured system cumulative energy (see 4.3 Summary Readings).
- View system settings (see 4.4 View Settings).
- View and change Generator schedules (see 4.6 Generator Schedules).
- Change settings to adjust the system operation (see 4.5 Change Settings).
- View system diagnostics such as battery and inverter temperatures and event counters (see 4.2.1 View Diagnostics).
- View logged events (see 4.5 Event Log).
- Manually start and stop the generator (see 6.4 Manual Generator Control).

3.1.1 Menu Navigation and Pushbuttons

Four pushbuttons are used to navigate the menu structure and select settings. The functionality of each button is context sensitive.

3.1.1.1 Screens with Context Sensitive information

The LCD displays the button function directly above the relevant button depending on the particular menu being accessed. The PREV  and NEXT  buttons are used to scroll through available screens, the OK  button is used to select a particular screen and the MENU/EVNT button  is used to exit the current screen and return to the top level of the particular menu structure or enter the Event view system.

The OK  button may be used to start/stop the generator (see 3.3.3 Starting the Generator from PS1).

The MENU/EVNT  button may be used to request an equalisation charge (see 3.3.5 Schedule Battery Equalise).

3.1.1.2 Changing Settings

Settings may be changed by selecting EDIT  while in the appropriate setting screen.

A ^ symbol will appear near the setting to be changed.

Use the INC  and DEC  keys to change the setting.

Use the OK  key to implement and store the change. Press and hold the OK  key to reload the value to factory default setting.

Use the CNCL  key to reject the change.

If no key is pressed for 10 seconds the EDIT screen will be exited without changing the setting.

3.1.1.3 Screens without Context Sensitive information

In screens without button function information displayed (e.g. within View Readings) the  and  buttons may be used to scroll through the available screens, the  button may be used to exit the current menu and return to the associated top level menu.

The  button may be used to start/stop the generator (see 3.3.3 Starting the Generator from PS1).

The  button may be used to request an equalisation charge (see 3.3.5 Schedule Battery Equalise).

3.1.2 Front Panel LEDs

Eight LEDs are provided on the PS1 front panel to indicate operation and system fault conditions as described below. Each LED uses steady state and two flash rates to show various conditions.

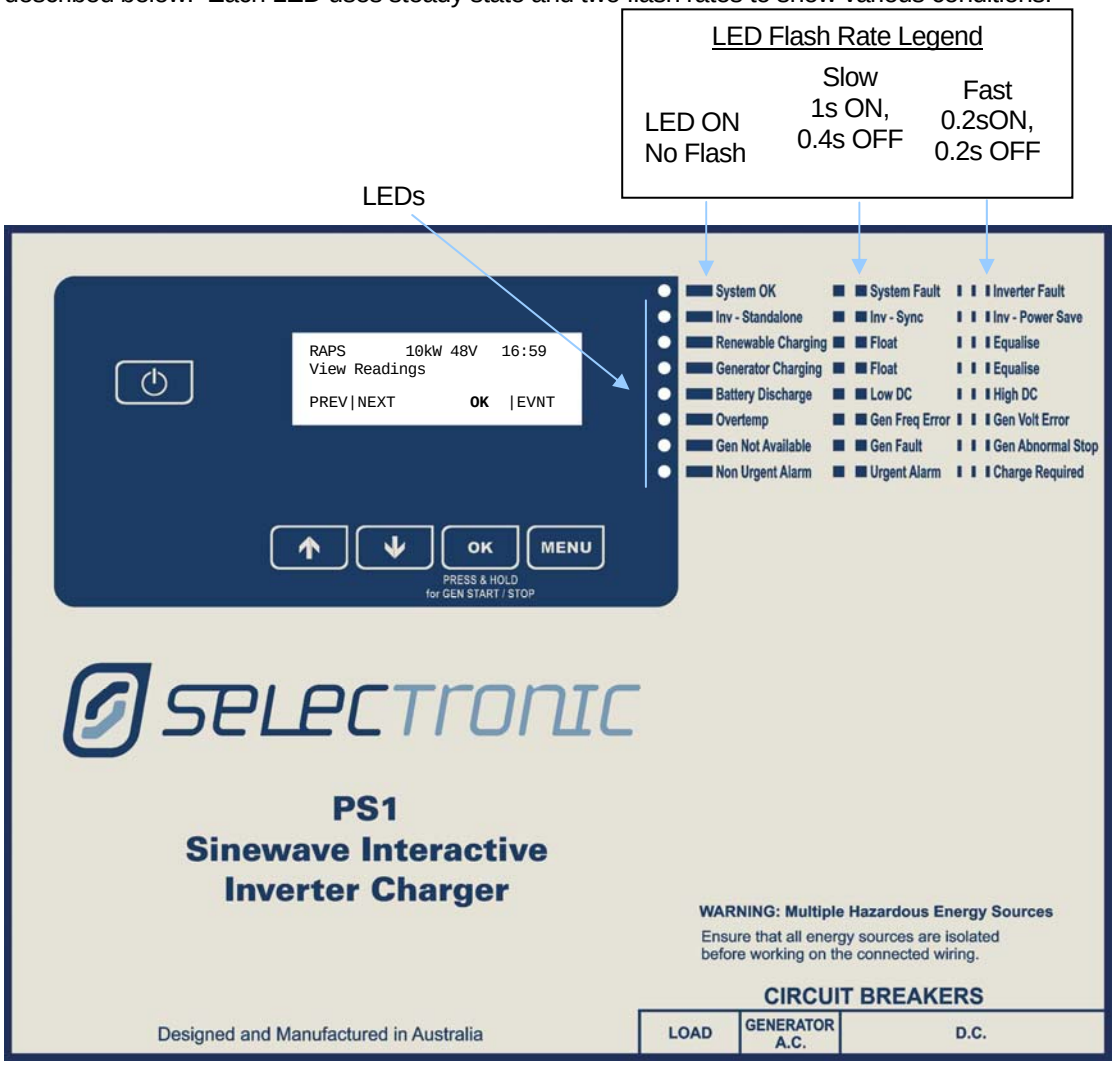


Figure 3 Front Panel LEDs

When the PS1 is switched on via its ON/OFF  pushbutton, all the LEDs illuminate briefly then display an upward moving flashing pattern while the PS1 performs a self-test to check for internal faults. If the LEDs remain off, the PS1 failed to start. If the PS1 was shut down from an abnormal cause, it may be necessary to operate the ON/OFF button again if the PS1 does not start.

If the PS1 passes self-test, the top LED is steady illuminated to indicate **System OK**, and the other seven LEDs indicate various operating states according to their panel labels. The indicated states can include successful operation and also abnormalities such as over temperature and shutdown etc, as described in the table below.

If the PS1 self-test detects a fault, it will not pass power, and the top LED on the panel flashes to indicate an **Inverter Fault.** The LCD will display the **Self Test Fail** message and a fault code that identifies the fault. Make a note of the fault code then contact your supplier for further instructions. The panel labelling for the LEDs does not apply in this situation.

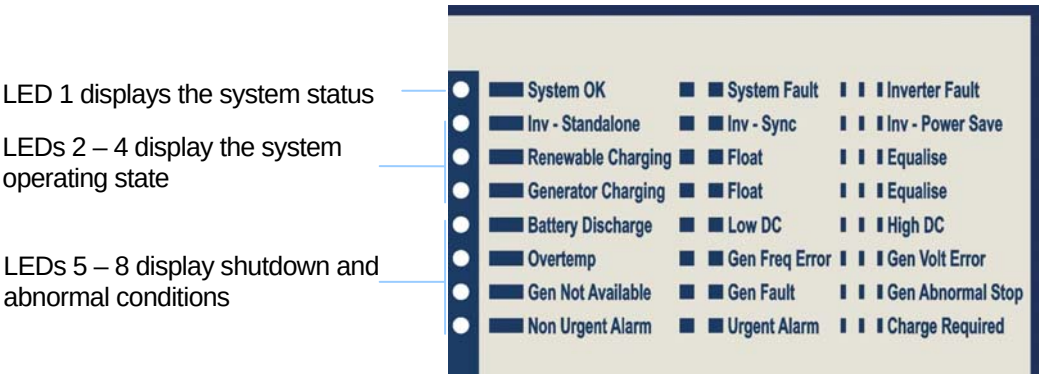


Figure 4 LED Functions

Each LED has three labels on the panel as shown above. The top four green LEDs indicate operational states and the lower four red/yellow LEDs indicate system warning and/or fault conditions. The table below identifies the PS1 system status for each LED condition.

	INDICATION	***SYSTEM STATUS***	***NOTES/SUGGESTED ACTION***
LED 1 (Top)	ON ■	**System OK**. Normal operation	No action required.
	Slow Flash ■ ■	**System Fault** The PS1 is shutdown and not available to supply the load.	The lower four LEDs (5 – 8) will show the reason for the shutdown. Refer to notes associated with these LEDs for further recommended action. Review event log for possible cause. See 4.7 LCD Event Log and B2 Event Definitions.
	Fast Flash ▌▌▌	**Inverter Fault** The PS1 has detected an internal fault during self test.	Try to restart the inverter. Record the fault code indicated on the LCD and then contact your installer for further instructions. See B3 Self Test Fault Codes.
	OFF	The PS1 is switched OFF	
LED 2	ON ■	**Inverter – Standalone** The PS1 is running independent of the attached generator and AC output is available at the terminals.	No action required. Note: the PS1 will remain in Standalone mode and this LED will not flash if the inverter cannot synchronise to the generator because the generator voltage or frequency is out of tolerance. If generator synchronisation is expected and is not achieved see 8 Troubleshooting
	Slow Flash ■ ■	**Inverter – Sync** The PS1 is correctly synchronised to and operating interactively with the generator.	No action required.
	Fast Flash ▌▌▌	**Inverter – Power Save** The PS1 has reverted to power save mode due to no or low AC load.	No action required.
	OFF	This is not a normal condition for this LED.	It may be OFF if an error condition exists. Refer to other LEDs.

LED 3	ON ▬	**Renewable Charging** The Renewable source/s is/are contributing greater than 1 amp to the DC system.	No action required.
	Slow Flash ■ ■	**Float** The Renewable source/s is/are contributing greater than 1 amp to the DC system. The battery charging process is presently in the Float phase.	No action required.
	Fast Flash ▌▌▌	**Equalise** The Renewable source is contributing greater than 1 amp to the system. The battery charging process is presently in the Equalise phase.	No action required.
	OFF	The Renewable source is contributing less than 1amp charge to the battery.	If Renewable contribution is expected See 8 Troubleshooting
LED 4	ON ▬	**Generator Charging** The Generator is contributing charge to the battery. The battery charging process is presently in the Initial, Bulk or Absorption phases of charging.	No action required.
	Slow Flash ■ ■	**Float** The Generator is contributing charge to the battery. The battery charging process is presently in the Float phase.	No action required.
	Fast Flash ▌▌▌	**Equalise** The Generator is contributing charge to the battery. The battery charging process is presently in the Equalise phase.	No action required.
	OFF	The Generator is not contributing charge to the battery.	If Generator contribution is expected See 8 Troubleshooting
LED 5	ON ▬	**Battery Discharge** Indicates the PS1 has shutdown due to excessively discharged battery	See 8 Troubleshooting.
	Slow Flash ■ ■	**Low DC** Indicates the PS1 has shutdown due to battery under-voltage.	This usually occurs when the generator is unavailable to charge the battery - refer to LED 7 for generator availability. Check the battery voltage in View Readings display. Note: the battery voltage reading may rise substantially higher due to reduced load when the PS1 is shutdown.
	Fast Flash ▌▌▌	**High DC** Indicates that the PS1 has shut down due to battery over-voltage.	Check the battery voltage and causes for overcharge. The renewable regulator may be set to a higher voltage than the shutdown threshold. The PS1 will restart when the voltage falls to within tolerance.
	OFF	**Normal Condition**	No action required.

LED 6	ON ▬	**Over Temperature** Indicates that the PS1 has shut down due to overheating.	A heatsink temperature of 100°C or transformer temperature of 130°C will cause a shutdown. Overheating may be due to sustained high load, faulty cooling fans, blocked ventilation, or high ambient temperature. It will automatically restart when it has cooled sufficiently.
	Slow Flash ▬ ▬	**Generator Frequency Error**	Check generator operation. Limits are set into the PS1 during installation.
	Fast Flash ▌▌▌	**Generator Voltage Error**	Check generator operation. Limits are set into the PS1 during installation.
	OFF	**Normal Condition**	No action required.
LED 7	ON ▬	**Generator Not Available** Indicates that the generator is not available for automatic control	If the Generator is required to automatically start check the generator available signal is active (see).
	Slow Flash ▬ ▬	**Generator Fault** Indicates that the PS1 has stopped the generator because the generators GEN FAULT input is active or the PS1 could not start and/or synchronise to the generator.	Check to see why the Generator Fault input is active. Refer to generator manufacturer's documentation for troubleshooting advice. The PS1 will attempt to restart the generator in 15 minutes then commence a generator restart sequence. See 6.5 Generator Fault Recovery.
	Fast Flash ▌▌▌	**Generator Abnormal Stop** Indicates that the generator stopped unexpectedly while running under PS1 control	Check to see why the generator fault or generator no fuel input is active. See 6.5 Generator Fault Recovery. Refer to generator manufacturer's documentation. Check if the generator circuit breaker has opened. Check if the generator was manually shutdown.
	OFF	**Normal Condition**	No action required.
LED 8	ON ▬	**Non Urgent Alarm** Indicates conditions where the PS1 system is functional but may require attention.	Refer to other front panel LEDs, Readings and Diagnostics screens for reason. See 3.1.2 Front Panel LEDs
	Slow Flash ▬ ▬	**Urgent Alarm** Indicates the PS1 system is non-functional or is likely to shut down in the near future.	Refer to other front panel LEDs, Readings and Diagnostics screens for reason. See 3.1.2 Front Panel LEDs
	Fast Flash ▌▌▌	**Charge Required** Indicates the battery requires charging but the generator is not available.	Check why generator is NOT available.
	OFF	**Normal Condition**	No action required.

3.2 Circuit Breakers

The PS1 has three manually operated circuit breakers on the front panel (see below).

The circuit breakers are:

- The **DC Circuit Breaker** which switches the battery and renewable source to the PS1. It is comprised of two ganged units for sufficient current rating. The circuit breaker will not close if the battery voltage is too high, too low or of reversed polarity. This circuit breaker will trip for various conditions including extremely low battery voltage, some internal faults, and 15 minutes after the PS1 is switched off via its **ON/OFF** pushbutton.
- The **Generator Circuit Breaker** which switches the Generator AC to the PS1.
- The **Load Circuit Breaker** which switches the load to the PS1.

The circuit breakers incorporate over-current trip to protect the PS1 from electrical faults.

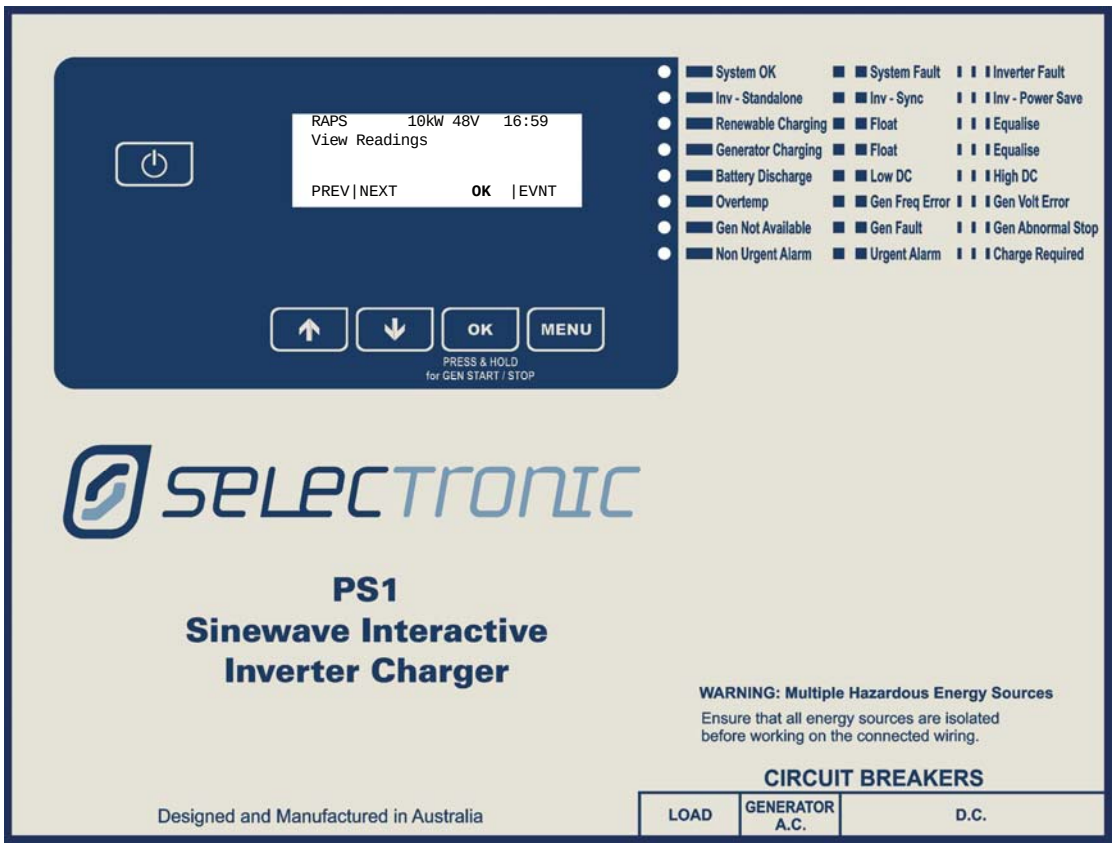
Figure 5 PS1 Circuit Breakers

3.3 Quick Start

3.3.1 To switch Inverter ON

1. If not already closed, close the Generator AC Circuit Breaker. (switch Up)
2. If not already closed, close the Load Circuit Breaker. (switch Up)
3. Press the front panel **ON/OFF** button for one second then release it. All LEDs illuminate briefly then display an upward moving flashing pattern while the PS1 performs a self-test. If the LEDs remain off, the PS1 failed to start. If the PS1 was shut down from an abnormal cause, it may be necessary to operate the **ON/OFF** button again if the PS1 does not start.
4. When the LCD displays "Please close DC CB", close the DC Circuit Breaker if not already closed. (switch Up).

On successful start up the **System OK** LED will be ON and the PS1 will enter Standalone mode (**Inv – Standalone** LED), or Synchronise mode (**Inv – Sync** LED) to the already running generator or Power Save mode (**Inv – Power Save** LED) depending on system settings. The View Readings menu will display as shown below.



3.3.2 To switch Inverter OFF

1. Press the front panel **ON/OFF** pushbutton for a second then release it. The LEDs and LCD will turn off.
2. Unless you want the generator to supply the load via the PS1, open the Generator and Load Circuit Breakers.

The DC Circuit Breaker will open automatically[1] 15 minutes after the PS1 is turned off.

3.3.3 Starting the Generator from PS1

1. Check that the **Generator Not Available** LED (see 3.1.2 Front Panel LEDs) is OFF indicating the generator is available for automatic control. If the LED is ON or flashing the generator has a problem which must be rectified before this procedure will start the generator.

[1] 24volt models have no control over the DC circuit breaker and the DC circuit breaker needs to be manually opened.

2. Press the front panel OK button OK for at least one second then release it.
3. The inverter will display Gen Start and then display the PS1 voltage and frequency and generator voltage and frequency plus the variation in generator frequency.

```
** Gen Starting **
      240       251
    50.00     52.38
Delta Gen Hz    0.47
```

4. The generator will start and after a short period the **Inv Sync** LED (see 3.1.2 Front Panel LEDs) on the front panel will flash. When the PS1 has determined the generator is no longer required, the generator will automatically switch off. See 6.3.4 Generator Automatic Stopping.

3.3.4 Stopping the Generator from PS1

1. Check that the **Generator Not Available** LED (see 3.1.2 Front Panel LEDs) is OFF indicating the generator is available for automatic control. If the LED is ON or flashing the generator has a problem which must be rectified before this procedure will stop the generator.
2. Press the front panel OK button OK for at least one second then release it.
3. The generator will be disconnected and power will be supplied to the load via the PS1. Note that some generators will continue to run for a short period as a cool down period, this does not affect the PS1.

3.3.5 Schedule Battery Equalise

1. A battery equalise can be scheduled for the next generator charging cycle by depressing the MENU button MENU for at least one second. The LCD will display the message “Eqlise Request”. Repeating this action will cancel the request.

4 PS1 User Menus

4.1 User Menu Structure

The diagram below shows the User menus for access to the PS1 settings and readings. The View Readings menu is the home menu and will be displayed when the PS1 has completed power up.

The View Readings, Summary Readings, View Diagnostics, View Settings, Generator Schedules and Event Log menus allow viewing of system settings, readings and event history without the possibility of inadvertent modification. The information provided in these screens is sufficient to monitor the day to day system operation and resolve system problems.

The Change Settings, Advanced Settings and Changes Schedules menu allow modification of the PS1 User settings and generator run schedules.

Your maintenance provider may ask you to extract information from these menus for remote diagnostic purposes. Familiarly with this information, while not mandatory for system operation, will greatly enhance your ability to respond to any problems that may arise.

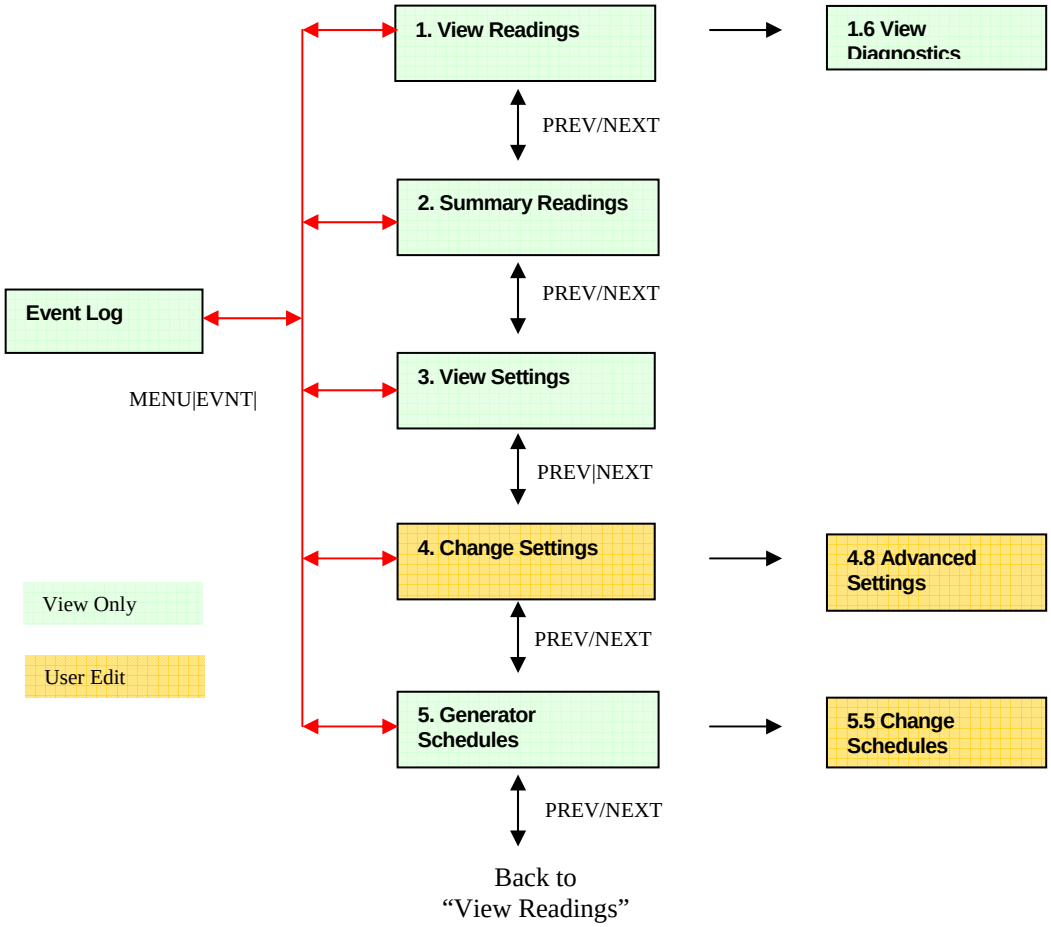


Figure 6 User Menus

User Menus allow viewing of the PS1 Readings, Settings and Schedules and changing of Settings and Schedules.

Use the four pushbuttons 

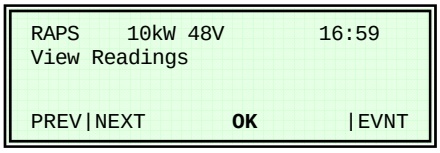
and associated LCD text to navigate the menu structure. See 3.1.1 Menu Navigation and Pushbuttons.

4.2 View Readings

The View Readings screens provide measured and calculated values of all significant system parameters. Most of the screens show four values. They provide an extensive view of the systems operation and include measured values such as voltages and currents, and values calculated by the PS1 from such measurements. For convenience the readings are grouped with related readings hence some readings are repeated in a number of places.

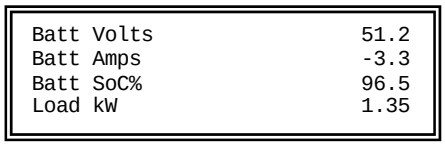
The values shown below are for illustration purposes only, actual values displayed will depend on the PS1 model and operating conditions.

1



Press OK to enter the View Readings screens. Within screens, press MENU at any time to return to this point.

1.1



View Readings=>

Batt Volts: measured DC battery voltage.

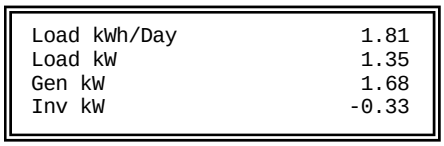
This figure may rise substantially during charging and fall soon after charging ends.

Batt Amps: net measured battery dc current including inverter current and shunt currents. Positive current charges battery, negative current discharges battery. It is possible for this figure to be negative whilst the generator is running if the inverter and generator are both supplying the load

Batt SoC%: estimated battery state of charge as a percentage of the **Batt Size Ah** setting. The value is near 100% when the battery is in a high state of charge and will decrease as the battery is discharged. During charging, the value may go above 100%; this will be reset to 100% at completion of the charge cycle if it exceeds 110%. See 6.1.1 Battery State of Charge (SoC).

Load kW: measured AC power to the load.

1.2



View Readings=>

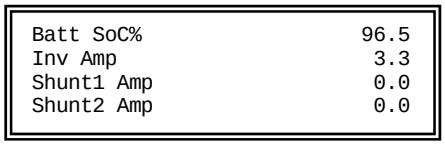
`Load kWh/Day:` measured average energy used per day for the past seven days. See 4.3 Summary Readings for accumulated load energy total.

`Load kW:` measured AC power to the load.

`Gen kW:` measured AC power from the generator. See 4.3 Summary Readings for accumulated generator energy total.

`Inv kW:` measured AC power through the inverter. When no generator is running the figure will always show positive (discharging the batteries). When a generator is operating the figure may be negative to show batteries are being charged or positive when the inverter and generator are providing power to the load

1.3



View Readings=>

`Batt SoC%:` estimated battery state of charge as a percentage of the **`Batt Size Ah`** setting.

`Inv Amps:` measured inverter dc current. Positive current charges battery, negative current discharges battery.

`Shunt 1 Amp:` measured current through Shunt 1. This could be a charging source (e.g. solar panels) which will show a positive figure, or a discharge source (e.g., DC pump or fridge) which will show a negative figure depending on the configuration for Shunt 1.
See 4.3 Summary Readings for accumulated Shunt 1 energy total.

`Shunt 2 Amp:` measured current through Shunt 2. This could be a charging source (e.g. solar/wind) which will show a positive figure, or a discharge source (e.g., DC pump or fridge) which will show a negative figure depending on the configuration for Shunt 2.
See 4.3 Summary Readings for accumulated Shunt 2 energy total.

1.4

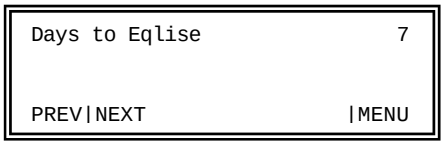
View Readings=>

`Inv VAC:` measured inverter AC voltage

`Inv Hz:` measured inverter frequency

`Gen VAC:` measured generator AC voltage

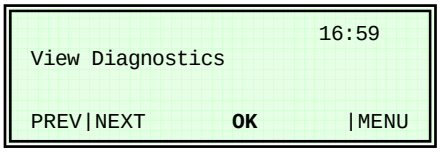
`Gen Hz:` measured generator frequency

1.5  	***View Readings=>*** **`Days to Eqlise:`** number of days remaining before the battery will be Equalised (see 6.1 Battery Management).

4.2.1 View Diagnostics

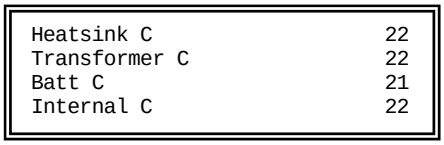
The diagnostics readings provide an insight into the system performance and operating conditions. It will be important to access this data if a fault or shut down occur.

1.6



Press OK to enter the View Diagnostics screens. Within screens, press MENU at any time to return to this point.

1.6.1



View Readings=>View Diagnostics=>

`Heatsink C:` measured PS1 internal heatsink temperature. The PS1 will start the fans at heatsink temperature of 50°C, start the generator and transfer load at 70°C and shut down at a heatsink temperature of 100°C. The inverter will restart at 85°C.

`Transformer C:` measured internal transformer temperature. The PS1 will start the fans at transformer temperature of 70°C, start the generator and transfer load at 100°C and shut down at a transformer temperature of 130°C. The inverter will restart at 115°C.

`Battery C:` measured battery temperature from the battery temperature sensor. The reading is used to compensate battery charge settings.
See **6.1.4 `Battery Temperature`**).

`Internal C:` measured internal temperature.

If shutdown temperatures are approached refer to the troubleshooting section.
See 8.3 Inverter Start/Stop/Shutdown

1.6.2

View Readings=>View Diagnostics=>

`Inv kW:` measured AC power through the inverter.

`Inv kVAr:` measured reactive power through the inverter.

`Gen kW:` measured AC power from the generator.

`Gen kVAr:` measured reactive power from the generator.

1.6.3

```
Gen:Avail kW              8.33
Gen kW                    0.47
Delta Gen Hz              0.00
Gen Hz                   50.01
```

View Readings=>View Diagnostics=>

`Gen:Avail kW`: estimated maximum power available from the generator based on the **`Gen:Max kW`** setting and the variation of generator output voltage and frequency from nominal (240VAC, 50Hz). The PS1 will limit the power drawn by the inverter to this estimated value.

As the generator frequency and voltage vary above and below nominal, **`Gen:Avail kW`** will adjust higher and lower accordingly.

At nominal, the **`Gen:Max kW`** equals the **`Gen:Avail kW`**

`Gen kW`: measured AC power from the generator.

`Delta Gen Hz`: the variation in generator output frequency.

`Gen Hz`: measured generator output frequency.

1.6.4

```
  30s Avg kW              8.50
 2min Avg kW              3.57
10min Avg kW              3.12
30min Avg kW              1.45
```

View Readings=>View Diagnostics=>

`30s Avg kW`: average load power over the last 30 seconds. The resolution is 0.5kW

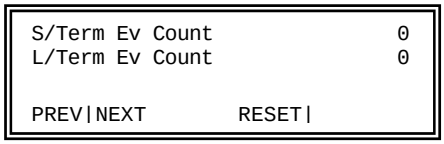
`2min Avg kW`: average load power over the last 2 minutes.

`10min Avg kW`: average load power over the last 10 minutes.

`30min Avg kW`: average load power over the last 30 minutes.

The 10 minute and 30 minute average load power levels may be set by the installer to trigger a generator start See 4.4 View Settings

1.6.5



View Readings=>View Diagnostics=>

`S/Term Ev Count:` a continuous count of abnormal system events. The count is capped at the **`S/Term Ev Limit`** value and reduced by one every 15minutes.

`L/Term Ev Count:` a continuous count of abnormal system events. The count is capped at **`L/Term Ev Limit + 2`** value and reduced by one every 6 hours.

A high frequency of such events may indicate a system problem.

Limits may be set for each of these counts. See 4.5.1 Advanced Settings.

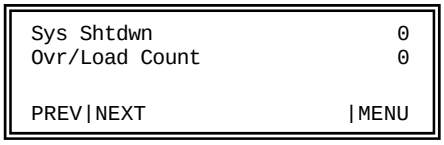
An Urgent alarm will be generated if the S/Term event count exceeds the **`S/Term Ev Limit`**. The system will shutdown for 15 minutes and then restart to clear the problem.

A Non Urgent alarm will be generated if the L/Term event count exceeds the **`L/Term Ev Limit.`** The system will not shutdown due to this threshold.

Pressing RESET will clear both counters to zero and clear the alarms.

See event information in Appendix B2.

1.6.6



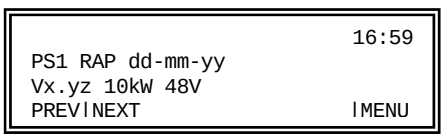
View Readings=>View Diagnostics=>

`Sys Shtdwn:` the System Shutdown will be one if the PS1 is in shutdown state and zero if the PS1 is operational. An automatic system restart will be attempted 15 minutes after shutdown.

`Ovr/Load Count :` the Over Load count is the number of inverter overloads. The counter is reduced by one (1) every 15 minutes and hence is an indication of recent inverter overloads. A maximum of 10 overloads per 15 minutes is permitted before the inverter will shutdown.

These counters cannot be reset by the user.

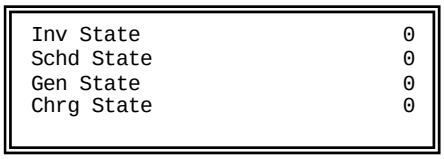
1.6.7



View Readings=>View Diagnostics=>

Software version information. This information will be required when reporting any issues.

1.6.8



View Readings=>View Diagnostics=>

`Inv State:` Inverter operating mode

`Schd State:` Generator scheduler mode

`Gen State:` Generator controller mode

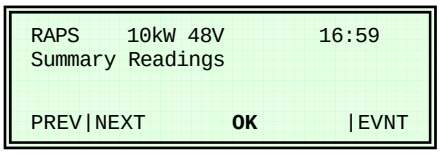
`Chrg State:` Charge controller mode

Internal state identifiers of PS1 functions.

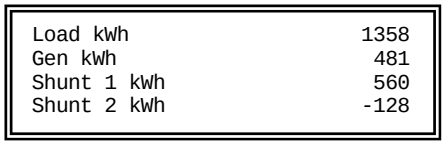
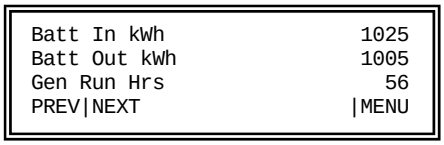
4.3 Summary Readings

The Summary Readings screens provide the cumulative measured energy usage/contribution for each of the energy loads and sources over the lifetime of the PS1. The values shown below are for illustration purposes only, actual values displayed will depend on PS1 operating conditions.

2



Press OK to enter the Summary Readings screens. Within screens, press MENU at any time to return to this point.

2.1 	***Summary Readings=>*** **Load kWh:** cumulative energy supplied to the load. **Gen kWh:** cumulative energy supplied by the generator. **Shunt 1 kWh:** cumulative energy measured on shunt 1. **Shunt 2 kWh:** cumulative energy measured on shunt 2. Note: Shunts may be configured as DC Load (negative kWh) or Renewable (positive kWh) or net Renewable + DC Load (positive = more renewable than DC Load, negative = more DC Load than Renewable).
2.2 	***Summary Readings=>*** **Batt In kWh:** cumulative energy supplied to the battery. **Batt Out kWh:** cumulative energy supplied by the battery. **Gen Run Hrs:** cumulative generator running time.

4.4 View Settings

The View Settings screens provide access to see settings that control the PS1 operation. They provide an extensive view of the systems current configuration. To prevent unintended changes, settings cannot be changed in the View Settings menus.

The majority of settings are configured as part of the installation procedure and are not alterable by the User. User alterable settings are indicated in the text. To change these settings access the Change Settings menus (see 4.5 Change Settings).

3

```
RAPS    10kW 48V        16:59
View Settings


PREV|NEXT        OK        |EVNT
```

Press OK to enter the View Settings screens. Within screens, press MENU at any time to return to this point.

3.1

```
Batt Size Ah                1000
Gen:Max kW                  8.00
Sync Tol VAC                  30
Float:Hold V                54.0
```

View Settings=>

`Batt Size Ah`: set battery size in ampere-hours configured in the system. This will be set according to the battery size installed and the typical charge discharge profile.

`Gen:Max kW`: Generator capacity in kW connected to the system. The maximum power the PS1 will draw from the generator at nominal output.

`Sync Tol VAC`: +/- generator AC voltage tolerance from nominal. The PS1 will not sync or disconnect outside these limits.

`Float:Hold V`: battery voltage maintained by the PS1 after charge cycle complete whilst still synchronised to the generator.

If the battery voltage is held above this level by other charging source/s for Float Time and the current is less than Equalise Charge A then the automatic equalisation will be deferred by 1 day – See **`Days to Eqlise`**.

3.2

```
Gen:Start V1              46.4
Gen:Start V2              44.4
Inv:Shtdwn V1             44.4
Inv:Shtdwn V2             42.4
```

View Settings=>

`Gen:Start V1:` battery voltage at which the generator will be started on load less than 10% of inverter power rating.

`Gen:Start V2:` battery voltage at which the generator will be started on load more than 10% of inverter power rating.

`Inv:ShtdwnV1:` battery voltage at which the PS1 will shut down on load less than 10% of inverter power rating.

`Inv:ShtdwnV2:` battery voltage at which the inverter will shut down on load more than 10% of inverter power rating.

Note: Generator will start at any time these settings are reached.

Note: On heavier loads the battery voltage is expected to be less than on lighter loads. If the PS1 is in shutdown the measured battery voltage may rise above these shutdown values due to the decreased load. The PS1 will restart when the battery voltage rises above the restart.

3.3

```
Level 1 SoC%              90
Level 2 SoC%              70
Level 3 SoC%              60
Inv:Shtdwn SoC%           50
```

View Settings=>

See 6.3.1 Generator Control based on SoC.

`Level 1 SoC%:` the battery state of charge below which the generator will start in the preferred generator run hour. The **preferred run hour** starts at the **`Begin Lvl 1 Hr`** and extends for 1 hour. Level 1 is normally set highest of the three SoC% levels.

`Level 2 SoC%:` the battery state of charge below which the generator will start during the preferred generator run period. The **preferred period** starts at the **`Begin Lvl 2 Hr`** and extends to the **`Begin Lvl 3 Hr.`** Level 2 is normally set as the mid SoC% level.

`Level 3 SoC%:` the battery state of charge below which the generator will start during the non-preferred generator run period. The **non-preferred period** starts at the **`Begin Lvl 3 Hr`** and extends to the **`Begin Lvl 2 Hr.`** Level 3 is normally set as the lowest SoC% level.

`Inv:Shtdwn SoC%:` the battery state of charge below which the PS1 will be shut down to prevent over-discharge of the battery.

A value of zero means that state of charge is not used to trigger PS1 shutdown.

3.4

```
                          16:59
Begin Lvl 1 Hr              17
Begin Lvl 2 Hr              12
Begin Lvl 3 Hr              21
```

View Settings=>

See 6.3.1 Generator Control based on SoC.

`Begin Lvl 1 Hr:` the beginning of the **preferred run hour** which is a one hour period when it is most preferable to have the generator running if the battery state of charge warrants it. The preferred hour must be within the preferred period (see Begin Lvl 2 Hr below).

A setting of zero disables this level.

`Begin Lvl 2 Hr:` the beginning of the **preferred period** when it is preferred to run the generator if the battery state of charge warrants it. The preferred period includes the preferred hour.

`Begin Lvl 3 Hr:` the beginning of the **non-preferred period** when it is not desirable to run the generator. The generator will start in this period if the battery state of charge warrants it.

A setting of zero disables the **non-preferred period**.

Note: Each of these settings can be changed from the Change Settings menus.
See 4.5 Change Settings.

3.5

```
Init:Chrg V                 55.2
Bulk:Chrg V                 56.1
Absorb:Chrg V               57.2
Eqlise:Chrg V               58.1
```

View Settings=>

`Init:Chrg V:` set point voltage during the Initial stage of the charging cycle.

`Bulk:Chrg V:` set point voltage during the Bulk stage of the charging cycle.

`Absorb:Chrg V:` set point voltage during Absorption stage of the charging cycle.

`Eqlise:Chrg V:` set point voltage during Equalisation stage of the battery charging cycle.

See 6.1.3 Battery Charger Operation

3.6

```
Init:Chrg A                 100
Bulk:Chrg A                  80
Absorb:Chrg A                30
Eqlise:Chrg A                10
```

View Settings=>

`Init:Chrg A:` maximum charge current during the Initial stage of the battery charging cycle

`Bulk:Chrg A:` maximum charge current during the Bulk stage of the battery charging cycle

`Absorb:Chrg A:` maximum charge current during the Absorption stage of the battery charging cycle.

Maximum charge current during the Float stage of the battery charging cycle**.**

`Eqlise:Chrg A:` maximum charge current during the Equalisation stage of the battery charging cycle

See 6.1.3 Battery Charger Operation

Note 1: These currents are the total charge current to the battery from both the generator and the renewable source combined.

3.7

```
Init:Time mins               10
Bulk:Time mins               20
Absorb:Time mins             40
Eqlise:Time hrs             3.0
```

View Settings=>

`Init:Time mins:` time in the Initial stage of the battery charging cycle once Init:Chrg V is reached.

`Bulk:Time mins:` time in the Bulk stage of the battery charging cycle once Bulk:Chrg V is reached.

`Absorb:Time mins:` time in the Absorption stage of the battery charging cycle once Absorb:Chrg V is reached.

`Eqlise:Time hrs:` time in the Equalisation stage of the battery charging cycle.

See 6.1.3 Battery Charger Operation

Note: Equalisation Time elapses when the battery voltage is between **`Eqlise:Chrg V`** and **`Eqlise:Limit V`**.

3.8

```
Chrg:End A/15m              20
Eqlise:Limit V            63.6
Chrg:Max Hrs                 6
Inv:ReStart V             52.3
```

View Settings=>

Chrg:End A/15m: Charge End Amperes per 15 minutes.

A slow rate of charge of the battery charging current is an indicator that the battery is no longer able to absorb much of the charge current. If the rate of change of the battery charge current falls below this level the Bulk and Absorption stages of the battery charging cycle will end and the charge cycle will enter the next stage.

Eqlise:Limit V: Equalise Limit Voltage. During battery equalization the battery voltage will not exceed this limit.

During all other charge stages, the compensated charge voltage will not exceed this limit.

Chrg:Max Hrs: maximum time allowed for each battery charge cycle to complete. After this duration the current charge cycle stage will be terminated and the next charge stage will start.

See 6.1.3 Battery Charger Operation

Inv:ReStart V: Voltage at which inverter will restart after discharge shutdown.

3.9

```
  30s Start kW              12.0
 2min Start kW              10.0
10min Start kW               8.0
30min Start kW               4.0
```

View Settings=>

30s Start kW: 30 second average load power setting to start the generator. This is a fixed system setting.

2min Start kW: 2 minute average load power setting to start the generator. This is a fixed system setting.

10min Start kW: 10 minute average load power setting to start the generator.

30min Start kW: 30 minute average load power setting to start the generator.

3.10

```
Gen:Min Load kW              7
Gen:Min Run min             30
Power Save W                20
PREV|NEXT                  |MENU
```

View Settings=>

Gen:Min Load kW: the minimum load that must be drawn from the generator for it to continue to run.

Gen:Min Run min: the minimum generator run time. If the generator is started it will run for at least this time.

To change this setting access the Change Settings menus (see 4.5 Change Settings).

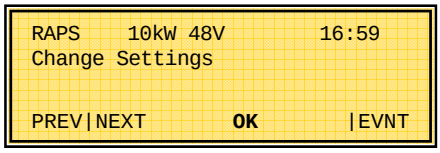
Power Save W: the minimum AC load that must be drawn in the house to take the PS1 from Power Save mode to continuous operation.

To change this setting access the Change Settings menus. See 4.5 Change Settings).

4.5 Change Settings

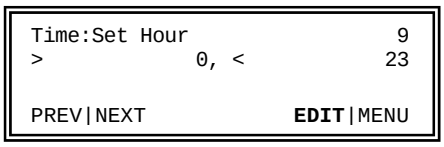
These menus provide access to change the user operational settings of the PS1. There is a top level menu (Change Settings) for the most frequently used settings and a submenu (Advanced User Settings) containing other less used settings.

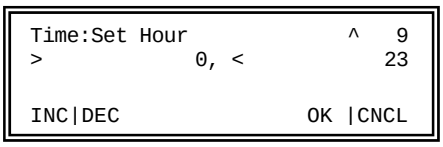
4



Press OK to enter the Change Settings screens. Within screens, press MENU at any time to return to this point.

4.1





Change Settings=>

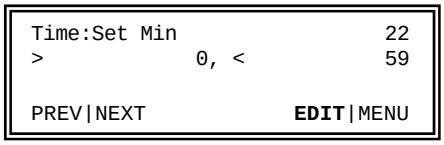
`Time:Set Hour`;

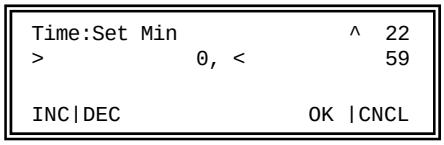
Unit - Hour of the day – 12 = midday, 0 = midnight

Range 0 -> 23

The system time is the basis of many system functions. It should be set to the correct local time of day.

4.2





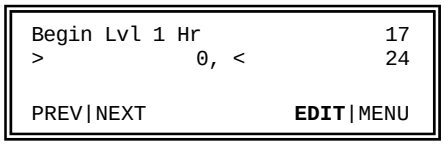
Change Settings=>

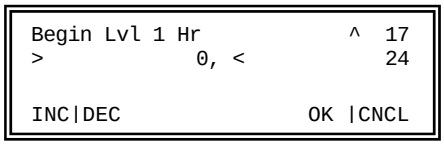
`Time:Set Min`;

Unit - Minutes

Range 0 -> 59

4.3





Change Settings=>

See 6.3.1 Generator Control based on SoC.

`Begin Lvl 1 Hr:`

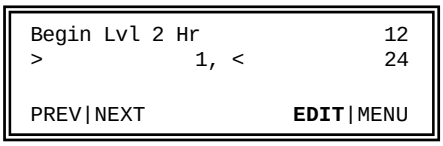
Unit - Hour of the day – 12 = midday, 24 = midnight

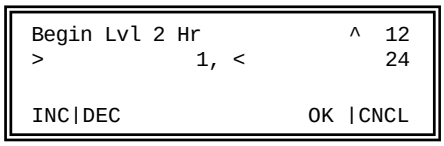
Default 17:00 hrs (5pm)

Range 0 -> 24

Setting this parameter to zero will disable charging based on **`Level 1 SoC%.`**

4.4





Change Settings=>

See 6.3.1 Generator Control based on SoC.

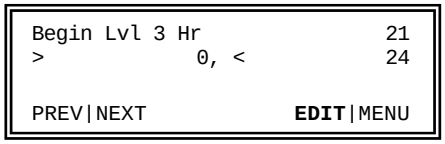
`Begin Lvl 2 Hr`.

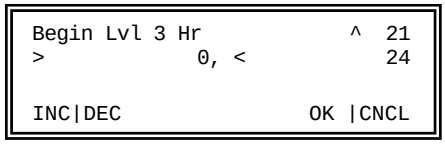
Unit - Hour of the day – 12 = midday, 24 = midnight

Default 12:00 hrs (12pm)

Range 1 -> 24

4.5





Change Settings=>

See 6.3.1 Generator Control based on SoC.

`Begin Lvl 3 Hr`

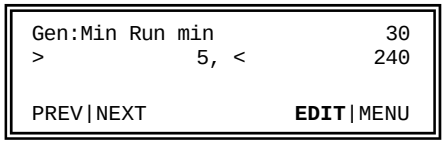
Unit - Hour of the day – 12 = midday, 24 = midnight

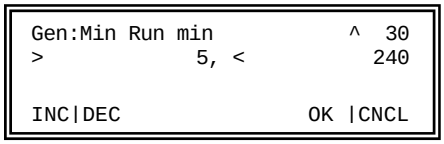
Default 21:00 hrs (9pm)

Range 0 -> 24

Setting this parameter to zero will disable charging based on **`Level 3 SoC%.`**

4.6





Change Settings=>

`Gen:Min Run min`:

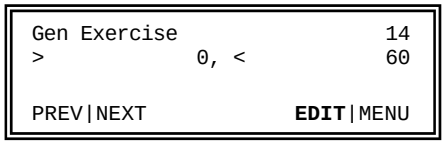
Unit - minutes

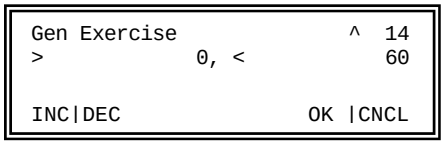
Default 30

Range 5 -> 240

This minimum run time should be set according to the generator manufacturers' recommendation.

4.7





Change Settings=>

`Gen Exercise` : Number of days between generator exercise starts.

Unit - days

Default 14

Range 0 -> 60

The PS1 will start the generator at the Begin Lvl1 Hr (or 12noon if Begin Lvl1 Hr is disabled) after Gen Exercise days has elapsed from the last time the generator ran. This ensures that the number of days between generator runs is never more than Gen Exercise days.

The Gen Exercise setting should be set according to the generator manufacturers' recommendations.

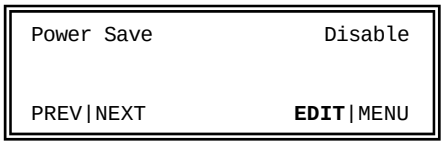
Setting this parameter to zero will disable the generator exercise function.

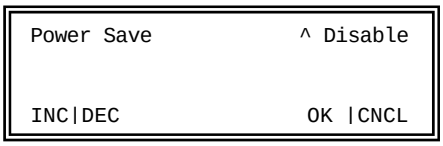
4.5.1 Advanced Settings

4.8

Press OK to enter the Advanced Settings screens. Within screens, press MENU at any time to return to this point.

4.8.1





Change Settings=>Advanced Settings=>

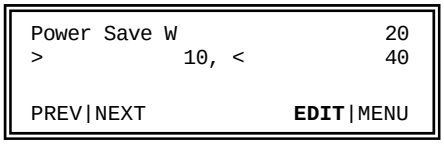
Power Save:

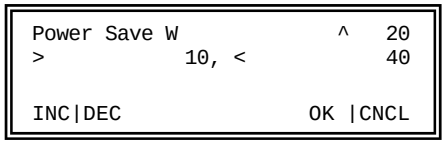
Default Disable

Options Enable, Disable

Enabling Power Save places the PS1 into Power Save mode. The PS1 pulses the load every second and switches ON the AC output continuously when a load exceeding **Power Save W** is detected. When the load power falls below this level the unit reverts to again pulsing the load.

4.8.2





Change Settings=>Advanced Settings=>

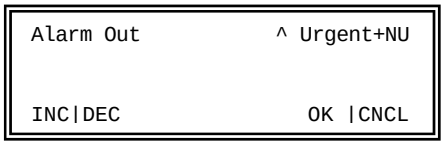
Power Save W:

Unit - Watts

Default 20

Range 10 -> 40

4.8.3



Change Settings=>Advanced Settings=>

See 6.6 Inverter External Alarm

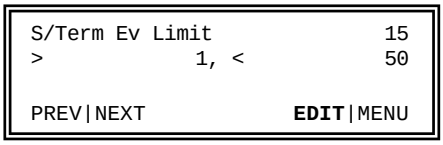
`Alarm Out`: Set what type of alarms to be output via the PS1 Alarm relay.

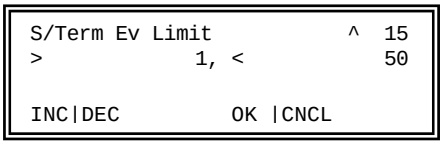
Default Urgent + NU

Options Urgent + NU, Urgent

NU = Non Urgent alarm

4.8.4





Change Settings=>Advanced Settings=>

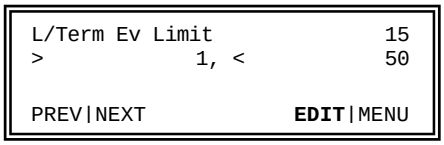
`S/Term Ev Limit:` Limit and alarm point for S/Term Ev Count.

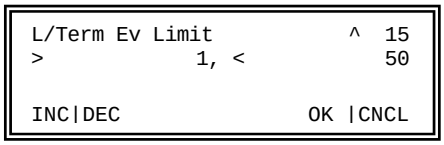
Unit - count

Default 15

Range 1 -> 50

4.8.5





Change Settings=>Advanced Settings=>

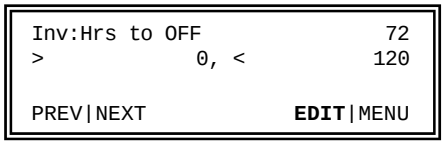
`L/Term Ev Limit`: Limit and alarm point for L/Term Ev Count.

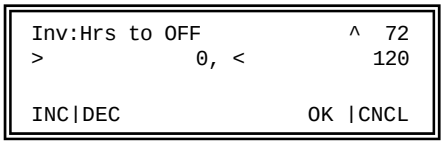
Unit - count

Default 15

Range 1 -> 50

4.8.6





Change Settings=>Advanced Settings=>

Inv:Hrs to OFF: the number of hours the PS1 controller will remain operational while in the shutdown state.

Unit: hours

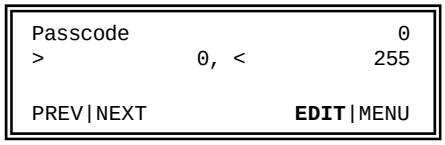
Default: 72

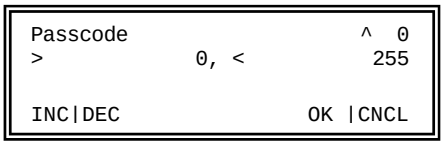
Range: 0 -> 120

The PS1 consumes a small standby current in the shutdown state. The controller must remain operational to allow for automatic shutdown recovery, system monitoring and logging and to enable the Generator Backup Schedule. To prevent excessive battery discharge, the PS1 will trip the DC circuit breaker and completely power down after the battery voltage falls below the nominal battery voltage (48.0VDC / 2.00V/cell) for the time set by this parameter.

Setting this parameter to zero will disable this automatic power down.

4.8.7





Change Settings=>Advanced Settings=>

Passcode: Extended installer access.

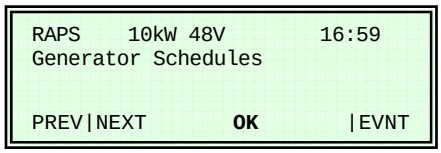
4.6 Generator Schedules

A comprehensive generator schedule is supplied as another means of starting the generator when required. The generator run times can be scheduled to meet regular heavy load periods such as meal times or other periods of high demand. Two schedule types are available each with four configurable start times and durations. A normal Gen Run Schedule (**Gen Run Schedule Start Time A - D**) for daily generator running and a Gen Backup Schedule (**Backup Run Schedule Time A - D**) for emergency generator running if the PS1 shuts down for an extended period.

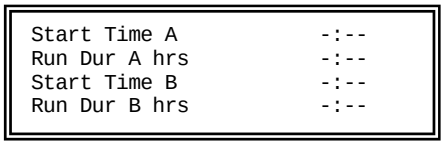
For further details of Generator Schedules see 6.3.5 Generator Scheduling

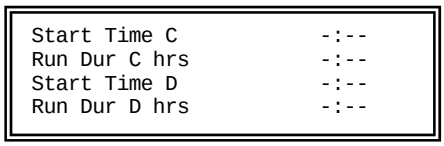
The Generator Schedules screens provide access to **view** configured generator run and backup schedules. All of these settings may be changed by the User. To change any of these settings access the Change Schedule submenu (see 4.6.1 Change Generator Schedules).

5



Press OK to enter the Generator Schedules screens. Within screens, press MENU at any time to return to this point.

5.1 	***Generator Schedules=>*** **Start Time A:** scheduled generator start time A. **Run Dur A hrs:** generator run duration from start time A. **Start Time B:** scheduled generator start time B. **Run Dur B hrs:** generator run duration from start time B. Note: The Start Times must be used in sequence A to D. An unused Start Time disables subsequent start times.

5.2 	***Generator Schedules=>*** **Start Time C:** scheduled generator start time C. **Run Dur C hrs:** generator run duration from start time C. **Start Time D:** scheduled generator start time D. **Run Dur D hrs:** generator run duration from start time D. Note: The Start Times must be used in sequence A to D. An unused Start Time disables subsequent start times.

5.3

```
Backup Time A          -:--
Run Dur A hrs          -:--
Backup Time B          -:--
Run Dur B hrs          -:--
```

Generator Schedules=>

Backup Time A: generator start time A in case of PS1 shutdown.

Run Dur A hrs: generator run duration from backup start time A.

Backup Time B: generator start time B in case of PS1 shutdown.

Run Dur B hrs: generator run duration from backup start time B.

Note: The Backup Times must be used in sequence A to D. An unused Backup Time disables subsequent Backup Times.

5.4

```
Backup Time C          -:--
Run Dur C Hrs          -:--
Backup Time D          -:--
Run Dur D hrs          -:--
```

Generator Schedules=>

Backup Time C: generator start time A in case of PS1 shutdown.

Run Dur C hrs: generator run duration from backup start time C

Backup Time D: generator start time D in case of PS1 shutdown.

Run Dur D hrs: generator run duration from backup start time D.

Note: The Backup Times must be used in sequence A- D. An unused Backup Time disables subsequent Backup Times.

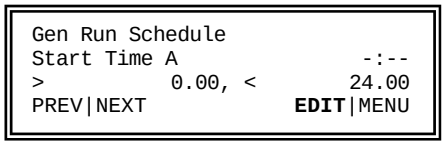
4.6.1 Change Generator Schedules

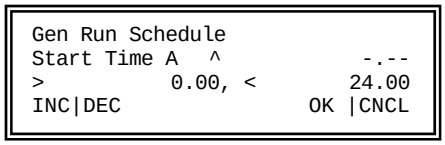
The Change Schedule screens provide access to modify configured generator run and backup schedules.

5.5

Press OK to enter the Change Schedules screens. Within screens, press MENU at any time to return to this point.

5.5.1





Generator Schedules=>Change Schedule

Gen Run Schedule - Start Time A:

Unit: hour:minute of day 12:00 = midday 24:00 = midnight

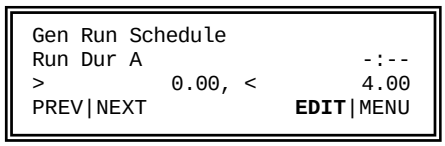
Default: -:-- (OFF)

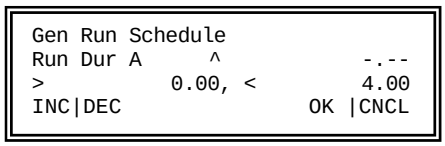
Range: 0:15 -> 24:00 in 15 minute steps

The generator will start at the set time and run for **Run Dur A** duration (see next menu).

There are three other identical menus **Start Time B, Start Time C** and **Start Time D** allowing four run periods per day.

5.5.2





Generator Schedules=> Change Schedule

Gen Run Schedule – Run Dur A:

Unit: hours:minutes

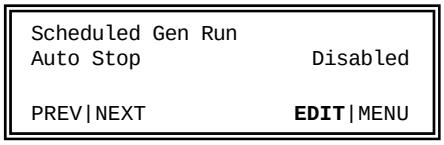
Default: -:-- (OFF or Auto Stop)

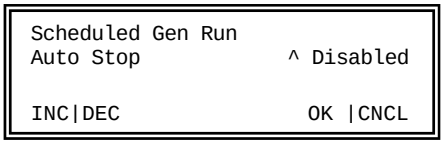
Range: 0:15 -> 4:00 in 15 minute steps

The generator will run for at least the configured duration and may keep running past the scheduled stop depending on the **Scheduled Gen Run – Auto Stop** setting (see next setting).

There are three other identical menus **Run Dur B, Run Dur C** and **Run Dur D** allowing four run periods per day.

5.5.9





Generator Schedules=> Change Schedule

Scheduled Gen Run – Auto Stop:

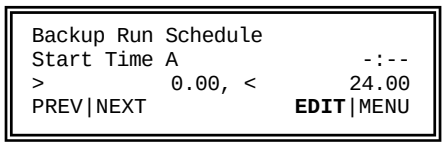
Default: Disabled

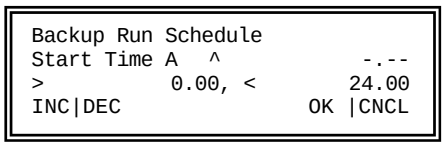
Options: Enabled, Disabled

If Auto Stop is disabled then the generator will run for the scheduled duration regardless of other factors.

If Auto Stop is enabled the generator may continue to run for longer than the configured duration (including zero duration) until the battery charge cycle is complete cycle and system load conditions not longer require the generator to run.

5.5.10





Generator Schedules=> Change Schedule

Backup Run Schedule - Start Time A:

Unit: hour:minute of day 12:00 = midday 24:00 = midnight

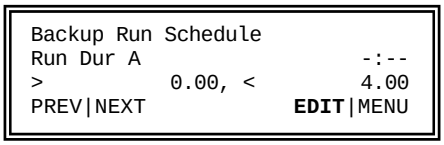
Default: -:-- (OFF)

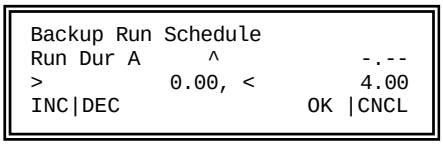
Range: 0:15 -> 24:00 in 15 minute steps

The generator will start at the set time when the inverter is shutdown and run for **Run Dur A** duration (see next menu).

There are three other identical menus **Start Time B, Start Time C** and **Start Time D** allowing four run periods per day.

5.5.11





Generator Schedules=> Change Schedule

Backup Run Schedule – Run Dur A:

Unit: hours:minutes

Default: -:-- (OFF)

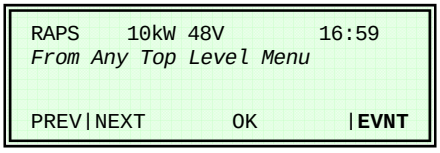
Range: 0:15 -> 4:00 in 15 minute steps

Run Duration A sets the backup run duration for **Start Time A**.

There are three other identical menus **Run Dur B, Run Dur C** and **Run Dur D** allowing four backup run periods per day.

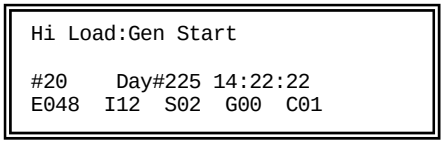
4.7 LCD Event Log

The Event log may be accessed from any top level menu using the EVNT function key. The log contains the last 32 events beginning with the most recent event. The UP key may be used to scroll backwards (in time) through the log, the DOWN key to scroll forward through the log. The forward scroll, (DOWN) halts at the most recent event.



Press MENU to enter the Event Log screens. Within screens, press MENU at any time to return to this point.

Example display



Hi Load:Gen Strt: Event text.

#20: Event sequence number in the 32 entry event log.

Day#225: Day of the year the event occurred.

14:22:22: Time the event occurred.

E048: Event identification number. Refer to Appendix B2 Event Definitions for more information.

I12, S02, G00, C01: Internal State Identifiers at time of event.

4.7.1 Using the LCD Event Log

The event log in conjunction with the menu system is an invaluable tool in understanding the systems operation, monitoring system performance and the diagnosis of system issues. The log is a circular list of the last 32 events. Generally, by the time the log is full the oldest event is no longer of interest and the next event replaces it in the log.

The most recent event is first to be displayed when the event log is accessed.

Use the event name and time stamp of the most recent sequence of events to gain an understanding of system behaviour. Each event may have a number of different causes, for example Hi Load Gen Strt may be due to one of four load levels. The event cause identification number (E048 in the example) provides more information on the cause of the event (see Appendix B2 Event Definitions).

Regularly reviewing the event log to understand normal sequences of events for your system will enhance your understanding of system operation and interaction with other system components and capability to respond to system problems.

5 User Operating Procedures

5.1 Routine Monitoring of Operation

The following items should be monitored on a regular basis:

- Battery Voltage, this should NEVER be below the nominal system voltage, e.g. 24v, 48v or 120v
- Battery SoC%, a high average figure will maintain battery life
- The average daily energy supplied to the load (**Load kWh/Day**), the lower this figure is, the less re charging will have to take place, this will maximize battery life
- Event Log – expected events
- Event Log – unexpected events
- System temperatures, the lower the better
- Short Term and Long Term event counts

5.2 Routine Maintenance

- Cleaning vents
- Five yearly refurbishment

5.3 Changing Configuration Settings

The following is recommended when adjusting system settings:

- Record existing settings for the parameters about to be changed
- Change the minimum set of parameters at any one time then check for expected results.

5.4 System Shutdown

If the system is to be left unattended with the power off:

- Turn off the inverter
- Isolate battery from the inverter.
- Isolate the solar array or other renewable from the inverter.

Your installer will provide details of how to do this.

5.5 Operating Without the Generator

If the generator is not available the following recommendations should be followed to conserve the battery:

- Turn on Load Search (see 4.5.1Advanced Settings). The PS1 will pulse the output voltage and only supply continuous voltage when the load exceeds a defined limit. If present, renewable energy will recharge the battery.
- Switch off the PS1 when ever possible to reduce the load on the battery, allowing the battery to be recharged even by small renewable power.
- If the battery becomes heavily discharged, the PS1 will automatically stop supplying AC power to the load, to prevent battery degradation or damage. Switching the PS1 briefly off then back on via the **ON/OFF** pushbutton**,** will restart the inverter for a short time at the expense of discharging the battery even more deeply.

Note: The PS1 internal electronics are powered from the DC (battery) side, not from the AC (generator) side. Therefore if the battery is excessively discharged, the electronics may not be able to start up until the battery is partially recharged, from renewable power for example.

6 PS1 Operation

The following section describes in detail the operation of the PS1. A good understanding of the operation of the unit is not necessary but by knowing how the system works will enable you to understand the programmed settings and change the user settings to suit your own needs as required.

The PS1 Battery management continuously monitors the system operation. This monitoring allows the PS1 to automatically start the generator to keep the battery system charged or if the load is sufficient, start to supply the load directly. The monitoring includes any input from renewable sources and any loads directly connected to the battery bank.

The PS1 uses a five stage temperature compensated battery charging system. This system gives a high degree of flexibility so it can charge the multitude of battery types available.

The PS1 incorporates a programmable generator scheduler. These schedules can be set to meet regular system loads. At a particular time the generator can be running ready to meet those loads which are better powered directly from the generator.

6.1 Battery Management

Please refer to the battery manufacturer's documentation for recommendations regarding settings for your particular battery. Inappropriate settings may have a detrimental affect on your battery life and performance.

The PS1 provides comprehensive battery management settings and control to allow a charge regime to achieve optimal battery life.

PS1 battery management features include:

- State of Charge monitoring and control.
- Battery voltage monitoring and control.
- Charging initiated by battery state of charge and/or battery voltage.
- Five stage charge cycle: Initial, Bulk (0-90%), Absorption (90%~100%), Float and Equalise.
- Shutdown on very low battery voltage, battery state of charge, or both.
- Battery Temperature compensation of charging voltage based on battery temperature.

The PS1 may be configured to automatically start the generator when a battery charge cycle is required.

It is important that the battery manufacturer's recommendation be adhered to for ongoing monitoring and maintenance of batteries.

6.1.1 Battery State of Charge (SoC) monitoring and control

The PS1 has no direct means of measuring the battery state of charge; it uses measurements of the currents flowing in and out of the battery to estimate the charge remaining in the battery. The resultant net current is expressed as a percentage of the battery size set in the PS1 (**`Batt Size Ah`**). There is no compensation for the rate at which the current is drawn from or fed into the battery.

Current into the battery during a charge cycle and current measured on either of the shunts, when configured as Renewable, add to the battery state of charge estimate.

Current out of the battery to supply the load and current measured on either of the shunts, when configured as Load, deduct from the battery state of charge estimate.

If the shunt is configured as Renewable (+) and Load (--) the net result is added to the battery state of charge estimate.

The state of charge is used to automatically start the generator and begin charging the batteries. Different levels apply at different time of the days to ensure the generator is only used when required. Refer to 6.3.1 Generator Control based on SoC

At completion of charge cycle the battery SoC based on the estimation will be close to 100% but may vary depending of the charge and discharge rates.

6.1.2 Battery Voltage monitoring and control

The PS1 directly measures the battery voltage.

The battery voltage is used to automatically start the generator and begin charging the batteries. Normally the battery voltage would not reach the levels set as the state of charge control levels would be reached first. Different levels are used depending on the load on the system.

The battery voltage is used to protect the system by shutting the unit down should the battery voltage go above or below set limits. The shutdown limits must be set to higher than the maximum charge voltage and less than the generator start limits. For the low voltage shutdown limits the unit again employs different levels depending on system load. The system will always attempt to start the generator before shutting the unit down due to low voltage.

6.1.3 Battery Charger Operation

The PS1 charges the battery in a five-stage cycle with each stage controlled by voltage, current and time settings. These settings are fully configurable in your unit however they should not require changing after initial installation unless some aspect of the battery installation changes. The configured value of each setting can be viewed on the LCD display (see 4.4 View Settings).

Each voltage setting is battery temperature compensated. The values displayed do not change. See Battery Temperature.

Refer to the Battery Charging Cycle graph of the following page.

6.1.3.1 Initial

The PS1 charges at the initial charging current (**Init:Chrg A**) until the battery voltage rises to the initial charge voltage (**Init:Chrg V**), holds this voltage for **Init:Time mins**, then starts the Bulk stage.

6.1.3.2 Bulk

The PS1 charges at the bulk charge current (**Bulk:Chrg A**) until the bulk charge voltage (**Bulk:Chrg V**) is reached, then holds this voltage for at least **Bulk:Time mins** and until the battery is approaching a high state of charge as indicated by the rate of change of charging current falling to **Chrg:End A/15m**. The Absorption stage is then started.

6.1.3.3 Absorb

The PS1 charges at the absorb charge current (**Absorb:Chrg A**) until the absorb charge voltage (**Absorb:Chrg V**) is reached, then holds this voltage for at least **Absorb:Time mins** and until the battery is approaching a high state of charge as indicated by the rate of change of charging current falling to **Chrg:End A/15m**. At completion of this stage the charger will enter the Float stage unless a battery Equalise cycle is due, in which case an Equalise cycle will complete before entering Float.

6.1.3.4 Float

The PS1 holds the battery voltage at the **Float Hold V** and will provide up to the absorb charge current to maintain the **Float Hold V**. The charge current is limited to **Absorb:Chrg A** in this stage. The PS1 will remain in this charge state until the generator has been shutdown.

6.1.3.5 Equalise

Periodically, as set by **Eqlise:Freq Day,** the PS1 performs an equalise charge in which the battery is held at a higher voltage between **Eqlise:Chrg V** and **Eqlise:Limit V** for several hours (**Eqlise:Time hrs**).

This restores to full charge any partially discharged cells in the series battery bank. To disable the Equalise function **Eqlise:Time hrs** may be set to zero.

The Equalise cycle will be automatically delayed by one day for each day the battery has been in above the **Float:Hold V** for the Float time set during installation.

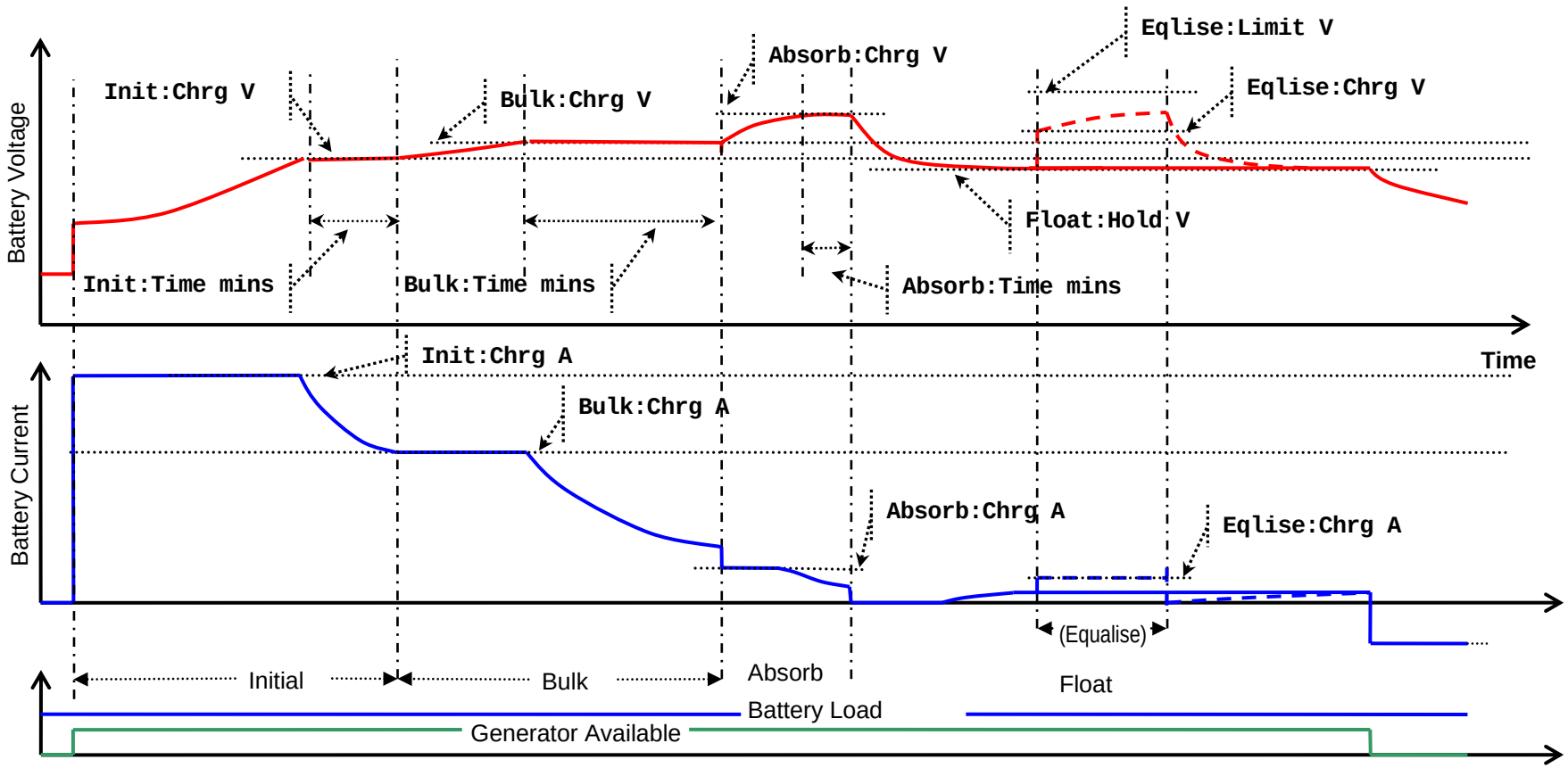


Figure 7 Battery Charging Cycle

6.1.4 Battery Temperature

The PS1 monitors the battery temperature via the sensor provided. The supplied battery temperature sensor is mounted in thermal contact with the centre of the side of a battery. If the sensor is not in thermal contact with the battery bank the batteries will not be correctly charged. Check battery temperature is reading correctly - see 4.2.1 View Diagnostics.

The charge voltage set points are compensated by battery temperature. The compensation applied is --5mV/°C/cell with zero compensation at 20°C.

e.g. Init:Chrg V = 55.2, Battery Temperature = 26°C, No. Battery Cells = 24.

Compensated Charge voltage = 55.2 + ((20 - 26) x 0.005 x 24)

= 54.48

Absorb:Chrg V = 57.6, Battery Temperature = 6°C, No. Battery Cells = 24.

Compensated Charge voltage = 57.6 + ((20 - 6) x 0.005 x 24)

= 59.28

During all charge stages, the compensated charge voltage will not exceed Eqlise:Limit V.

Compensation improves battery performance and prevents battery overheating.

The charge current is also limited by battery temperature. Battery temperatures above 40°C cause the battery charger to reduce the charge current limit point. This will help prevent battery overheating.

6.2 Renewable Management

The PS1 feeds renewable power to the AC load, and any excess is stored in the battery for later usage. If the battery is fully charged and the DC load is not on, the excess is wasted (the renewable power is reduced or disconnected by the regulator). Such waste can be reduced by reducing the level to which the generator charges the battery, or particularly for solar renewable, by not running the generator in the morning.

If battery charging is in progress and renewable output increases sufficiently to cause the generator charge power to become negative when averaged over 2 minutes, the PS1 terminates the charge cycle after the generator minimum run time has expired. If equalize charging was in progress, it is terminated and rescheduled for the next day Such conditions occur when renewable output exceeds the sum of the load demand plus the required charge power.

6.3 Automatic Generator Control

The PS1 may be configured to automatically control the generator as required to supply the load and charge the attached battery or to allow manual control of the generator by the user. Generally automatic control of the generator is recommended for daily operation.

The generator will only run in automatic mode if the Gen NOT Available LED (LED7) is off. If this LED is ON, the PS1 will not automatically start the generator. This is controlled via a digital input to the PS1 - Generator Available or can be permanently enabled via an installer setting.

As part of the installation, the PS1 settings are configured to automatically run the generator to:

- Limit the depth of battery discharge, for maximum battery life.
- Deliver energy efficiently by supplying sustained large loads direct from the generator.
- Load the generator to the highest possible level while running, to efficiently convert fuel to electricity.
- Not frequently start and stop the generator, which would reduce its life and increase maintenance.
- Avoid noise by starting the generator late at night only for heavy loads or a deeply discharged battery.

In the PS1 RAPS system, the PS1 automatically runs the generator for the following reasons:

- Battery conditions, in particular state of charge (SoC), require the generator to charge the battery (see 6.3.1Generator Control based on SoC and 6.3.2 Generator Control based on Battery Voltage).
- Load conditions are such that the PS1 ratings are exceeded or a sustained load is large enough to efficiently load up the generator hence running the generator will be the most efficient method to supply the load. For loads exceeding the generator rating the PS1 draws power from the battery, adding its power output to that of the generator (see 6.3.3 Generator Control based on AC Load).
- Time Schedules are set to regularly run the generator at times of expected peak loads or at convenient times (see 6.3.5 Generator Scheduling).

- The generator has not been run for Gen Exercise days. The PS1 will start the generator at the **`Begin Lvl 1 Hr`** or 12 noon if **`Begin Lvl 1 Hr`** is disabled. Normal automatic stop conditions apply.
- Backup Schedules are set to run the generator in case of PS1 shutdown to power vital equipment (see 6.3.5 Generator Scheduling).

6.3.1 Generator Control based on SoC

The PS1 may be configured to start the generator to charge the battery based on the battery **S**tate **o**f **C**harge (SoC). This method of generator control is recommended to efficiently and reliably maintain the battery charge.

The battery SoC is estimated by the PS1 and displayed as a percentage of the battery capacity and represented throughout this manual and in the menu system by the symbol SoC%. See 6.1.1 Battery State of Charge (SoC) for a details of state of charge estimation.

A daily profile of preferred generator start times and battery charge levels may be configured to allow the PS1 to automatically start and stop the generator. The profile provides the flexibility to accommodate for individual site characteristics such as renewable availability, usage patterns and generator noise considerations.

Several PS1 settings are configured to divide the day into three periods (refer Figure 8):

- **Preferred Hour:** The one hour when it is most preferable to run the generator. This is a period starting at **`Begin Lvl 1 Hr`**, typically about 5 or 6pm. During this period the generator is started if the battery is discharged below **`Level 1 SoC%`** to perform a full battery charge.
- **Preferred Period:** The period from **`Begin Lvl 2 Hr`** to **`Begin Lvl 3 Hr`**, when you prefer the generator to run if the battery state of charge warrants it. The preferred period includes the preferred hour. During this period the generator is started if the battery is discharged below **`Level 2 SoC%`** to perform a full battery charge.
- **Non-Preferred Period:** The period from **`Begin Lvl 3 Hr`** to **`Begin Lvl 2 Hr`**, when you prefer the generator **not** to run. This period is usually overnight to avoid noise. During this period the generator will be started only if the battery is seriously discharged (below **`Level 3 SoC%`**) and will only perform a partial recharge.

If the PS1 starts the generator within the non-preferred period it will run the generator for time determined by the **`Gen:Min Run min`** setting. At other times, once the generator is started, it is run until the battery is fully charged.

Once the charging is completed the generator will stop unless the load or schedules keep it running. See 6.3.4 Generator Automatic Stopping

The starting time for each of the periods (**`Begin Lvl 1 Hr`** , **`Begin Lvl 2 Hr`** and **`Begin Lvl 3 Hr)`** can be set via the User menus. The battery state of charge levels (**`Level 1 SoC% Level 2 SoC%`** and **`Level 3 SoC%)`** are set by the installer at the time of installation.

6.3.1.1 Example Configuration 1 – Solar + Generator

The generator starting strategy depends on individual site requirements. In systems with high solar contribution the **`Begin Lvl 2 hr`** could be delayed until later to provide an opportunity for solar to charge the battery (see Figure 8 below).

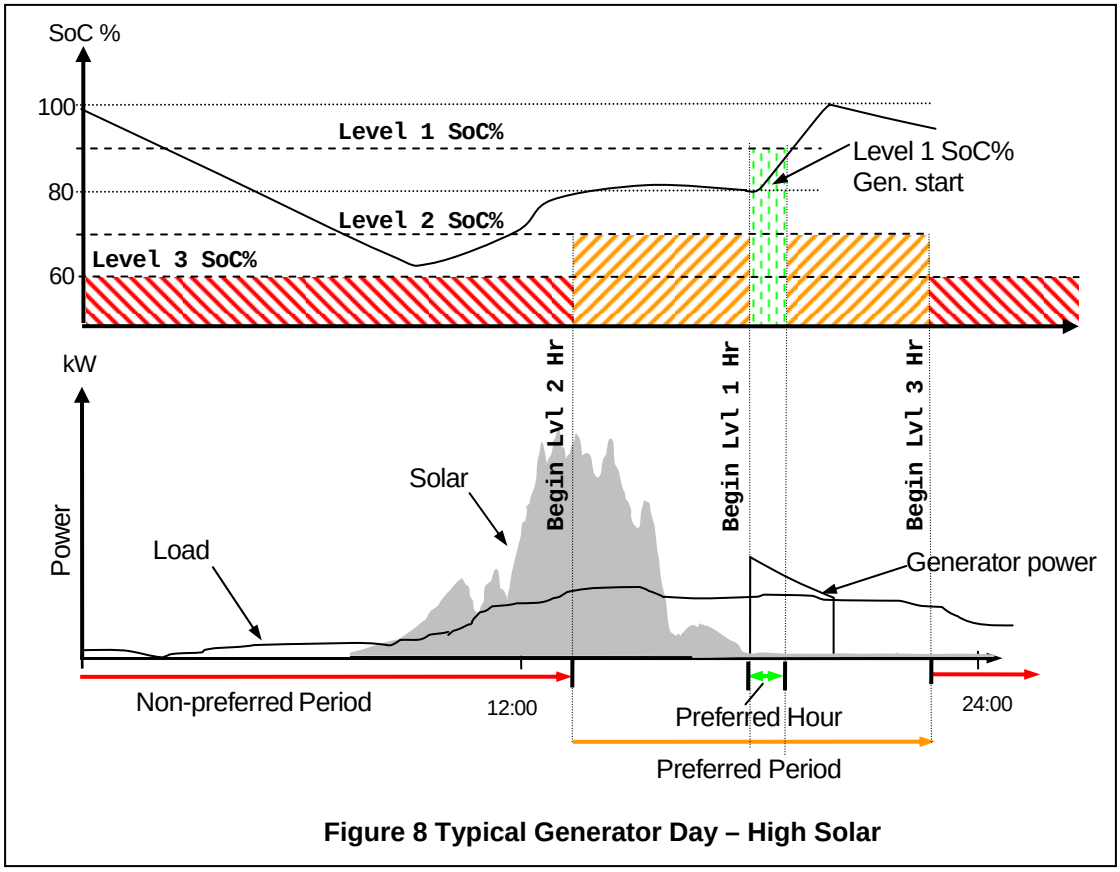


Figure 8 Typical Generator Day – High Solar

6.3.1.2 Example Configuration 2 – Generator Charger

In a generator/charger system, or systems with low solar contribution, this period would begin early in the morning to start the generator and replace the charge used overnight (see Figure 9 below).

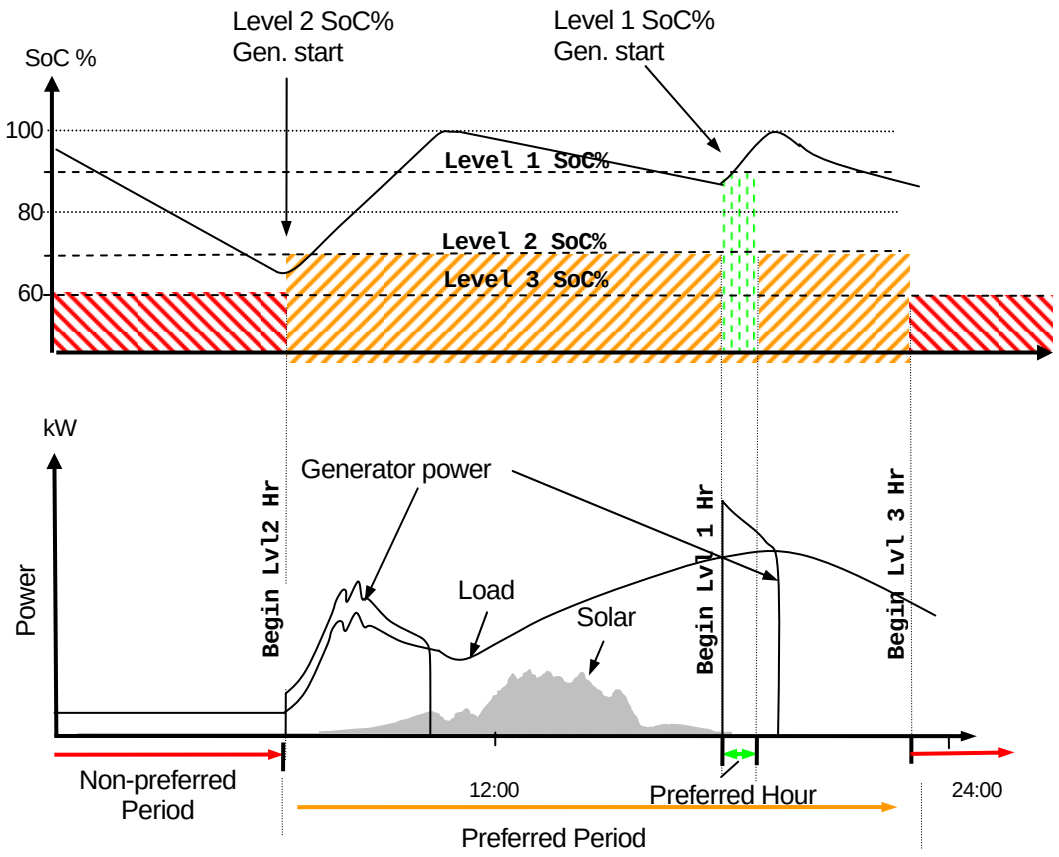


Figure 9 Typical Generator Day – Low Solar

6.3.1.3 Example Configuration 3 – Poor Setup

Figure 10 illustrates a system with levels and times unsuited to the load requirements resulting in failure to charge the battery adequately to accommodate the overnight load. The battery SoC falls below the Level 3 threshold and the generator is started during the night to stop the battery becoming excessively discharged. A better generator run strategy would be set the Level 1 or Level 2 settings to cause a charge late in the day to fully charge the battery before the Level 3 period starts thus averting the generator start overnight.

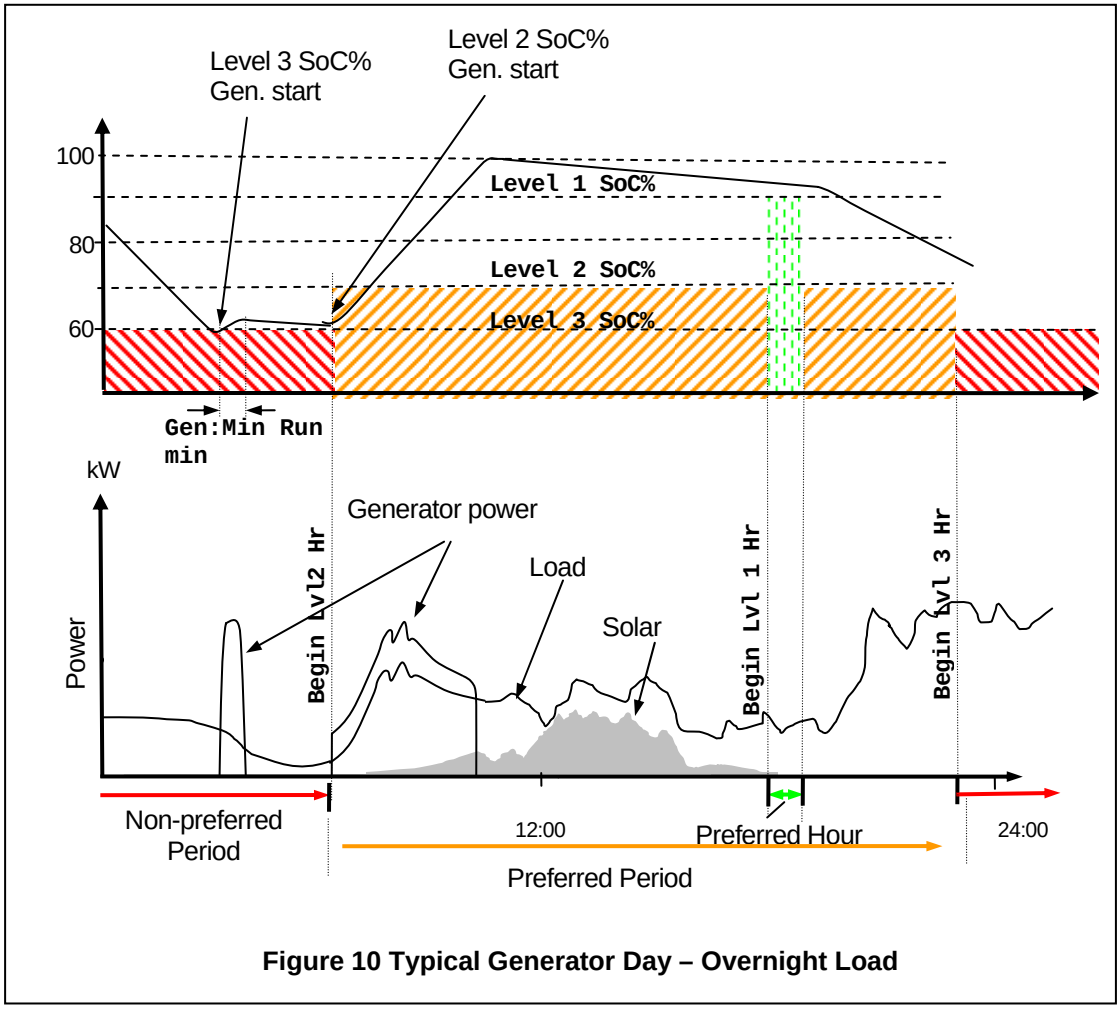


Figure 10 Typical Generator Day – Overnight Load

6.3.2 Generator Control based on Battery Voltage

The PS1 will start the generator based on battery voltage. Normally these limits are not met as the SoC control will have already started the generator.

The generator will start at any time should any of the pre-configured limits be met.

If the generator starts in the Preferred Period, the PS1 will perform a full battery charge. If the generator starts in the non-preferred period, the PS1 will perform a partial battery charge.

When complete, the generator will be stopped (see 6.3.4 Generator Automatic Stopping).

6.3.3 Generator Control based on AC Load

The PS1 will automatically start and stop the generator based on the average power delivered to the load over the time period of the limit. Two factory-configured and two installer configurable settings determine the power levels at which the generator will be started.

- The 30 second limit is factory set at 120% of the PS1 rating.
- The 2 minute limit is factory set at 100% of the PS1 rating.
- The 10 minute and 30 minute limits are installer configurable.

The generator will continue to run until the average load power falls below all start limits and all other stop criteria are met (see 6.3.4 Generator Automatic Stopping).

6.3.4 Generator Automatic Stopping

The PS1 will automatically stop the generator when it is not required for charging the battery or supplying the load.

If the generator is automatically started in the preferred period, the PS1 will stop it after completion of a battery charge cycle unless:

- A generator scheduled run is in progress (see 6.3.5 Generator Scheduling).
- The average load kW exceeds one of the four configured start limits (see 6.3.3 Generator Control based on AC Load).
- The minimum generator run time (**Gen:Min Run min**) has not expired (see 4.5 Change Settings).
- The generator load is greater than **Gen:Min Load kW**.
- The remote run signal is active.

If the generator is automatically started in the non-preferred period, the generator will be stopped after the minimum generator run time set by **Gen:Min Run min** unless:

- A generator scheduled run is in progress (see 6.3.5 Generator Scheduling).
- The average load kW exceeds one of the four configured start limits (see 6.3.3 Generator Control based on AC Load).
- The generator load is greater than **Gen:Min Load kW**.
- The remote run signal is active.

The generator will be stopped at midnight if the generator and system load is low except if an equalize charge is in progress.

6.3.5 Generator Scheduling

Two schedule types are available each with four configurable start times and durations.

- Gen Run Schedule (**Gen Run Schedule**) for daily generator running intended to accommodate day to day peak load periods. While the SoC method of generator control (see 6.3.1 Generator Control based on SoC) is recommended to efficiently and reliably maintain the battery charge, generator schedules may be used as an alternative generator control method or as an adjunct to SoC control to cater for expected loads.
- Backup Run Schedules (**Backup Run Schedule**) for emergency generator running intended for use when the PS1 is in a shutdown state for an extended period due to some abnormal condition as may be the case if the PS1 is unattended for long periods. The backup schedule will periodically run the generator to power vital appliances such as refrigerator or freezer etc.

Setting Run Schedules

Both Gen Run Schedules and Backup Run Schedules are configured by setting up to four start times and associated run durations.

The start times may be set to any time but must be used in sequence; an unused start time disables subsequent start times. For example, if two generator run periods per day are required **Start Time A** and **Start Time B** must be used.

For each start time a generator run duration (**Run Dur A - D**) may be set in 15 minute increments. The generator will run for at least the set duration regardless of other settings (except for duration of zero, see below). If **Scheduled Gen Run – Auto Stop** is disabled the generator will run for the set duration only. If **Scheduled Gen Run – Auto Stop** is enabled the generator will run for the set duration and then stop in accordance with Generator Automatic Stopping.

If start time/duration combinations cause an overlap in generator run periods the generator will continue to run through both periods.

The run duration may be set to zero. The resultant operation differs for each schedule type as follows:

Setting a Gen Run Schedule duration to zero either;

disables the associated start time if **Scheduled Gen Run – Auto Stop** is disabled,

or,

allows the generator to start at the scheduled time and automatically stop on completion of a battery charge cycle and/or load power requirements if **Scheduled Gen Run – Auto Stop** is enabled.

Setting a Backup Run Schedule duration to zero disables the associated start time (PS1 is in shut down so cannot run a charge cycle).

Note: The Generator Schedule will override the generator minimum run time setting (**`Gen:Min Run min`**). Consider the generator manufacturer's recommendation regarding minimum run time when setting schedules.

6.4 Manual Generator Control

The generator can be manually controlled via:

- The generator local controls. The PS1 generator available signal from the generator switch must be inactive indicated by the Gen NOT Available LED (LED7) being ON. (see 3.1.2 Front Panel LEDs). **Note:** To prevent reverse power flow into the generator, before manually stopping the generator it is advisable to open the Generator AC Circuit Breaker and wait until the PS1 LEDs no longer indicate **Inv Sync** (see 3.1.2 Front Panel LEDs) . After the generator is stopped, close the Generator Circuit Breaker ready for the next generator start. .
- The **OK** pushbutton on the front panel. See 3.3.3 Starting the Generator from PS1.
- A **Remote Run** input that can be wired from the PS1 to a switch in a convenient location such as in a residence. Several such switches can be wired in parallel. The Gen NOT Available LED (LED7) must be OFF (see 3.1.2 Front Panel LEDs).

6.4.1 Remote Run Input

The **Remote Run** switch operates as follows:

- A switch closure longer than 0.5 seconds and shorter than 2 seconds causes the PS1 to start the generator. Another such closure stops it, else it is stopped automatically when the battery reaches full charge and any sustained large load ceases. The switch is typically a non-latching pushbutton.
- A switch closure longer than 2 seconds causes the PS1 to start the generator, and stop it when the switch is opened. The switch is typically a latching toggle.

Regardless of how the generator is started (manually or automatically), while the generator is running the PS1 automatically charges the battery whenever sufficient generator power is available, and when fully charged will hold the battery in float charge.

6.5 Generator Fault Recovery

If the PS1 fails three consecutive times to detect significant generator voltage for one minute after a generator start or, if voltage is detected but fails to synchronise for five minutes, a Generator Fault alarm will be asserted. The PS1 will then use the following sequence of generator start attempts:

- After 15 minutes
- After 1 hour
- Daily at the **`Begin Lvl 1 Hr`** (or 12 noon if **`Begin Lvl 1 Hr`** is disabled)

A Gen Fail event will be generated and logged each time a start attempt fails.

Note: To force the PS1 to immediately restart the generator toggle the Generator Available input so that the generator changes to NOT Available then back to Available. Use the **OK** pushbutton to start the generator.

6.6 Inverter External Alarm

The PS1 provides a single alarm output which can be wired to an external alarm buzzer or light etc. An urgent alarm is indicated by a continuous ON condition and a non-urgent alarm is indicated by a slow intermittent ON/OFF condition. If the PS1 is shutdown or OFF the urgent alarm output is ON.

NON-URGENT conditions can be prevented from raising the alarm, via the LCD displays (see 4.5.1 Advanced Settings **`Alarm Out`** setting).

The URGENT and NON-URGENT alarms are also separately indicated on the front panel LEDs (see 3.1.2 Front Panel LEDs). Short term and long term event counters are provided and the users may set limits for each to generate alarms. Refer to settings **`S/Term Count`** and **`L/Term Count (`**4.2.1 View Diagnostics) and **`S/Term Limit`** and **`L/Term Limit`** 4.5.1 Advanced Settings.

7 PS1 Communications

The PS1 provides an isolated serial communications port for monitoring and controlling the PS1. The connection is internal to the unit. The port can be used to connect to a local PC or to connect to a modem. Each unit is supplied with suitable cables for connecting to the serial port, one, to connect from the PS1 to a modem and two, a "cross-over cable" to connect from the modem cable into a PC. The modem cable will be installed and accessible from the bottom of the unit. If not, check with your installer.

Using a PC to communicate with the unit requires the use of a "terminal" emulation program such as HyperTerminal or TeraTerm. This manual does not specifically describe the configuration or operation of the "terminal" emulation program but provides information specific to communicating with the PS1.

Where <ENTER> is written, this means press the enter key.

Any text in [ ] is the name of the parameter being display or set not the actual value.

All entered commands are not case sensitive - typing h is the same as typing H.

Text in the following format is to indicate what you will see on the terminal –

```
ATE0
PS1 RAP 2-8-06
V8.AG 10.0kW 48V
(C) Selectronic
Data Monitor V7.2 Selectronic 2005

>
```

7.1 Serial Port Setup

The PS1 serial port has a fixed configuration. The port is set to 2400baud, 8 data bits, 1 stop bit and no parity. XON/XOFF flow control is supported. The terminal emulation program must be set to match these parameters.

7.2 Command Line Interface(CLI)

Connect a PC serial port to unit via cross-over cable and supplied serial cable. When connected press <ENTER> and unit should respond with prompt -

>

>

At the prompt enter – H <ENTER>

>h

```
H Help menu - Monitor
TU yy mm dd hh mm / TD: Time Update, Display
GA/GD Get All, Day logged data
>
```

The unit will now display the list of available commands

7.2.1 Modem Initialisation

Periodically, the PS1 will send a modem initialise string.

```
>AT
ATE0Q0V1
AT
ATE0Q0V1
AT
ATE0Q0V1
```

If this starts whilst typing a command, wait until complete and backspace to clear out any entered commands and press <ENTER> to obtain prompt again. You may now continue with normal operation.

7.3 Standard Commands

7.3.1 Time Display and Update

At the prompt enter – TD <ENTER >

```
>td
   6  39   9  46  20
>
```

The PS1 will respond with the internal date and time in the format of –

[Year] [Day No.] [Hour] [Minute] [Second]

[Year] - two digit year display e.g. 6 = 2006

[Day No.] - number of days from 1st January e.g. 39 = 8th February

39 – 31 (days in January) = 8

[Hour] - Hour of Day

[Minute] - Minute of Day

[Second] - Second of Day

The date and time can be updated using the TU command. The date and time is set entering the date and time in the following format –

TU [Year] [Month] [Day] [Hour] [Minute]

At the prompt enter – TU 6 2 8 9 46<ENTER>

```
>tu 6 2 8 9 46
RTC & Time set
>
```

7.3.2 Logged Data Retrieval

The periodically logged data and long term summary information can be retrieved from the PS1. Two commands allow you to either retrieve all the data stored in the unit or retrieve a single day's data.

GA – Get All data. Previous eight days of information plus summary information.

GD [Day No] - Get one Day's data. Collect data of the day specified plus summary information.

The commands list all the data directly to the terminal. It is necessary to log or capture this data to a file to allow further processing. Before entering these commands ensure the terminal program is set to log or capture the data to a file.

Note: The following displays are a partial example of the downloaded data.

To retrieve all the data, at the prompt enter –

GA<ENTER>

```
>ga
&400E00030000FFFD001A000A2D6C03F52D6519170000FFF8FFF83A982D6EDFFB
&3F0E00030000FFFE0010000A2D6E03F42D6919170000FFFAFFF83A982D72E0F9
&3E0E00030000FFFE000F000B2D6D03F32D6819170000FFF8FFF83A982D71E1FF
…..
>
```

The data will take a few minutes to be completely downloaded. This process cannot be stopped once started.

To retrieve one day's data, at the prompt enter –

GD [Day No]<ENTER>

```
>gd 36
&030E0A9006341C2F0011100C2F06111C0C0806341C301B11340C3007111CC114
```

```
&020E0C0007161E004611190C3107111E0C8B07121E4E571100004E001133436B
&010E00560000334E6F1101006C00113310090001336D0011160C6D071133063C
…..
>
```

The data will take a minute to be completely downloaded. This process cannot be stopped once started. If the day number cannot be found in the log then only the summary information is retrieved.

To process and display the retrieved data is not covered by this manual. Contact your installer for details or download the software and instructions from the Selectronic web site.

7.4 Protected Commands

A passcode must be entered to access protected commands. The passcode is fixed and is shown below.

At the prompt enter -

P B2FF< ENTER>

```
>p b2ff
>
```

Access to the protected command is now available.

At the prompt enter – H < ENTER>

```
>h

H Help menu - Monitor
TU yy mm dd hh mm / TD: Time Update, Display
GA/GD Get All, Day logged data
SS,SL,SV - Show, Status, Lcd, Version
STG,SPG,STB,SPB - STart, StoP, Gen, Equlise
>
```

The unit will now display the extended list of available commands.

After a period of time of no activity, the passcode will expire. Protected commands will no longer be available unless the passcode is re-entered.

7.4.1 Inverter Status & Version

The operating status of the inverter can be displayed.

At the prompt enter -

SS<ENTER>

```
>ss
Inv Waiting load
Gen manual & off
OK
>
```

The inverter will respond with display indicating the status of the inverter and generator.

At the prompt enter -

SV<ENTER>

```
>sv
ATE0
PS1 RAP 2-8-06
V8.AG 10.0kW 48V
(C) SELECTRONIC
S/N 12345 J/N 54321
OK
>
```

The inverter will respond with display indicating the revision of the inverter software and serial number.

7.4.2 Generator Control

The generator can be started and stopped. Check the status of the inverter before attempting to start or stop the generator. The status must indicate that the generator is in automatic mode for these commands to work.

To start the generator, at the prompt enter -

STG<ENTER>

```
>stg
OK
>
```

The generator will now start and begin charging the batteries. Normal automatic stop conditions apply.

Check the status to ensure generator is running and inverter is synchronised.

To stop the generator, at the prompt enter –

SPG<ENTER>

```
>spg
OK
>
```

The generator will now stop.

Check the status to ensure generator has stopped and inverter is running normally.

7.4.3 Equalise Control

An equalise charge can be requested or cancelled at the end of the next charge cycle.

To request an equalise charge, at the prompt enter -

STB<ENTER>

```
>stb
OK
>
```

To cancel an equalise request, at the prompt enter –

SPB<ENTER>

```
>spb
OK
>
```

7.4.4 Remote LCD Control

The remote LCD control allows for virtual control of the PS1 from the connected terminal. In this mode, the information on the LCD will be displayed on the terminal and pressing specific keys on the terminal is equivalent to pressing the four front panel pushbuttons. In this mode, the LCD and front panel pushbuttons continue to work in the same way with exactly the same information being displayed on the LCD as on the remote terminal display.

At the prompt enter –

SL<ENTER>

The terminal screen will go blank as the normal CLI is disabled then the virtual LCD will be displayed. The display is continuously updated with any changes.

```
PS1 10kW 48V    11:19
View Readings

PREV|NEXT   OK |EVNT
```

The terminal keys which are equivalent to the four front panel pushbuttons are –

H = UP 

J = DOWN 

K = OK 

L = MENU 

Press these keys as you would for the front panel pushbuttons to change menus and access and modify all readings and settings.

To exit the remote LCD mode, press X <ENTER> at any time.

```
[?25hNEXT    OK |EVNT
Error, command not recognised
>
```

Unexpected characters may appear and an error message may be reported. These can simply be disregarded and the normal CLI interface has been restored.

Remote LCD control will automatically timeout and exit to the command line mode after five minutes if no key is pressed. Pressing the space key will reset the timeout back to five minutes but not change the displayed screen.

8 Troubleshooting

8.1 General

If the system is not operating correctly, perform a general check as follows:

Check if the front panel LEDs indicate a problem, and take the recommended action as described in 3.1.2 Front Panel LEDs. Switch the PS1 off via the **ON/OFF** pushbutton for a few seconds then back on. If this does not restore normal operation, check if the front panel LEDs now indicate a problem, and take the recommended action as described in 3.1.2 Front Panel LEDs.

8.2 Generator Starting/Stopping Problems

The generator starts because the load is high or the battery is discharged. It stops when the load falls to lower levels, the battery is recharged or, if level 3 charge mode is set up, when the generator has run for the minimum run time and the load is sufficiently low. Daily patterns of generator operation will change as the load supplied each day changes and as any renewable input such as solar increases or decreases from day to day or season to season.

Use the View Readings menu to check measured values and inspect the event log to determine the reasons for generator starts and stops. Refer to 4.7 LCD Event Log on using event data to monitor and diagnose performance.

If the generator runs more often than normal or expected:

There are several possible causes:

1. The system average load has increased:

   Check the **`Load kWh/Day`** in the View Readings menu and compare it with the value displayed when the system was operating satisfactorily.

   Compare the **`Load kWh/Day`** against the system design value which should have been supplied by the installer.

   If loads have significantly increased identify any new electrical equipment that has been added
2. The system peak loads are very high:

   Check the **`30sec, 2min, 10min`** and **`30min Avg kW`** in the View Readings menu while operating any new appliance that has been added to the system. The associated **`Start kW`** setting (see 4.4 View Settings) may need adjustment by your supplier.
3. The load during the Level 3 time, typically late night and early morning, is higher than expected but not high enough to keep the generator running permanently there may be multiple starts and stops as the battery becomes discharged and is partly recharged:

   Increase the generator minimum run time to increase the amount of battery recharge before stopping hence reducing the number of starts and stops.

   Check the load levels to see if they have increased during the level 3 part of the day.
4. The battery is not operating correctly (see 8.5 Battery Problems).

If the generator runs longer than normal or expected:

This is generally because system load has increased or the renewable input from solar has decreased. It could also be because the battery efficiency has fallen off with age or cell failure in the battery.

Use the event log to establish load levels and reasons for generator starts and stops (see 4.7 LCD Event Log).

Use the View Readings menu to check measured values, particularly the accumulated battery energy in and energy out totals. These will have to be recorded over a week to see the change in the accumulated values.

It may be doing an Equalise charge which can take some hours to complete; check if the **Equalise** LED is flashing.

There may be a sustained load on the system. Check to see that appliances have not been left on. The 4.2 View Readings and 4.2.1 View Diagnostics provide information regarding the load power.

Check the generator schedule settings (see 4.6 Generator Schedules)

If the generator restarts a minute or so later then the battery is discharged, the battery volts are low or a load is present. You can shut the generator down permanently by setting the generator to NOT available.

8.3 Inverter Start/Stop/Shutdown Problems

PS1 will not Start

If the LEDs remain dark when the PS1 is switched on as per 3.3.1 To switch Inverter ON the PS1 did not start up. Retry the procedure, if it continues to fail contact your supplier for further instructions.

If the PS1 starts with the **Inv Fault** indication (see 3.1.2 Front Panel LEDs) record the fault code indicated on the LCD and contact your supplier for further instructions.

PS1 Shuts Down

Whenever the PS1 shuts down, it attempts to restart once per 15 minutes.

The PS1 shuts down automatically for the following conditions, which should be investigated:

- Overload
- DC over-voltage and under-voltage
- Excessive battery discharge
- Over-temperature

Check if the PS1 front panel LEDs indicate a problem, and take the recommended action as described in 3.1.2 Front Panel LEDs. The 4.2 View Readings and 4.2.1 View Diagnostics may provide information regarding the shutdown cause. If the problem continues record the front panel LED status and contact your supplier for further instructions.

DC Circuit Breaker Trips

DC Circuit Breaker trip may be due to battery under-voltage. It may also be caused by a combination of low battery voltage and a sustained AC overload. Check if the front panel LEDs indicate a problem, and take the recommended action as described in 3.1.2 Front Panel LEDs.

The DC Circuit Breaker trip may be due to a very high DC current which cannot be controlled electronically. The PS1 will stop operating, and may be faulty. Record the front panel LED status and contact your supplier for further instructions.

8.4 AC Power Problems

If the power fluctuates, lights go bright or dim but don't go out.

- Check the PS1 front panel LEDs and Event log for information on the cause.
- The generator output may be varying due to poor generator condition or switching on and off heavy loads. Check the generator voltage reading (`Gen VAC`) via the PS1 LCD.
- The PS1 output may be varying due to switching on and off heavy loads. Check the output voltage reading (**`Inv VAC`**) via the LCD.

If the power goes off for short periods (1 second to a few minutes)

- Check the PS1 front panel LEDs and Event log for information on the cause.
- The PS1 may be in Power Save mode and the load is too small to detect. In this mode the PS1 pulses the output until a load is detected. Check the PS1 front panel LEDs and settings **`Load Search and Load Search W.`**
- The PS1 may be shutting down due to overload or low DC voltage and periodically attempting restarts. If the PS1 is shutting down switch off any heavy loads that may be causing the shut down. If the PS1 is shutting down due to low DC voltage, check generator availability and reasons for the generator not starting such as flat start battery or no fuel

If the power goes off for longer periods (10 minutes to many hours)

- Check the PS1 front panel LEDs and Event log for information on the cause.
- PS1 shutdown due to low DC voltage and no generator available to charge
- **`S/Term Ev Count`** may be exceeding limit due to some system problem. Check **`S/Term Ev count`** and Event log for information. Reset **`S/Term Ev Count`** if necessary.

8.5 Battery Problems

Batteries are very dangerous. Please read the safety information provided by the battery supplier and the information in 1 Precautions and Safety.

Battery does not charge properly

- Check that the battery charging requirements are correctly set up in the PS1 (see 6.1 Battery Management).
- Check that the solar regulator is correctly set up.
- Check all cables and connections to the batteries.

If the solar does not appear to be doing much

The solar regulator may be set too low. Check LEDs and readings

The battery is not operating correctly:

Physically inspect the battery and check for loose connections. Monitor the battery voltage as heavy loads supplied by the PS1 are turned on and off.

Check the voltage on each battery making up the battery bank to see if there are cells not fully charged or not accepting charge. Measure voltages on each cell/battery at different times in the charge discharge cycle. Just after charge has started say after 10 minutes, in mid charge, just before end of charge, ten minutes after discharge starts, mid discharge and just before recharge starts.

Appendix A Specifications

A1 Product Specifications

Parameter	Product					
	PS1 3/24	PS1 5/24	PS1 6/48	PS1 10/48	PS1 11/108	PS1 12/120
Inverter Mode						
Battery voltage nominal	24V DC	24V DC	48V DC	48V DC	108V DC	120V DC
Battery voltage default range	22-34V DC	22-34V DC	44-68V DC	44-68V DC	98-170V DC	
Continuous output power @ 25˚C	3kW	5kW	6kW	10kW	11kW	12kW
Continuous output power @ 30˚C	2.7kW	4.5kW	5.5kW	9kW	10kW	11kW
Continuous output power @ 40˚C	2.5kW	4kW	5kW	8kW	9kW	10kW
Continuous output power @ 50˚C	2.0kW	3.2kW	4kW	6.4kW	7.2kW	8kW
Continuous output power @ 60˚C	1.5kW	2kW	2.5kW	4kW	5kW	5.5kW
Max output power five minutes @ 25˚C (initial power <1kW)	4kW	6.5kW	8kW	13kW	14kW	16kW
Maximum overload 0~5 seconds	5kW	8kW	10kW	16kW	20kW	22kW
Maximum continuous output - interactive mode @ 25˚C	3kW + generator output	5kW + generator output	6kW + generator output	10kW + generator output	11kW + generator output	12kW + generator output
Maximum continuous AC output current	12A + generator current (max 63A)	21A + generator current (max 63A)	25A + generator current (max 63A)	42A + generator current (max 125A)	46A + generator current (max 125A)	50A + generator current (max 125A)
Maximum continuous DC input/output current	150A DC	250A DC	150A DC	250A DC	120A DC	
DC input inverter in power save, no AC load	0.6A/15W	0.6A/15W	0.3A/15W	0.3A/15W	0.12A/15W	
DC Input inverter ON, no AC load	< 1.3A/ 30W	< 2.5A/ 60W	< 1.35A/ 65W	< 1.9A/ 90W	< 105W	
Power save sensitivity range	10-40W	10-40W	10-40W	10-40W	10-40W	
Output voltage/frequency - invert mode, zero to max load	240 +1-4%, 50Hz +/-.01%	240 +1-4%, 50Hz +/-.01%	240 +1-4%, 50Hz +/-.01%	240 +1-4%, 50Hz +/-.01%	240 +1- 4%, 50Hz +/-.01%	
Total harmonic distortion, zero to max load	<4%					
Interactive Mode						
Changeover time, invert to generator	zero					
Maximum supported generator capacity	15kVA	15kVA	15kVA	30kVA	30kVA	
Load switched to generator in fault mode	Yes	Yes	Yes	Yes	Yes	
Max inverter charge rate, adjustable	0-120A	0-200A	0-120A	0-200A	0-100A	
Max inverter charge power	Continuous output power of inverter (ref above)					
No of charge stages	Four stages plus equalise					
Charge type	Unity PF: 4-state constant voltage with current and power limiting					

Charge settings	Adjustable to suit all battery types					
Generator Start Parameters						
	4 x time of day, 3 x state of charge					
	2 x adjustable power limits, 4 x back up times					
	Battery voltage, inverter shutdown					
	Inverter temperature					
Generator start method	2 or 3 wire, pulsed and/or run signal (adjustable)					
General						
Weight	72kg	72kg	73kg	87kg	93kg	
Weight packed	79kg	79kg	80kg	94kg	100kg	
Dimensions	585H, 400W (430 incl. mtg flanges), 420D (mm)					
Communications serial interface	RS232 x 2400 bps					
Memory retention of settings and logged data	Permanent via on board battery backed RAM, and EEPROM					
Number of shunts	One x 100A internal / one optional external					
Circuit breaker for generator input	63A	63A	63A	125A	125A	
Circuit breaker for AC output	63A	63A	63A	125A	125A	
Circuit breaker for DC battery input	250A	250A	250A with electronic trip	125A with electronic trip	125A with electronic trip	
Standby battery current, inverter shutdown (DC CB closed)	400mA	400mA	245mA	245mA	120mA	
Battery current, DC CB tripped	20mA	20mA	20mA	20mA	20mA	
Standards	Ctick, AS3100					
Efficiency @10% nominal Load	92.0%	87.0%	85.0%	91.0%	90.0%	90.0%
@30% nominal Load	95.0%	91.0%	93.0%	96.0%	95.0%	95.0%
@50% nominal Load	94.0%	91.0%	93.0%	96.0%	96.0%	96.0%
@100% nominal Load	89.0%	90.0%	92.0%	93.0%	94.0%	94.5%
Safety isolation	AC output to chassis & battery 5kV, battery to chassis 1kV					
Power factor charging	Unity					
Power factor inverting	0 to 1					
Enclosure rating	IP40					
Cooling method	Thermostatically controlled fans					
Protection	Circuit breakers on all external power connections, plus electronic trip of DC breaker***** providing reverse battery protection					
On board log	Records over 200 events, alarms and data which can be accessed remotely via serial port/modem. Current day on LCD					
Four line alphanumeric backlit LCD displays:	Configuration parameters, Batt Volts, Net Batt Amps, AC Load kW, Gen kW/Volts/Freq, Av daily kWh, Shunt 1 & 2 Amps, Event log, Charge Amps, State of Charge					

***** no electronic breaker trip on 24V model

Note: Performance to specifications cannot be guaranteed if the PS1 is operated with generators that are not capable of being synchronised. Check with supplier or Selectronic if unsure.

Selectronic reserve the right to change specifications without notice.

A2 Standards Compliance

AS/NZS 3100:2000	Approval and Test Specification – General Requirements for Electrical Equipment
AS/NZS 1044:1995 Amendment 1:1997 Amendment 2:2000	Limits and methods of measurements of radio disturbance characteristics of electrical motor-operated and thermal appliances for household and similar purposes, electric tools and similar electric apparatus.

Ctick Australia

Appendix B Definitions

B1 Settings Index

B2 Event Definitions

Events displayed and logged in the PS1 are assigned an event code. The text displayed for each event on the LCD is abbreviated. The following describes in more detail each event. The table also details whether the event increments the event counters or triggers an immediate shutdown of the inverter.

Event Code	Event description	Triggers	
		Event Counter	Shutdown
0	Internal state change		
1	Generator did not start when required		
2	Generator started but inverter could not synchronise		
3	Illegal Scheduler state - Reset Scheduler		
4	Illegal Generator Control state - Reset Generator Control		
5	Illegal Inverter state - Reset inverter		
6	Generator did not shutdown when required		
7	Generator manually started via front panel control		
8	Generator manually stopped via front panel control		
9	Generator not under inverter control		
10	Generator under inverter control		
13	Hardware DC over current		Yes
14	Hardware bridge over current shutdown		Yes
15	Hardware DC over voltage shutdown	Yes	Yes
17	Control PCA initiated shutdown	Yes	Yes
18	Software initiated shutdown	Yes	Yes
19	Power PCA initiated shutdown	Yes	Yes
20	Sustained shutdown input	Yes	Yes
21	Recurring shutdown input	Yes	Yes
22	I2T 10 sec overload shutdown	Yes	
23	Sustained current limit shutdown	Yes	Yes
25	Command port overflow	Yes	
26	I2T 32 sec overload shutdown	Yes	
27	AC over voltage shutdown		Yes
31	Generator start on low DC volts, high load		
34	Battery volts high shutdown	Yes	Yes
35	Battery volts were high now OK		
38	Generator controller, shutdown on fault input	Yes	
39	Generator controller, retry generator start	Yes	
40	Generator controller, no start after 3 retries	Yes	
41	Generator started using remote start		
42	Generator stopped using remote start		
43	Generator controller, no pulse signal, volts present	Yes	
45	Generator start on low DC volts, low load		
46	Scheduler generator start on 30 sec load		
47	Scheduler generator start on 2 min load		
48	Scheduler generator start on 10 min load		
49	Scheduler generator start on 30 min load		
50	Scheduler start on level 2 SoC		
51	Scheduler start on level 1 SoC		
52	Scheduler start on level 3 SoC		
53	Low battery restart with AC volts		
54	Generator disconnect due to reverse power	Yes	
55	Generator disconnect due to bad ACV or Freq	Yes	
56	Generator disconnect due to current limit	Yes	
57	Generator disconnect due to very low AC volt	Yes	

Event Code	Event description	Triggers	
		Event Counter	Shutdown
61	Low battery reset with renewable recovery		
63	Fuel Low Alarm		
64	Fuel Low Alarm reset		
65	Fuel Empty Generator shutdown		
66	Fuel Empty reset		
67	System restart by internal reset		
69	Generator started, 14 days since last run		
70	Generator stopped during charge cycle	Yes	
73	Generator shutdown - midnight low load		
83	Setting store corrupt, reloaded default values	Yes	
84	First block of setting store bad - restored from parameter ram	Yes	
85	Second block of setting store bad - restored from parameter ram	Yes	
86	Setting store missing or bad settings, reloaded default values		
87	Restart after power up or micro reset		
88	Equalise manually initiated		
89	Equalise or Generator run manually stopped		
90	Generator disconnect due to sustained power error	Yes	
91	Generator supplying load, inverter inhibited		
92	Settings loaded OK		
93	Setting store failed	Yes	
94	Setting edit timed out, setting unchanged		
95	Setting modified		
98	Equalise terminated on max time	Yes	
99	Equalise terminated normally		
100	Equalise charge started		
101	Equalise automatically initiated		
103	Initial charge started		
104	Over temperature shutdown		Yes
106	Permanent data erased		
109	State of charge shutdown	Yes	Yes
110	Low battery voltage shutdown	Yes	Yes
111	Self test completed OK		
112	Renewable battery float achieved, equalisation deferred one day		
118	Generator start from OK pushbutton		
119	Generator stop from OK pushbutton		
120	Time of day changed		
122	Data logging restarted		
123	Remote start Generator command		
124	Remote stop Generator command		
125	Remote initiate Equalise command		
126	Remote finish Equalise command		
134	Generator start, high temp		
135	Generator start, overload shutdown		
138	Shutdown repetitive minor events		Yes
139	Non urgent alarm asserted		
144	Generator shutdown due to frequency shift		
146	Normal generator shutdown		
151	Abnormal charge end, excess Ahr		
152	Normal charge end		
154	Abnormal Equalise end, excess Ahr		
155	Abnormal charge end, reverse Generator power		

Event Code	Event description	Triggers	
		Event Counter	Shutdown
174	Run time completed in non-preferred period		
175	Generator run request after overload shutdown		
176	Emergency reset & Generator run, battery very low		
180	Skipped midnight shutdown, load high		
181	Skipped midnight shutdown, equalise in progress		
195	DC Circuit Breaker open, inverter shutdown	Yes	Yes
197	Scheduled generator start		
200	Inverter fault shutdown - 15V supply fail	Yes	Yes
201	Power board MOSFET control shutdown	Yes	Yes
202	CB open shutdown - current sustained after disable		Yes
203	Heatsink temperature high shutdown	Yes	Yes
204	TX temperature high shutdown	Yes	Yes
206	Generator contactor fault	Yes	
207	Processor turning power off		
210	Overcharge adjusted		
211	Undercharge adjusted		
215	Battery temperature senor FAILED	Yes	
216	Battery temperature senor OK		
220	Scheduled Generator stop		
221	Backup Generator start		
222	Backup Generator stop		
223	Self test fail		
226	Generator request ignored - Generator not in auto		
227	Setting store - detected write failure	Yes	
228	Setting store - cleared write failure		
229	Inverter out of service		
230	Bulk charge started		
231	Absorb charge started		
232	Absorb charge complete		
233	Charge stage timeout		
234	Equalise state aborted		
240	Manual mode Inverter auto disconnect from Generator		
241	Over temperature Generator Start		

B3 Self Test Fault Codes

The PS1 will display a fault code on the LCD if the start-up self test fails. The following table describes each of the fault codes.

Code	Description
2	FET switch short circuit detected
4	FET switch monitor circuit failed
6	FET switch controller failed
8	Current detected during switch test
10	Current limit detected during switch test
12	FET switch control shutdown during switch test
14	Incorrect FET switch control signal detected
16	Over temperature detected.
18	Control shutdown
20	Reference voltage control failure
22	FET switch monitor not zero in idle condition
24	I/O system failure
26	FET switch not switching low
28	FET switch not switching high
32	Start disabled
34	No FET volts detected – start fail
36	No transformer detected – start fail
38	FET control not detected – start fail

Appendix C Configuration Log

PS1 Settings							
Inverter model				Installer name			
Serial No.				Client name			
Date installed:				Modem No			
User Edit Menu							
Settings	Default	Actual Setting	Unit	Settings	Default	Actual Setting	Unit
Generator Schedule Settings				**AC Output Settings**			
		A / B / C / D		Inv: Nom VAC	240		volts
Gen Run Schedule Start Time			hrs	Sync Tol VAC	30		volts
Gen Run Schedule duration			hrs	Sync Hi Hz	55		Hz
Scheduled Gen Run - Auto stop	disabled			Sync Lo Hz	48		Hz
Backup Run Schedule Start Time			hrs	**Shunt Settings**			
Backup Run Schedule duration			hrs	Shunt 1 - Renew able	on		
Change Settings				Shunt 1 - DC Load	off		
Begin Lvl 1 hr	17		hr	Shunt 1: A/mV	2		A/mV
Begin Lvl 2 hr	12		hr	Shunt 1 Zero	0		
Begin Lvl 3 hr	21		hr	Shunt 2 - Renew able	off		
Gen: Min Run	30		min	Shunt 2 - DC Load	off		
Advanced User Settings				Shunt 2: A/mV	1		A/mV
Load Search	disabled			**Charger Settings**			
Load Search W	20		w atts	Init: Chrg V	55.2		volts
Alarm Out	Urgent+NU			Init: Chrg A	120		amps
S/Term limit	15			Init: Time mins	5		mins
L/Term limit	15			Bulk: Chrg V	56.4		volts
Inv: Hrs to Off	72		hrs	Bulk: Chrg A	90		amps
Passcode	0			Bulk: Time mins	10		mins
Battery Settings				Absorb: Chrg V	57.6		volts
Batt Size Ah	1000		Ahr	Absorb: Chrg A	50		amps
Level 1 SoC%	90		%	Absorb: Time mins	20		mins
Level 2 SoC%	70		%	Float: Hold V	54		volts
Level 3 SoC%	60		%	Float: Time hrs	2		hrs
Inv: Shtdw n Soc%	50		%	Eqlise: Chrg V	58.8		volts
Inv: SoC Cntl	enabled			Eqlise: Chrg A	15		amps
Inv: Shtdw n V1	46		volts	Eqlise: Time hrs	3		hrs
Inv: Shtdw n V2	42		volts	Eqlise: Limit V	63.6		volts
Inv: Restart V	52.3		volts	**Advanced Charger Settings**			
Inv: Shtdw n HV	64.8		volts	Chrg: Max hrs	2		hrs
Generator Settings				Eqlise: Freq days	14		days
Gen: Max kW	10		kW	Absorb: End A/15m	20		%
Gen: Start V1	46.8		volts	**Additional Displays**			
Gen: Start V2	44.4		volts	S/Shtdw n Count	0		
10min Start kW	8		kW	Ovr/Load Count	0		
30min Start kW	6		kW				
Gen: Min Load kW	50		%				
Gen: Reverse kW	-1.2		kW				
Remote Gen Run - Auto Stop	disabled						
Gen Avail	Follow I/P						
Ctrl Rlys	Standard						
Gen: Pulse Delay	2		sec				
Gen: Pulse Time	2		sec				
Gen Type	0						
Gen Type 3 - Prop. Gain	80						
Gen Type 3 - Integral Gain	200						
Gen Type 3 - Period Gain	0						

Appendix D Revisions and Changes

D1 Revisions to this Document

Revision	*Date*	*Description*
01	31 Mar 2005	Initial release
02	31 May 2005	Updated specification, manual equalise.
03	4 May 2006	Numerous clarifications
04	27-July-2006	Added information on remote LCD timeout
05	18-October-2006	Updated software version applicability

D2 Software Version Applicability

This manual is applicable to the following software versions:

Versions	*Description*
9.AG, 9.BG, 9.CG, 9.DG, 9.EG, 9.FG	Improved DC current flow control Improved Shunt 2 logging
8.AG, 8.BG, 8.CG, 8.DG, 8.EG, 8.FG	Remote LCD timeout added for enhanced modem compatibility. Improved dynamic response of power controller. Improved generator type defaults.
7.AF, 7.BF, 7.CF, 7.DF, 7.EF, 7.FF	Remote LCD function added plus other minor functional enhancements, addition al generator control improvements. Generator control parameters not as detailed.
6.AE, 6.BE, 6.CE, 6.DE, 6.EE, 6.FE	Improved generator control functionality. Does not include remote LCD function. Not all communications commands available. Some default parameter not as detailed.
2.AD, 2.BD, 2.CD, 2.DD	Initial Software release. Does not include remote LCD function. Not all communications commands available. Some default parameter not as detailed.