



SELECTRONIC

Instruction Manual for
SP PRO Energy Centre

User | Installation | SP LINK | Service

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Thank you for purchasing a Selectronic SP PRO series Sinewave Interactive Inverter Charger.

Selectronic has an accredited Quality Assurance system to AS/ISO9001 covering both their manufacturing and design operations with over 25 years experience designing power conversion equipment for both domestic and industrial purposes.

As a result we have had plenty of opportunity to listen to both integrators and system owners and determine their real needs.

What we have heard is that:

- Modern systems need to do more than provide power and control a generator.
- Inverters should be flexible enough to “multi task” i.e. the same inverter should be able to run a remote area home, be suitable for mobile applications and be able to support the mains grid in times of failure and export power to the mains grid when it is surplus to requirements.
- Complexity should be a matter of choice. The inverter should be able to perform with the minimum of programming but still be capable of complex programming if required.
- Battery longevity is paramount. A combination of battery protection and the best charging parameters are essential.
- Monitoring / programming software should be user friendly with intuitive “at a glance” menu clarity.

The SP PRO has been designed with these, and many other criteria in mind. In addition to power production the SP PRO can control, by time or power levels, water pumping, equipment switching, scheduled events and even – with appropriate sensors – determine if your soil in the garden is too dry and switch on a watering system. The possibilities are endless; Your SP PRO is a complete Energy Centre.

The SP PRO is a remote area power supply in off grid areas, a mobile power supply in boats and mobile homes and an on grid support and export device. All at the selection of one program option.

Through a set of default parameters the SP PRO can simply be “hung on the wall” and work well; or can have any of more than 220 parameters individually programmed.

Those same default parameters provide safe and efficient charging for most common batteries along with provision to customize for your individual battery pack.

SP LINK, our software program, has been designed with the user in mind. No need to sift through menu chains – if you want to change a parameter relating to your batteries click on “Battery”, if you want generator control click on “Generator”. Why was it ever difficult?

If you have any comments about this document or your new SP PRO, please do not hesitate to contact us via our web site www.selectronic.com.au.

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





Australian/New Zealand Warranty

Your Selectronic SP PRO product is warranted by the manufacturer for a period of 5 years 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 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 the repaired inverter to the customer within Australia or New Zealand 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, failure to act on service warning from the inverter 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 a salesperson or installer not directly employed by Selectronic.

A separate Warranty Registration form is included and in part must be completed by the installer. If your warranty card is returned within 30 days of purchase and installation is signed off by a Selectronic Accredited SP PRO installer your 5 year warranty will become 7 years.

In the event of service being required during the warranty period, the unit must be returned to Selectronic. Where the product has been installed by a Selectronic Accredited SP PRO installer, it may be possible to "field service" the unit on site, this will minimise downtime. Field service is at Selectronic's discretion. If you have purchased your SP PRO outside Australia or New Zealand, please see the separate warranty supplied by the authorised distributor in your country.

Remember, please return your warranty card.



Included in this package

- Mounting bracket (attached to base of SPMC models)
- Quick Start Guide (SPMC models only)
- Rear Outlet Mesh Cover (SPLC models only)
- Contents check list, checked and signed by Selectronic
- Display Quick Reference
- Warranty card
- Tool kit
- This Manual
- SP LINK CD ROM
- SP PRO Serial Data Cable
- Serial Cross-Over Cable
- USB to Serial Adapter

Benefits of SP LINK

Provided with your SP PRO inverter is a free copy of our SP LINK software. We urge you to look at what you can do with this software package. Without SP LINK the SP PRO energy centre will operate using the carefully considered default settings.

By using SP LINK you can use a computer to adjust more than 220 different parameters within the SP PRO, allowing you exact setting up of your system. SP LINK will allow you to connect current shunts to your SP PRO allowing measurement of external system devices such as solar panels, wind generators or other DC loads.

SP LINK will allow you to access a host of monitoring features to allow you to keep an eye on exactly what your system is doing and how it is performing.

PCs can be either wireless or wired to your SP PRO to open the window to the full feature potential of your SP PRO Energy Centre.



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Using This Manual

While every attempt has been made to ensure this manual is as self explanatory and clear as possible, there are some technical issues and safety warnings that require thorough understanding. 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 or worse still, stop you from gaining the full benefits that we know this product can give you.

Four colour coded sections are contained within this document to allow fast access to relative sections. The colour of the symbol located in the top right-hand corner of this page (and following pages) indicates the section.

LIGHT BLUE PAGES Are relevant to the user and cover the day to day use of the SP PRO as well as certain safety warnings. This section presumes the units installation and set up is complete and correct.

NAVY BLUE PAGES Contain information relevant to installers, from unpacking the unit to configuring the settings of the SP PRO.

ORANGE PAGES Describe the complete use of the complimentary SP LINK software provided with your SP PRO inverter.

SILVER PAGES Provide information to service personnel in regards to preventative maintenance and troubleshooting in case of a fault.

A PDF copy of this manual may be downloaded from the Selectronic web site www.selectronic.com.au. The 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).

You will notice that throughout the manual three symbols will be repeated. These symbols are very important.



This symbol indicates danger. Failure to observe this warning may result in serious injury or death, loss of property or damage to the power system.



This symbol is used to draw attention towards information that will assist you in making full use of your system or gives notice to information which may not seem immediately apparent.



Who should install this unit



While the SP PRO is designed for easy installation, and can be connected by any suitably qualified person, to maximize the performance of your system and tailor the programming of the inverter to your specific needs we recommend you use a Selectronic Authorised Installer. These selected professionals within the industry have been extensively trained to analyse your system requirements, design ancillary equipment and have access to specialist support within Selectronic to assist with your individual requirements.

The voltages produced within your power system may be hazardous. Even though the SP PRO may derive it's input from a low voltage battery, the output voltage is just as hazardous as grid electricity.

All AC connections to the inverter must be carried out by a qualified Electrical contractor or similar, failure to do so will contravene legal requirements.

All DC wiring must be carried out by a person experienced with DC electrical circuits and must understand high current low voltage circuits. To ensure an efficient system installation, cable sizing and voltage drop must be understood.

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 from them.

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



An inverter or power system which has NOT been installed by appropriately qualified personnel may have insurance claims refused.



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Precautions and Safety

Chapter One



The procedures covered in this manual all have inherent risks. While we have made the SP PRO as safe as we can, including safety features never before found in any inverter, the fact remains that mains grid level power is dangerous – possibly fatal – and this we feel can never be stressed enough.

Multiple Hazardous Energy Sources



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

Preparation

While every effort has been made to pack the SP PRO in a way that will provide adequate protection, damage in transit can occur.



Please carefully check the packaging and the SP PRO for signs of damage and that all components mentioned in the “Included in the Package” section of this manual.

Please report any damage or missing parts to Selectronic or your Selectronic Authorised Installer as soon as practical. Consult the Selectronic web site for your closest Distributor or Authorised Installer.

Please retain the original packaging as this will be the safest and most effective method of repackaging if required.



Installation



- The SP PRO requires adequate ventilation, away from hot equipment. Do not obstruct the airflow passage of the SP PRO case (top and bottom). Ensure when installed in an enclosed space that there is adequate ventilation.
- The SP PRO must be located in a place away from electrolyte and corrosive aerosols.
- The SP PRO contains arcing contacts so must not be located where explosive gas mixtures could occur, such as hydrogen from batteries or diesel fumes. The SP PRO must never be installed above the battery bank.

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.

Inverter or Generator may start automatically



The SP PRO automatically starts and/or restarts and may restore power or start the generator at any time. If a fault or overload is detected the SP PRO will shutdown and may automatically attempt to restart at varying intervals of up to several hours.

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 SP PRO. Only suitably trained and qualified personnel should disconnect any DC power connection, including battery cell connections, and only with suitable procedures and safety precautions.
- System battery voltages of 60 V or greater are to be treated as Hazardous.



SP PRO System Integration

Chapter Two



The SP PRO is just one part of a power system. The design of this system must be carefully considered to ensure the SP PRO will perform as expected and to specification.

SP PRO Sinewave Interactive Inverter Chargers can be used in applications where no mains grid is available, in mobile applications such as motor homes and boats and in grid support / grid feed systems.

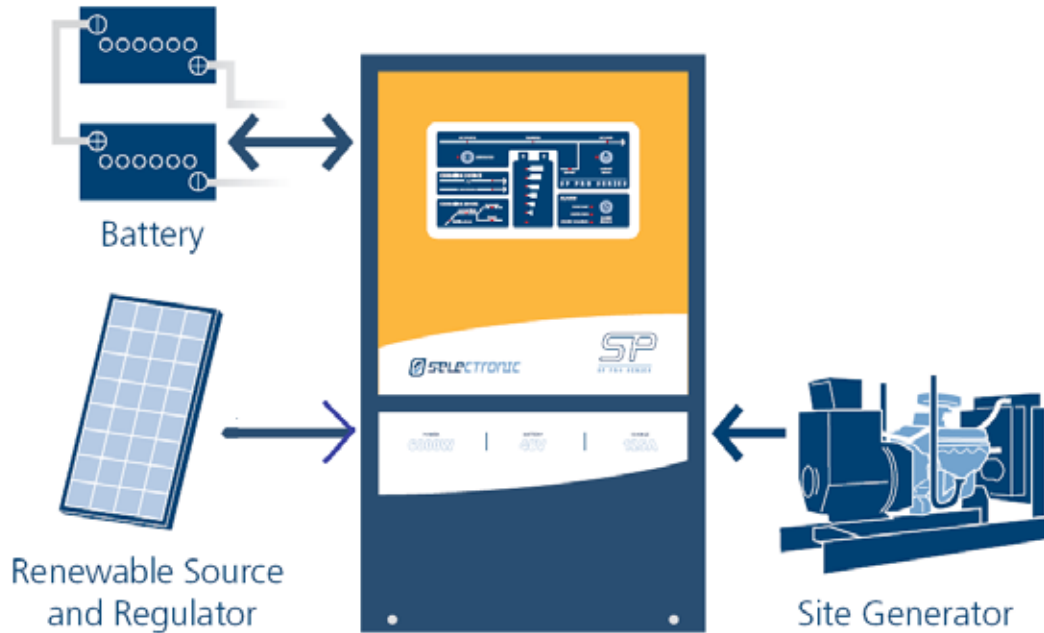
Off Grid Stand Alone Power Systems (SPS)

The SP PRO is the heart of your power system. It quietly provides AC power from the battery bank and renewable sources. The SP PRO can be programmed using SP LINK to monitor battery state of charge and load conditions. The SP PRO will automatically start the generator only when required to charge the batteries, supply loads heavier than the SP PRO can easily handle and efficiently utilise the generator to supply the site load. These features will have the effect of increasing your battery life when configured correctly.

The SP PRO can supply short-term overloads larger than its continuous load rating and will continue to supply fault over-current for several seconds.

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

The SP PRO can be configured to automatically start and stop the generator. When the generator is running, the SP PRO 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 SP PRO will add its power to the generator. When the site loads are reduced, the SP PRO will return to battery charging. The above operation will happen automatically, whilst always maintaining “no break” power to the site.



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

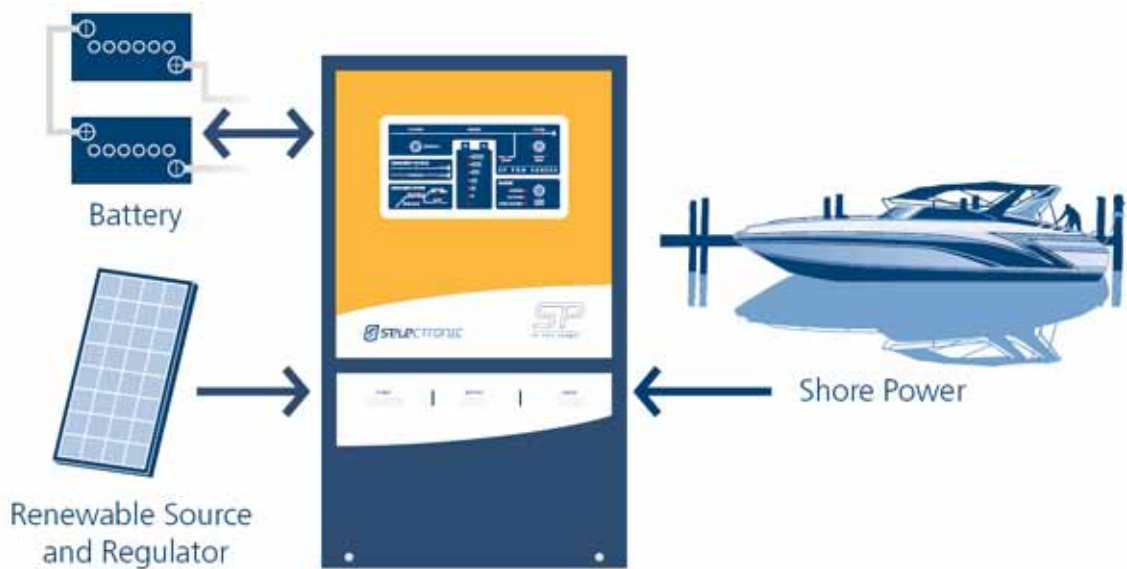
The charging parameters are automatically compensated for battery temperature. It is important that the included battery temperature sensor be fitted to the battery bank and that the temperature is reading correctly for the most accurate and safe battery charging.

The SP PRO has provision for two current shunts to monitor renewable power sources and loads connected to the battery bank. This allows the SP PRO to include all sources of charge and load to be taken into account ensuring the batteries are correctly charged.



Mobile Systems

The SP PRO can support either an on board generator or shore power.



On Grid Support and Feed Systems



The system in conjunction with your SP PRO can even be configured to automatically start and stop a generator, if one is available, in case of prolonged mains failure. When the generator is running, the SP PRO will use the generator to power the site load plus use any additional generator capacity to charge the batteries.



Battery Sizing

Off Grid Stand Alone

Sufficient battery capacity is imperative for optimum operation of your system. Working out the correct battery pack size that will suit your needs involves a number of factors including the daily discharge required of your system. The peak surge of the appliances etc and should be determined by your Selectronic Authorised Installer. A rough “rule of thumb” is to start with your expected daily requirement (in kilowatt hours or kWh) divide it by the nominal system voltage, double this figure to allow for 50% depth of discharge and multiply the result by 5 to allow for five days autonomy.

$$\frac{4500}{48} = 93.75 \times 2 = 187.5 \times 5 = 937.5 \text{ amp hours battery capacity is required.}$$

As stated before there are many other factors to consider including battery efficiency and temperature effects the above is simply a rough guide.

Batteries for use in Off Grid applications will generally be “Deep Cycle” type.

Grid Connected

Effective sizing on grid connected systems, depends on a number of factors, including frequency of grid failure and the export potential of your solar array.

If your system is predominantly designed to provide power during blackout periods, then your battery capacity should be designed around your average power consumption and the longest power outage you are likely to experience.

As an example, if your usual combination of appliances draw 2 kW with a 48V battery, and the longest power interruption in your area in recent years is 3 hours then

$$\frac{2000 \text{ (2kW)}}{48 \text{ (battery volts)}} = 41.66 \times 2 \text{ (to allow for 50\% depth of discharge)} \times 3 \text{ hrs} = 249.96 \text{ amp hours of battery capacity}$$

To cover for various inefficiencies you would most likely choose a 300 amp hour battery pack.

Once again, this is a rough guide and you should consult a Selectronic Accredited Installer for a total system design.

Batteries for use in On Grid applications would generally be “UPS” type.

Generator Sizing

Your SP PRO can be programmed to accommodate almost any size of generator; however too small a generator can result in wastage of fuel. A well sized generator will be able to supply all your normal loads and have enough reserve to use the maximum capacity of your SP PRO to charge batteries. Remember that the quality of power produced by the generator will be feeding through to your AC Loads - sensitive appliances may suffer if power from generator isn't “mains” quality.

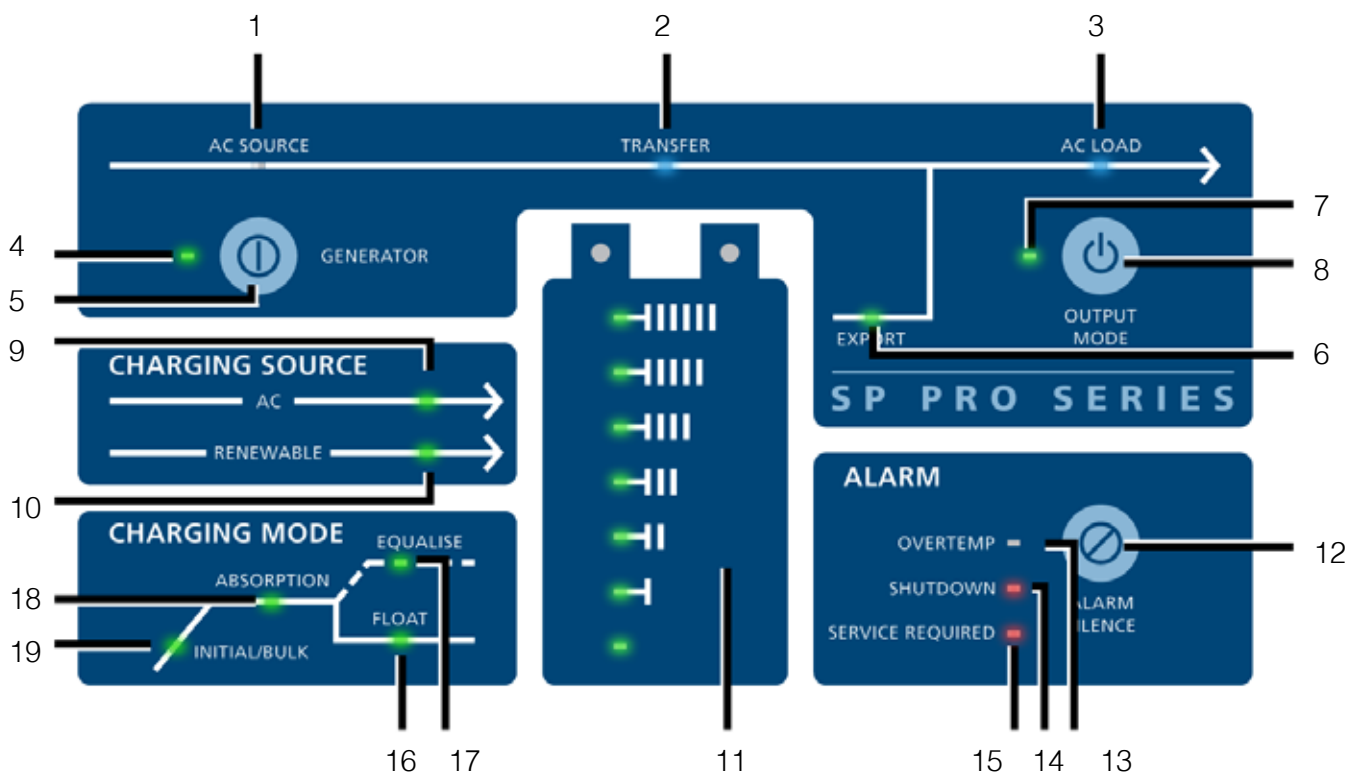
EXAMPLE

If your usual house load is around 2 kW and you are using a SPMC 482 inverter, a generator capable of providing 8 kW would be an appropriate choice ,this will normally mean a 10 kVA generator. Your Selectronic Authorised Installer will be able to advise you in this matter.



Controls and Indicators

Chapter Three



User Interface

The following page is a list of the SP PRO interface functions which correspond to the labelled image above.



1 AC SOURCE *

When illuminated this LED shows the presence of AC input voltage from either a motor generator or the mains grid, whichever is applicable. This LED is powered directly from the incoming AC Source.

2 AC TRANSFER *

Illuminated when an external AC source is connected to AC loads. If the AC source LED is illuminated but not the transfer LED it would generally indicate that the input is out of tolerance – that is that either the voltage or the frequency of the source is unacceptable. If the source is a motor generator check if it needs servicing; if the mains grid check with your supplier for a problem or that the tolerances have not been set too tight.

3 AC LOAD *

When illuminated this LED shows the presence of AC voltage ready to supply loads. If, in normal running conditions, it is not illuminated it indicates there is a fault within the system.



* These LEDs can operate even if your SP PRO is not switched on. An external power source can activate these LEDs.

4 GENERATOR (MULTI FUNCTION LED)

- Flashing Green - generator is in the process of starting
- Steady Green - generator has started
- Flashing Yellow - generator is not available for auto start
- Flashing Red - there is a generator fault

5 GENERATOR START/STOP BUTTON

A brief press of this button (<1 second) will start or stop the generator. Two long presses (>2 seconds) will request an equalizing charge on the batteries after full battery charge.

6 EXPORT

This LED indicates, in a grid connected system, that the SP PRO is exporting power to the grid: On, renewable feeding grid and AC Load; Flashing, feeding AC Load.

7 OUTPUT MODE (MULTI FUNCTION LED)

- Off Inverter is monitoring but providing no output.
- Steady Green The inverter is performing normally.
- Slow Flashing Green SP PRO Econo mode is enabled and is sensing load conditions.
- Fast Flashing Green SP PRO is preparing to start.
- Steady Red Indicates that a Unit Fault has been detected and no output is possible.

8 OUTPUT MODE BUTTON

LONG PRESS (>1 second) - turns the SP PRO on, another long press turns SP PRO off. LED is steady green.
SHORT PRESS (<1 second) - activates Econo mode. LED is flashing green.

9 & 10 CHARGING SOURCE

If AC LED is on, it indicates the SP PRO using an external AC source such as a generator or shore power to charge the batteries.

If RENEWABLE LED is on, it indicates the SP PRO has detected a charge current of greater than 0.4 Amp on either external shunt. Shunts by default are disabled and must be enabled using SP LINK for detection of current. Both LEDs may on together.

11 FUEL GAUGE

This series of LEDs will represent the voltage of your battery. All LEDs on indicate the battery is at Float voltage. If just the bottom LED is on, battery voltage is approaching the Shutdown voltage.

If your SP PRO has State of Charge enabled, the series of LEDs will represent the percentage of usable charge remaining in the batteries. Usable charge is defined from 100% SoC down to the Shutdown SoC parameter.

In voltage or SoC mode, the two bottom LEDs will glow yellow to indicate you are approaching a low battery shutdown situation and shutdown when just the bottom LED is RED.

If the top LED is flashing RED, the SP PRO has shutdown due to very high DC voltage.

When all LEDs are flashing RED, inverter is in Low DC Shutdown Override or “Just Go” mode. The “Just Go” feature enables the inverter to be forced to work even when the battery voltage is too low in emergency situations, this will only apply until the battery voltage will no longer keep the inverter running. We remind you, using this emergency feature may damage your batteries or connected equipment.

12 ALARM SILENCE BUTTON

The Alarm Silence button cancels any audible alarm. This does not remove the alarm, just the audible component.

13 OVERTEMP

- Yellow - SP PRO is approaching an over temperature situation
- Red - SP PRO has shutdown due to an over temperature situation

14 SHUTDOWN

- Yellow - SP PRO is approaching a shutdown situation
- Red - SP PRO has shutdown

15 SERVICE REQUIRED

There are a number of preventative steps that can avoid a premature fault situation within the inverter – such as the fan filter requiring cleaning. When this LED illuminates consult the “Data View” section of SP LINK to determine the reason for the alert.

CHARGING MODE

The Charging Mode panel, comprising LEDs **16, 17, 18 & 19** indicate the stage of the charging process that is presently being performed, or the stage that will be started at the next starting of the generator or the connection of the mains grid.



SP PRO Operation

Chapter Four



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

The SP PRO Battery management continuously monitors the system operation. This monitoring allows the SP PRO 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 SP PRO 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. Also incorporated is 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.

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



SP PRO battery management features include:

- State of Charge monitoring and control.
- Battery terminal voltage monitoring (Battery Sense) and control.
- Charging initiated by battery state of charge and/or battery voltage.
- Five stage charge cycle: Initial, Bulk, Absorption, Float (short term and long term) and Equalise.
- Shutdown on very low battery voltage, battery state of charge, or both.
- Two stage Battery Temperature compensation of charging voltage based on battery temperature.

The SP PRO 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.

Battery State of Charge (SoC) monitoring and control

If you have enabled State of Charge control using SP LINK, you must ensure that all currents, other than the inverter current, flowing in and out of the battery are being monitored on either or both of the two current shunt inputs to the SP PRO. No current shunt is required to read the SP PRO's current as this is read internally. The resultant battery current is monitored to track the battery SoC which is expressed as a percentage of the battery size set in the SP PRO (Battery Capacity). The accuracy of Battery State of Charge is limited by many factors including shunt accuracy and can only be considered as an estimate.

Puekerts equation is utilised to provide a more accurate discharge figure whilst an adaptive algorithm is used to constantly update a "charge efficiency index" which is used during recharge.

The state of charge is used to automatically start the generator and begin charging the batteries. Different levels can apply at different times of the day to ensure the generator is only used when required.

Battery Voltage monitoring and control

The SP PRO measures the battery voltage both at the inverter and also directly at the battery pack using the Battery Sense wiring(if installed). Sensing the actual battery terminal voltage (using Battery Sense wiring) eliminates the effect of cables losses which irrespective of charge or discharge currents keeps the battery terminal voltage at or within set limits.

The battery voltage is used to automatically start the generator and begin charging the batteries. Different levels are used depending on the load on the system. With SoC control enabled, the generator voltage start or voltage shutdown levels are used as a backstop given the normally SoC control levels would be reached first.

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.



Battery Charging Operation

The SP PRO battery charging system utilises the combined effect between renewable and grid/generator charging. This combination allows minimum draw, even not at all, on grid or generator if other charge sources such as renewable are meeting battery charge requirements.

The SP PRO continuously monitors all charging sources to recharge the battery in a five-stage cycle. Each stage or Charging Mode is controlled by voltage, current and time settings. These settings are fully configurable using SP LINK however should not require changing after initial installation unless some aspect of the battery installation changes.

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

BATTERY CHARGING MODE.

Read the following with reference to the Battery Charging Cycle graph on the following page.

INITIAL

The SP PRO charges at the initial charging current until the battery voltage rises to the initial charge voltage, then holds this voltage for the time you set before starting the Bulk stage. When in the Initial charge phase, the Initial/Bulk LED will flash.

BULK

The SP PRO charges at the bulk charging current until the battery voltage rises to the bulk charge voltage, then holds this voltage for the length of time you set, before starting the Absorption stage. In Bulk charge mode, the Initial/Bulk LED will be steady ON.

ABSORB

In the Absorption charge phase the SP PRO will charge at the absorb charge current until the absorb charge voltage is reached. Once voltage is reached, the SP PRO will carefully monitor the rate of change of the charge current as set in the Absorb-Float transition setting.

When the Absorb-Float transition setting is met, the charge cycle will switch to Float and terminate an auto start generator if connected. If programmed, an equalise charge cycle will now be performed. The Absorption LED will be steady on when in the Absorption phase.

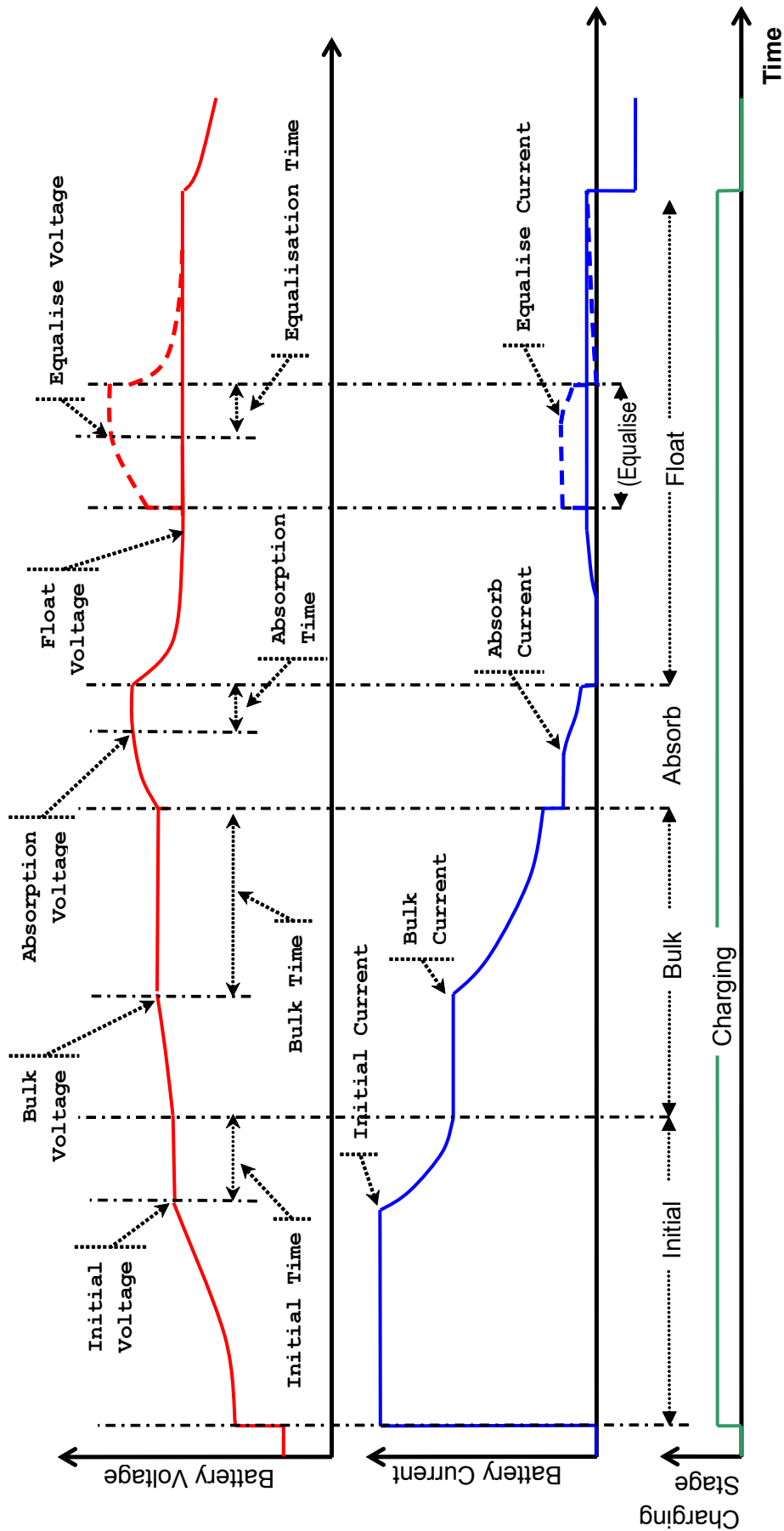
FLOAT

The SP PRO holds the battery voltage at the Float level and will provide up to the float current to maintain the float voltage. The SP PRO will remain in this charge state until battery voltage falls below the Initial Return level. If the SP PRO is still connected to an AC Source after 24hrs of Float, it will transition to the Long Term Float voltage. Long Term float voltage will allow batteries to sit at a lower voltage level indefinitely.

EQUALISE

Periodically, the SP PRO performs an equalise charge in which the battery is held at a higher voltage for a period set in the EQUALISE window. This equalise charge will make sure all battery cells are at the same level. This restores to full charge any partially discharged cells in the battery bank.

The equalise LED will be steady when in equalise mode and will flash when an equalise is pending, that is the charger will perform an equalise after float stage is next reached.



Battery Charging Cycle



Battery Temperature

The SP PRO 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 the 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 in the Temperature Control section of Technical Data in SP LINK.

The charge voltage set points are compensated by battery temperature. The default compensation applied is $-5.5\text{mV}/^{\circ}\text{C}/\text{cell}$ with zero compensation at 25°C .

e.g. Initial Voltage = 55.2, Battery Temperature = 26°C , No. Battery Cells = 24.

Compensated Charge voltage = $55.2 + ((26 - 25) \times -0.0055 \times 24)$
= 55.07

Absorption Voltage = 57.6, Battery Temperature = 6°C , No. Battery Cells = 24.

Compensated Charge voltage = $57.6 + ((6 - 25) \times -0.0055 \times 24)$
= 60.11

During all charge stages, the compensated charge voltage will not exceed Max Voltage Limit.

Compensation improves battery performance and prevents battery overheating.

The charge current is also limited by battery temperature. Battery temperatures above 45°C cause the battery charger to reduce the charge current limit point. This will help prevent battery overheating.

Renewable Management

In Off Grid and Mobile applications your SP PRO 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 external regulator). Such waste can be reduced by tailoring your generator starting parameters to suit your individual site needs. See the generator control parameters in Using SP LINK.

Automatic Generator Control

The SP PRO 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 your SP PRO recognises that the generator is available for automatic operation via a digital input to the SP PRO or can be permanently enabled via an installer setting.

As part of the installation, the SP PRO 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.
- Limit generator starting frequency, 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 SP PRO SPS system, the SP PRO automatically runs the generator for the following reasons:

- Battery conditions, in particular state of charge (SoC), require the generator to charge the battery
- Load conditions are such that the SP PRO 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 SP PRO draws power from the battery, adding its power output to that of the generator.
- Time Schedules are set to regularly run the generator at times of expected peak loads or at convenient times



- The generator has not been run for the number of days specified in the Generator Exercise setting.
- Backup Schedules are set to run the generator in case of SP PRO shutdown to power vital equipment.

Generator Control based on SoC

The SP PRO may be configured to start the generator to charge the battery based on the battery State of Charge (SoC). This method of generator control is recommended to efficiently and reliably maintain the battery charge.

The battery SoC is estimated by the SP PRO and displayed as a percentage of the battery capacity and represented throughout this manual and in the menu system by the symbol SoC%. A daily profile of preferred generator start times and battery charge levels may be configured to allow the SP PRO 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 SP PRO settings are configured to divide the day into four periods:

- NIGHT ASSIST:** This is a period starting, typically about 5 or 6pm. During this period the generator is started if the battery is discharged below Start SoC% and will cease at Stop SoC%.
- SOC NORMAL:** This setting applies at all times. If SoC falls below Start SoC% at any time the generator will be started and will charge until Stop SoC% or for Generator Min Runtime if Stop SoC% is reached before the minimum runtime has elapsed.
- RENEWABLE ASSIST:** If your system has been designed in such a fashion that the input from your renewable sources (solar, wind etc) will always be lower than your usual daily power usage it is possible to start the day with a generator run period that will make up the shortfall. This ancillary charge is determined by Start SoC% and Stop SoC%.
- RENEWABLE PREFERRED:** If, due to inclement weather, the input from your renewable sources is lower than expected the generator will start at Start SoC% and will cease at Stop SoC%. Once the charging is completed the generator will stop unless the load or schedules keep it running. The starting time for each of the periods can be set via the Generator Auto Run menus within the AC Source tab. The battery state of charge levels (Start SoC% and Stop SoC%.) are set by the installer at the time of installation.
If a Generator Lockout period is used the generator will still start if the generator lockout override On Low SoC limit is reached.

Generator Control based on Battery Voltage

The SP PRO will start the generator based on battery voltage. Normally these limits are not met as the SoC control will have already started the generator unless SoC control has been disabled. The generator will start at any time should any of the pre-configured limits be met.



Generator Control based on Battery Load

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

- A 5 minute rating
- A 15 minute rating

The power level at which these settings take effect is Net Battery Load.

The generator will continue to run until the average load power falls below all start limits and all other stop criteria are met. It can take several minutes for the average battery load to fall below the set limit once the loads have been removed.

Generator Automatic Stopping

The SP PRO will automatically stop the generator when it is no longer required for charging the battery or supplying the load.

If the generator is automatically started in any of the prescribed periods the SP PRO will stop it after it reaches Stop SoC% unless:

- A generator scheduled run is in progress
- The average load kW exceeds one of the configured start limits
- The minimum generator run time (Generator Min Runtime) has not expired
- The remote run signal is active.

If the generator is automatically started in the Generator Lockout period, the generator will be stopped after the minimum generator run time or Generator Lockout Override Stop SoC unless:

- A generator scheduled run is in progress.
- The remote run signal is active.



Generator Scheduling

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

RUN SCHEDULE For daily generator running intended to accommodate day to day peak load periods. While the SoC method of generator control 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.

UNAVAILABLE SCHEDULE For emergency generator running intended for use when the SP PRO is in a shutdown state for an extended period due to some abnormal condition as may be the case if the SP PRO is unattended for long periods. The backup schedule will periodically run the generator to power vital appliances such as refrigerator or freezer etc.

SETTING SCHEDULES

Both Run Schedule and Unavailable Schedule are configured by setting up to four start times and associated run durations.

For each start time a corresponding stop time must be set.

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

For Run Schedules, the stop time may be disabled. Disabling a stop time allows the generator to start at the scheduled time and automatically stop on completion of a battery charge cycle and/or load power requirements.



Note: Generator Schedules will override the generator minimum run time. Consider the generator manufacturer's recommendation regarding minimum run time when setting schedules.



Manual Generator Control

The generator can be manually controlled via the generator local controls. The SP PRO generator available signal from the generator switch must be inactive.



Note: To disconnect from a generator without supply interruption, before manually stopping the generator it is advisable to open the Generator AC Circuit Breaker and wait until the SP PRO no longer indicates transfer.

After the generator is stopped, close the Generator Circuit Breaker ready for the next generator start.

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 SP PRO 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 SP PRO 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 SP PRO automatically charges the battery whenever sufficient generator power is available, and when fully charged will hold the battery in float charge.

Generator Fault Recovery

If the SP PRO 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 SP PRO will then use the following sequence of generator start attempts:

- After 15 minutes
- After 1 hour
- Daily, when any pre-programmed SoC level is reached.
- When any DC low voltage limit is reached.

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



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



Inverter External Alarm

The SP PRO provides an alarm output which can be wired to an external alarm buzzer or light etc. A shutdown alarm is indicated by a continuous ON condition and an alert alarm is indicated by a slow intermittent ON/OFF condition. If the SP PRO is shutdown or idle the urgent alarm output is ON. Alert conditions can be prevented from raising the alarm, via SP LINK.

Environmental Considerations

TEMPERATURE

Your SP PRO is designed for an ambient operating temperature between -20°C and 60°C, with a storage temperature range between -20°C and 70°C.

AIR FLOW

For best performance ensure nothing impedes ambient air from being drawn in the bottom of the unit and that hot exit air is vented away and doesn't recirculate into the unit. Particular attention must be paid when installed inside a cabinet or enclosure.

CLEARANCE FROM OTHER EQUIPMENT

A minimum distance of 250 mm around the top and sides plus 200 mm from the bottom is recommended.

HUMIDITY TOLERANCE

Your SP PRO is designed to operate in a humidity range of 0 – 99% non condensing.

INGRESS OF PARTICLES

Your SP PRO has been designed to meet IP rating 43 (Protected against solid objects larger than 1.0mm / protected against water falling as a spray at up to 60 degrees from the vertical) i.e. may be installed outside under cover and is insect and vermin resistant.

Effects of altitude on the SP PRO

Altitude (m)	Derating Factor @ 40°C
0, sea level	1.00
1000	0.95
1500	0.90
2000	0.85

The power rating of the SP PRO should be compensated for the effects of altitude by applying the appropriate derating factor. For example, at 2000m above sea level, 6 kW x 0.85 = 5.1 kW. The altitude compensated rating is still at 40°C.

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SELECTRONIC

Instruction Manual for
SP PRO Energy Centre

User | Installation | SP LINK | Service



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Installing for PRO Performance

Chapter Five



Preparation

The selection of a suitable site and good preparation is essential in getting optimum performance from the SP PRO.

Inverter performance is dependant upon the environmental operating conditions, in particular ambient temperature and ventilation. In addition safety aspects must be considered, such as:

- Restricted access to unauthorised personnel and children.
- Consideration of maintenance of ambient temperatures to ensure performance within product specification.
- Adequate ventilation, positioned away from heat producing devices and adhering to the minimum clearances required for adequate heat dissipation.
 Minimum 250mm clearance from top and sides, 200mm from below.
- In a covered location.
- Away from any explosive gas.
- Rodent Proof.
- Enough room to remove the cover if required.
- The provision of infrastructure for monitoring - eg data cables

The SP PRO should be installed in a separate area to the battery system. The battery bank can emit explosive gas(hydrogen) and this must be vented outside and away from the SP PRO. The battery system should not be accessible by the user.

For Off-Grid and On-Grid applications it is recommended that the installation be in lockable power room with a separating partition between the SP PRO and the battery area.



RCD Type Recommendation

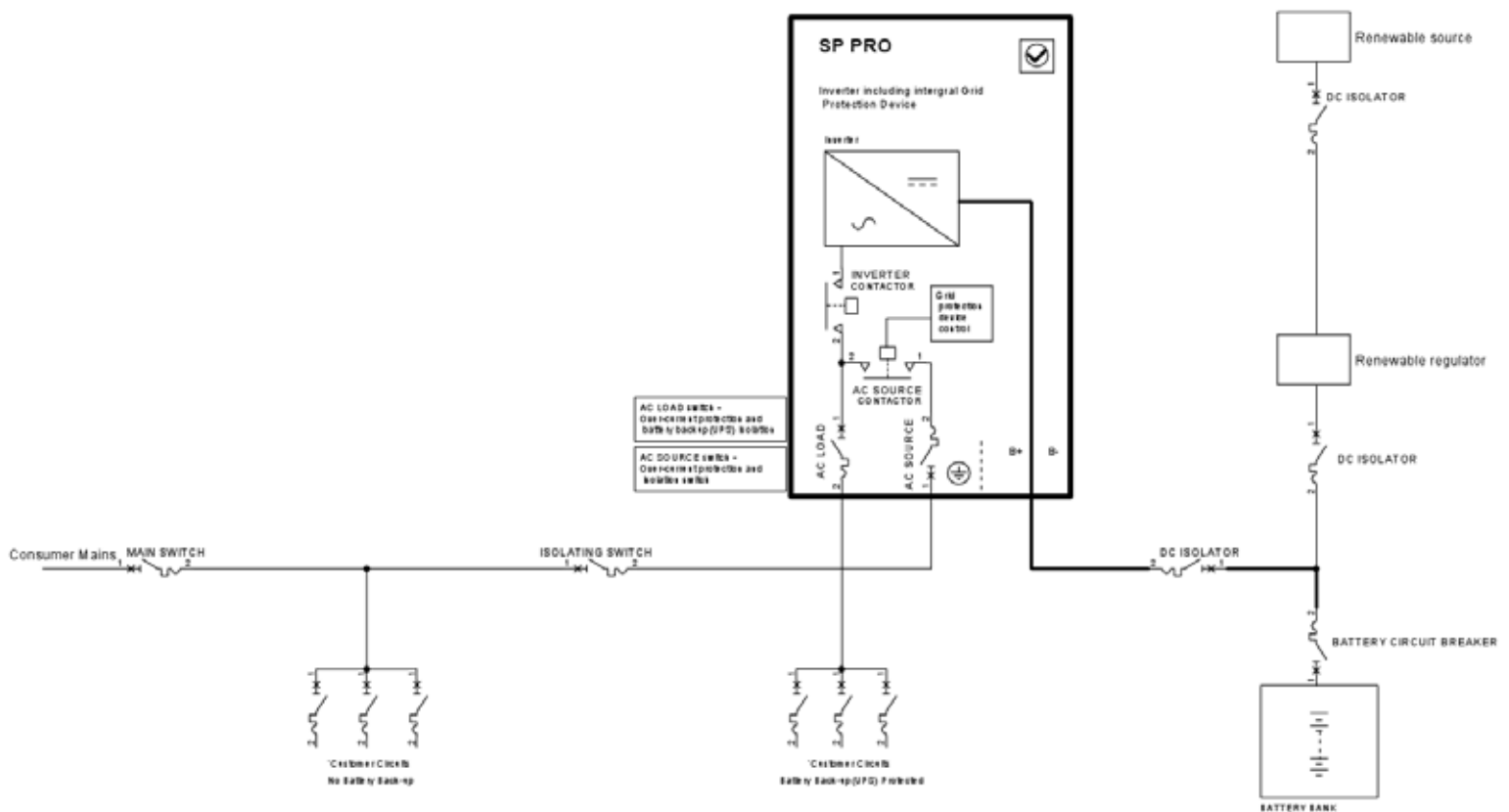
The SP PRO produces a low distortion sine wave via 50Hz isolation transformer. This topology ensures that the output is sinusoidal and that there is no D.C. component associated with the SP PRO AC supply, whether that be feeding a domestic load or exporting solar to the grid.

Standard Type AC RCDs are suitable for use with an SP PRO. Other types of RCDs may also be used with the SP PRO.

On-Grid Preparation

The intended application and use of the SP PRO must be well understood to allow the SP PRO to be appropriately connected to the installation. Depending on whether the entire installation load or only essential loads are to be battery backup protected when consumer mains is disrupted, will depend on how the SP PRO is wired into the switch board.

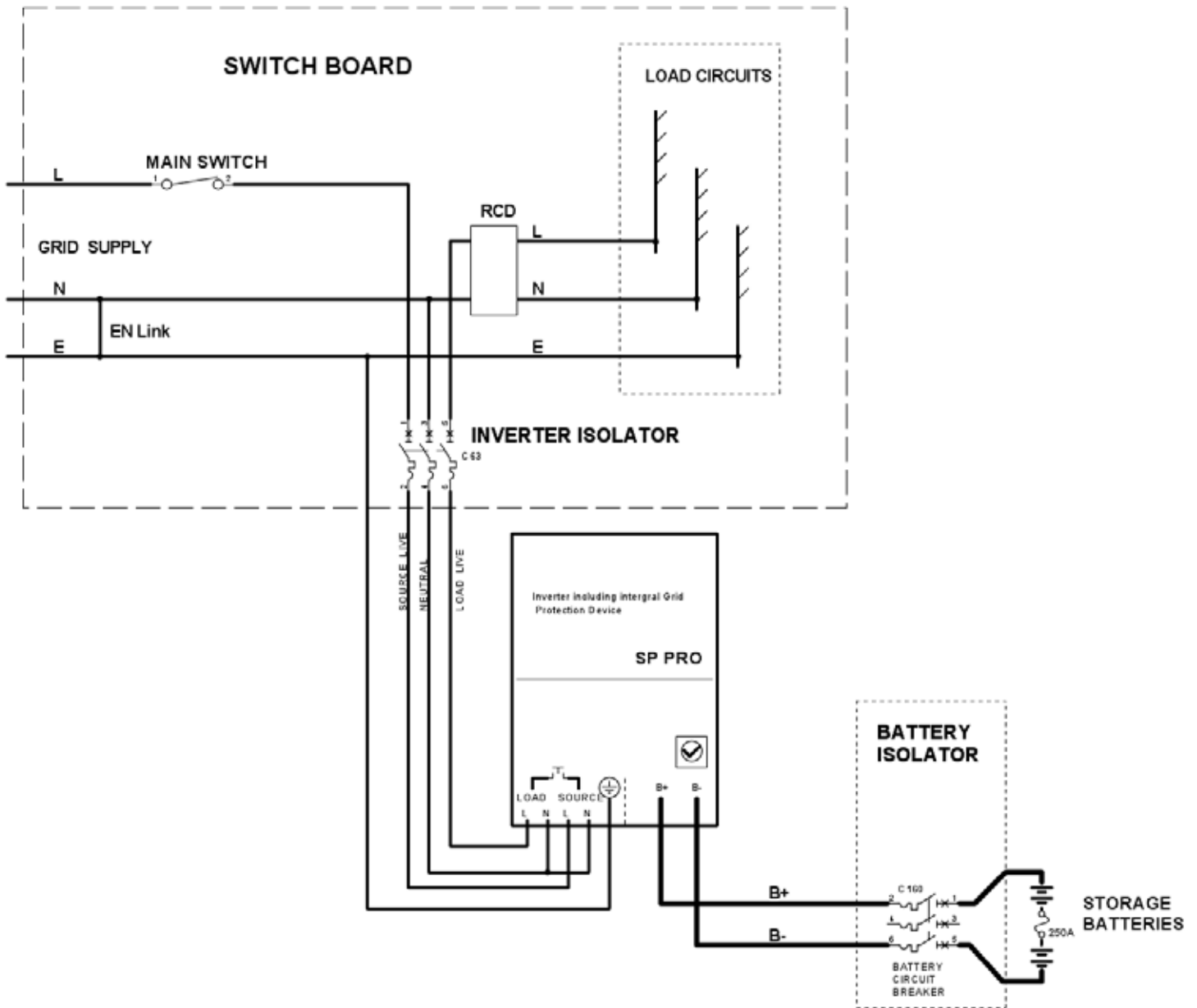
The following is a single line diagram in a similar format to AS4777.1 figure 3. This diagram indicates the customer circuits some of which are battery back-up protected, some which are not.



The diagram also shows locations of various isolating switches, using similar terms to AS4777.1 figure 3.



Attention must be paid to the Neutral conductor and connection through to the loads. The neutral conductor connecting to the loads must be maintained such that operation of the SP PRO isolators would not alter the bonding between Neutral and Earth. The following diagram shows all conductors in an installation with all Load circuits battery backup protected.



The diagram illustrates that with the operation of the inverter isolator the neutral conductor remains connected through to the load circuits.

Given that the Neutral conductor must remain connected through to the load, particular care should be taken with the placement of RCDs. These devices open both Active and Neutral conductors thus the SP PRO must be installed on the grid side of these devices.



Mobile Preparation

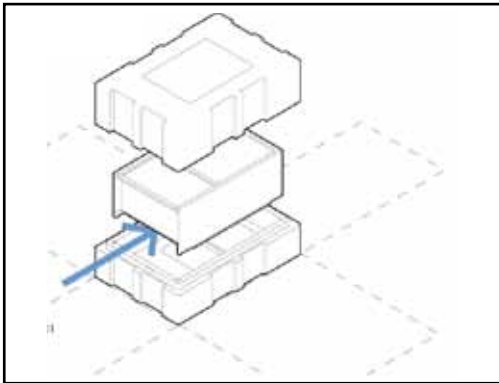
When the SP PRO is to be installed in a mobile application (caravans, mobile homes, boats etc) the SP PRO must be configured such that the maximum current rating of the pluggable connection (wiring and plug) to the ac source is not exceeded.

For example, if the pluggable connection for a caravan used a 10A rated lead and plug, the SP PRO must be configured appropriately via SP LINK to prevent the current from exceeding this rating. In SP LINK the Nominal AC Voltage may be set to 240V and the Min AC Voltage tolerance may be set to -10% (216V); then in SP LINK the AC Input Power must be set to no greater than $216 \times 10 = 2160\text{W}$, or 2.1kW.

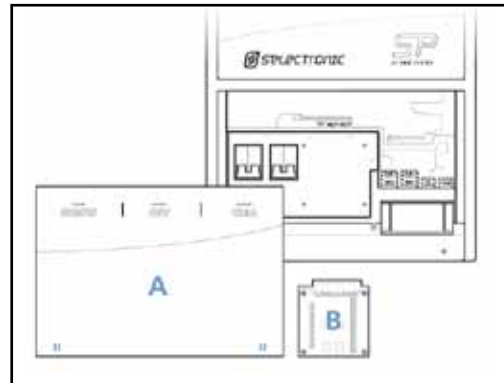
For further information on configuring SP PRO, refer to section 6 of this manual.



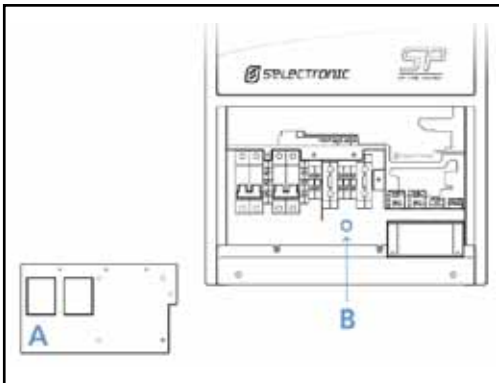
Installation of SPMC models



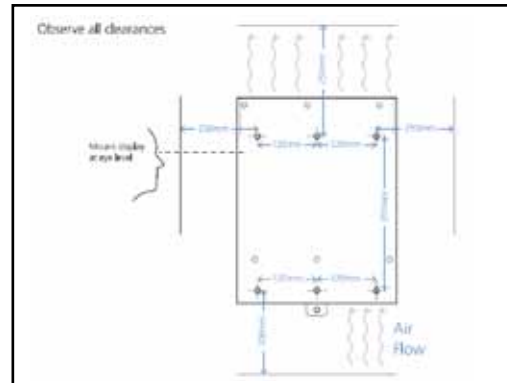
1 - Unpack the SP PRO onto a flat surface. When removing the SP PRO from its packaging carefully inspect for any damage that may have occurred in transit. Damage must be reported to your supplier immediately.



2 - Remove the cover plate(A) by unscrewing the two thumbscrews near the bottom of the SP PRO. Using the T10 torx driver undo the 4 screws securing the expansion card(B) and gently sliding the card down.



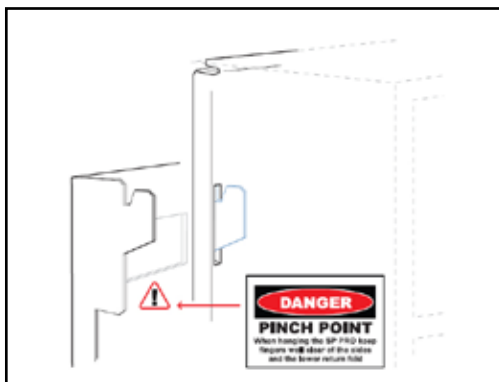
3 - Using the T10 torx driver remove the terminal cover(A) by undoing the 4 screws. Use the 6mm allen key to remove the transit bolt(B) positioned below the DC battery terminals.



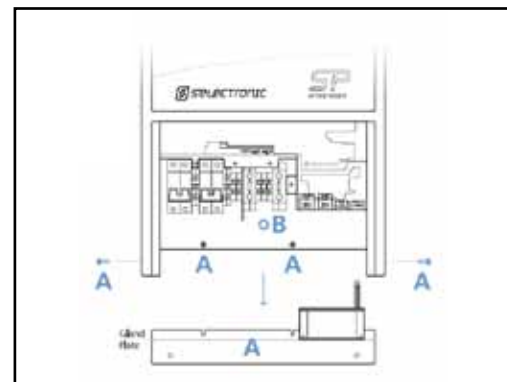
4 - Choose a suitable weight bearing and temperature resistant surface to mount the SP PRO. Max temperature is ambient +30 degrees C, max weight is 40kg. The display of the SP PRO should be at eye level.

Remove the mounting plate from the rear of the SP PRO.

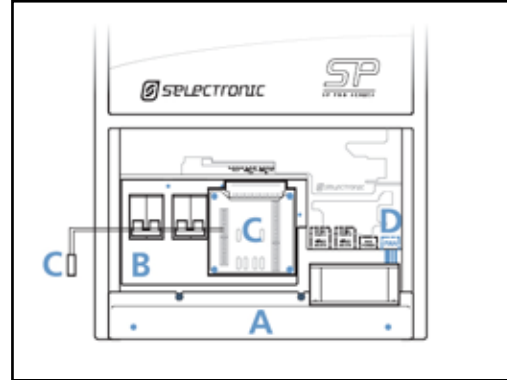
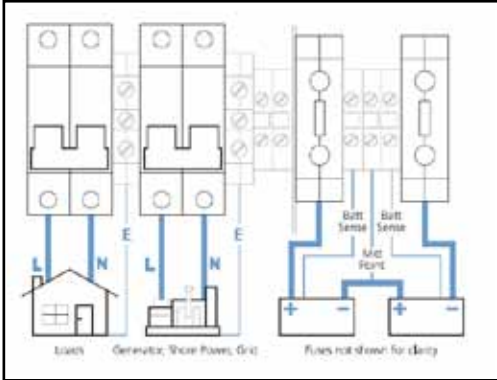
There should be no obstructions to the clear passage of air. Use the 6 x M8 holes to mount the bracket, if the SP PRO is being installed in a mobile situation use the optional mobile mounting bracket.



5 - Mount the SP PRO on the mounting plate by first hooking the top of the inverter plate by the projections on the mounting plate and lowering it into position. Care should be taken to observe Pinch Point warning. Secure the bottom of the inverter to the mounting plate with the transit bolt using the allen key provided.



6 - The gland plate can be removed if required to give greater access to wiring terminals using T20 torx driver. NB, internal screws need only be loosened.



7- Wiring can only be carried out by suitably qualified installers and must adhere to all relevant standards.

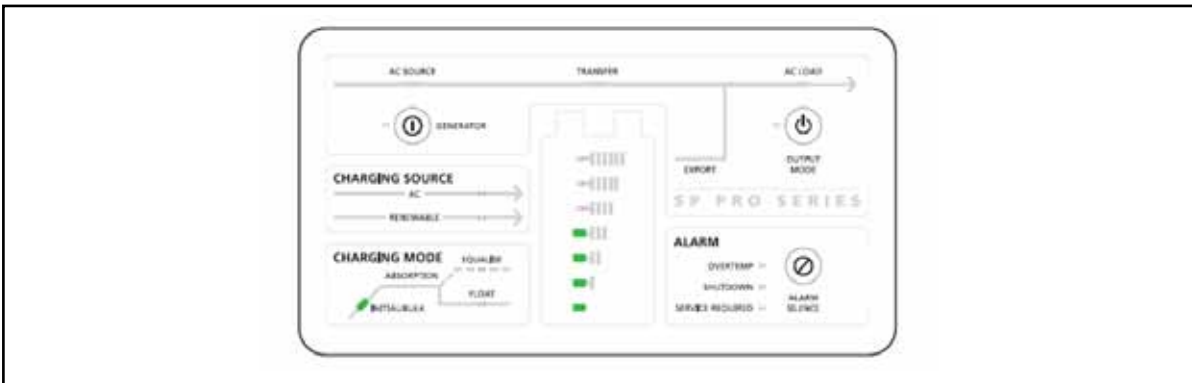


Detailed instruction for wiring SP PRO contained on the following pages. These MUST be followed before proceeding with installation.

Please bear in mind that installations performed and signed off by a Selectronic Accredited installer will benefit from additional warranty cover.

8 - Important points

- Failure to fill any holes in the gland plate (A) will reduce IP rating and compromise thermal design.
- Failure to connect the fan to the appropriate socket (D) will result in over heating.
- Installation of the battery temperature sensor (C) is imperative for the correct and accurate charging of your batteries.



9 - The SP PRO is ready to go.



Battery Cabling Requirements

Minimum Recommended Copper Battery Cable Sizes

Total distance of one conductor from the SP PRO to the battery terminals	Minimum Size Copper Battery Cables based on cable loss < 2% (V-75, V90 OR V-90HT INSULATION)				
	SPMC 240	SPMC 241	SPMC 481	SPMC 482	SPMC 1201
< 2 m	50 mm ²	70 mm ²	50 mm ²	50 mm ²	35 mm ²
2 - 5 m	70 mm ²	50 mm ² x 2	50 mm ²	70 mm ²	35 mm ²
5 - 10 m	Note 1	Note 1	70 mm ²	70 mm ² x 2	50 mm ²
> 10 m	Note 1	Note 1	Note 1	Note 1	Note 1

Note 1: This cable length/product combination is not recommended.

Note 2: V-75, V90 or V-90HT insulated cables are required to be spaced apart by at least the diameter of the cable. For cables with higher grade insulation, no spacing is required.

Fusing

Recommended Battery Fuse Sizes

Product	SPMC 240	SPMC 241	SPMC 481	SPMC 482	SPMC 1201
Battery Fuse Rating (A)	250	250	160	250	160



The DC Breaking Capacity (normally specified in kA at a maximum DC voltage) of the fuse must be greater than the maximum DC Short Circuit current for the sites connect battery system.



DC Wiring

The SP PRO does NOT contain an internal fuse or DC breaker. The DC wiring must be fitted with appropriate fusing or circuit breakers.

The fuse or circuit breaker must be located in a user accessible position and be in close proximity to the battery system. The battery system must not be accessible by the user.

There are four DC wiring connections that should be made. B+ and B-, pre charge and optional mid point monitoring. DC wiring should be fed up through the appropriate gland and terminated into the correct terminals. Connect the battery negative lead with the insulation stripped back 28 mm to the SP PRO's Battery Negative screw terminal. Tighten the hex screw with the Allen key provided. Repeat the same process with the positive battery lead.

Copper wiring must be used through out



Multiple Hazardous Energy Sources

DC wiring is fed from multiple sources including internal capacitors. Care must be taken to ensure that under no circumstances can the user access or touch wiring even after the operation of external circuit breakers or fuses assemblies.

AC Wiring

The AC cabling should be sized according to maximum demand through (consumed by the AC Load) and consumed by the SP PRO (consumed by the charging of batteries). The SP PRO is fitted with 63A circuit breakers which are suitable for accepting up to 25 mm² cables. The 63 A circuit breakers will protect 16 mm² cables but additional external protection must be provided if a lighter duty cable is used.

AC wiring should be fed up through the appropriate gland and terminated to the SP PRO.

Connect the AC load wiring to the SP PRO: earth stripped back 16 mm to the load earth terminal, neutral and active stripped back 12 mm to the Load Circuit Breaker.

Connect the AC source wiring to the SP PRO: earth to the AC Source earth terminal, neutral and active to the AC Source Circuit Breaker.

Copper wiring must be used though out.



Multiple Hazardous Energy Sources

AC wiring is fed from multiple sources. Care must be taken to ensure that under no circumstances can the user access or touch wiring even after the operation of external circuit breakers.

Earth Wiring

The inverter shall be earthed to the installations Earth system. A minimum copper earthing conductor of 6 mm² shall be used. For further information see AS3000 Table 5.1 – Earthing conductor size.

Earth the inverter by connecting earth wiring from the switchboard to the inverter Earth terminal. The SP PRO is suitable for Multiple Earth Neutral systems.

Copper wiring must be used through out.



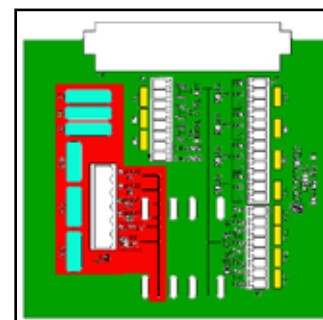
SPMC 1201 Expansion Card Warning



SPMC 1201 models - Hazardous Voltage - 120 V Battery

Expansion card connects to both Hazardous and Safety Extra Low Voltage (SELV) wiring. The connector and wiring to J4 (marked in RED) MUST be treated as Hazardous and be physically segregated from other wiring connected to expansion card.

Protective cover MUST be installed on the Expansion card.



Current Shunt Wiring



SPMC 1201 models - Hazardous Voltage - 120 V Battery

Current shunts connections are both internally and externally connected to battery negative terminal and MUST be treated as Hazardous. Double insulated sense cabling MUST be used.

DC Shunts MUST be installed into the battery negative lead. Ensure that the shunt ONLY measures the renewable or other DC load current and not any current feeding to or from the inverter.

The sense wires for the externals shunts should be fed up through the appropriate gland and terminated to the SP PRO expansion card. The sense cabling should be kept as short as possible. "CAT5" type cabling or any multi conductor multi strand cable is suitable for shunt sense wiring. Remember that these small cables are connected to battery negative and an inadvertent short circuit with either lead to battery positive would short circuit the battery bank. It is recommended that both these wires be fused.

The polarity of these shunt sense leads is not important if they are configured to either "Load" or any of the input selections, such as "Solar"; however polarity is important when using the shunt in "Dual" mode – that is where the shunt is used for both input and output measurement to obtain a nett result.

In "Dual" mode, the sense leads must be connected correctly – expansion card shunt terminal 1A or 2A to the solar and load side, 1B or 2B to the battery negative side.

Battery Temperature Sensor



SPMC 1201 models - Hazardous Voltage - 120 V Battery

Battery temperature sensor is internally connected to battery negative terminal and MUST be treated as Hazardous. Sensor cable is double insulated.



The battery temperature sensor will be pre-wired to the expansion card and must be installed in thermal contact with the centre of a side of a battery, insulated from external temperature effects for accurate charging results. If the cable provided is not long enough it may be extended, polarity of the cable is not important.

Generator Control Wiring

Generator control wiring should be fed up through the appropriate gland and terminated to the SP PRO Expansion card - at a minimum; one of the four relay outputs for a generator run signal. "CAT5" type cabling or any multi conductor multi strand cable is suitable for all control wiring. The Expansion Card can be plugged in and out of the SP PRO for ease of wiring.

Serial Port Connection

The communication cable can be attached to either of the RJ45 sockets on the control board.



Gland Plate Fitout

To maintain the IP rating and safety approval of the SP PRO, all gland plate holes must be completely filled. For any unused holes, plug these with the supplied blanking plugs. If the plug is metal; once installed from the underside of the gland plate, ensure that it is secured in place by bending all of the inner fingers tabs over flush.

Initial Start up Procedure

Before turning on the SP PRO double check all connections, paying particular attention to correct polarity. Give each cable a firm tug to ensure it is securely fitted. If satisfied everything is well, attach the terminal cover plate and insert and secure the expansion card.



SPMC 1201 models - Protective cover **MUST** be installed on Expansion card.

Connect the pre charge wires and wait until all LEDs are lit and stable.

Connect battery cables

Press output mode button (long press > 1 second) once, AC Load LED will be steady blue. You can now start to use your SP PRO by turning on both AC Source and AC Load circuit breakers.

Replace top cover and tighten thumb screws.



To maintain IP rating, thumb screws must be tightened enough that they require a screw driver to loosen.

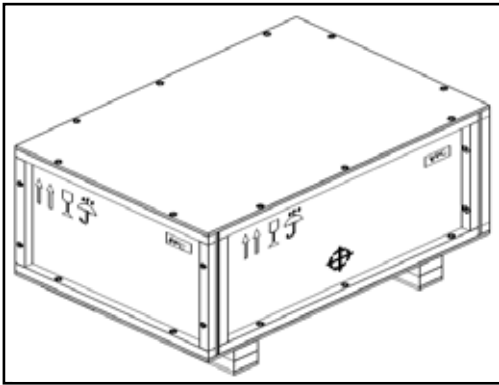
Labelling

Regulations mandate the application of warning and control labels to the various circuit breakers, isolators and switch boards in the installation.

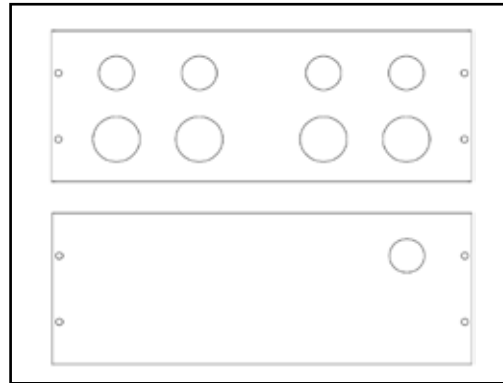
The SP PRO behaves like a UPS and will continue to provide power to the load upon interruption of mains supply. Warning signs must indicate which circuits or switchboards operate in this manner. For further information see AS4777.1 section 5.6 Additional Requirements for UPS systems.



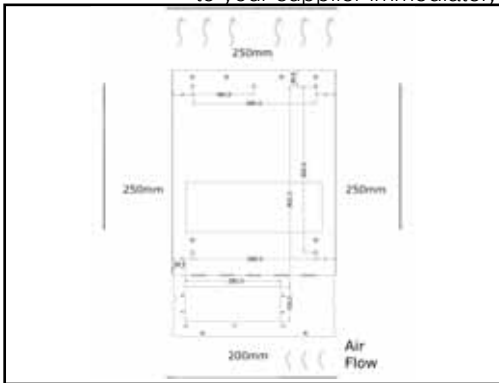
Installation of SPLC models



1 - Undo ten bolts ($\frac{7}{16}$ ") to remove lid. Cardboard tray contains mounting plate, rear air outlet mesh cover and all documentation. Inspect for damage in transit and report any to your supplier immediately.



2 - Cable entry is either from below or wall entry by flipping position of inter changeable gland plates. Gland plates secure to the underside of unit base or to the inside of the mounting plate using four T10 Torx screws.



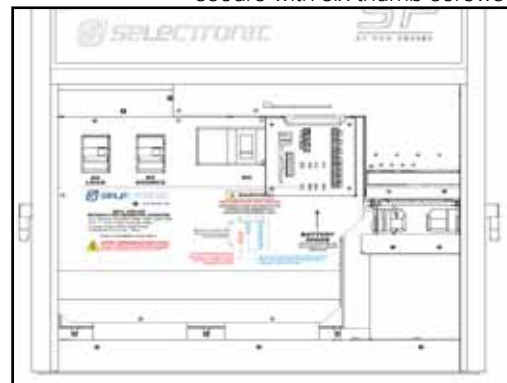
3 - Choose a suitable weight bearing and temperature resistant surface to install the mounting plate. Max temperature is ambient +30°C, weight is 105 kg. The plate should be mounted at a convenient level. There should be no obstructions to the clear passage of air. Wall or cavity cables may now be fitted through gland plate.



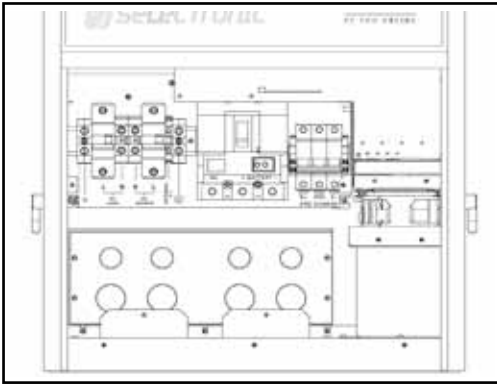
4 - Undo 10 bolts ($\frac{7}{16}$ ") to remove sides from the packing base. Undo 8 bolts ($\frac{7}{16}$ ") to remove clamps from handles
HEAVY: Take care when lifting - 105 kg
SHARP: Use gloves - handle edges sharp.
TOP HEAVY: Secure unit when standing upright.
 Stand unit upright using handles.
REAR AIR OUTLET MESH COVER: Fit and secure with six thumb screws



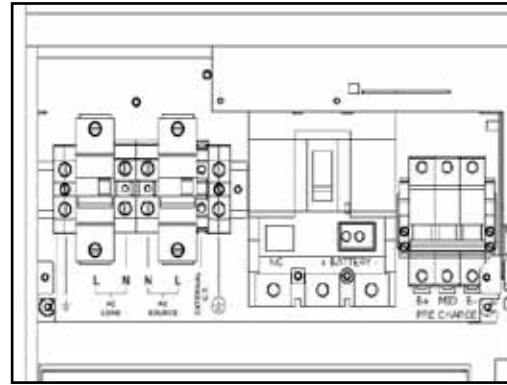
5 - Mount the SP PRO on the mounting plate by first hooking the top of the inverter over the projections on the mounting plate and lowering it into position. Care should be taken to observe Pinch Point warning. Secure the bottom of the inverter to the mounting plate with two M6 bolts provided.



6 - Remove the cover plate by unscrewing two thumbscrews near bottom of SP PRO. Expansion card remains secured to SP PRO.



7 - Undo five T10 Torx screws to remove terminal plate.
Note: Gland plate shown in wall entry cable position.
Expansion card not shown for clarity.

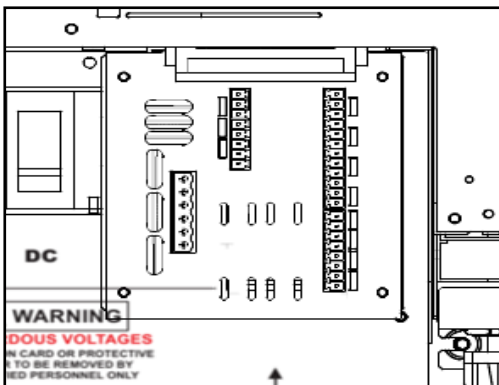


8 - Wiring can only be carried out by suitably qualified installers and must adhere to all relevant standards.

Installations performed and signed off by a Selectronic Accredited installer will benefit from an additional warranty cover.

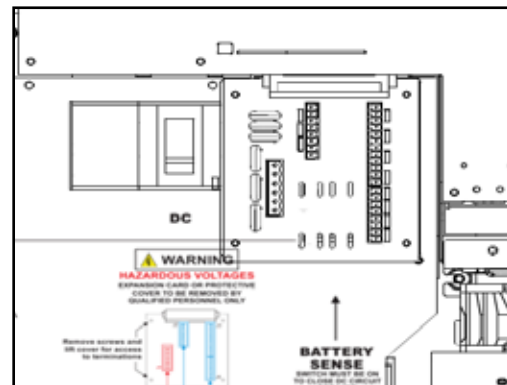


9 - STOP: Detailed instruction for wiring SP PRO contained on the following pages. These MUST be followed before proceeding with installation.



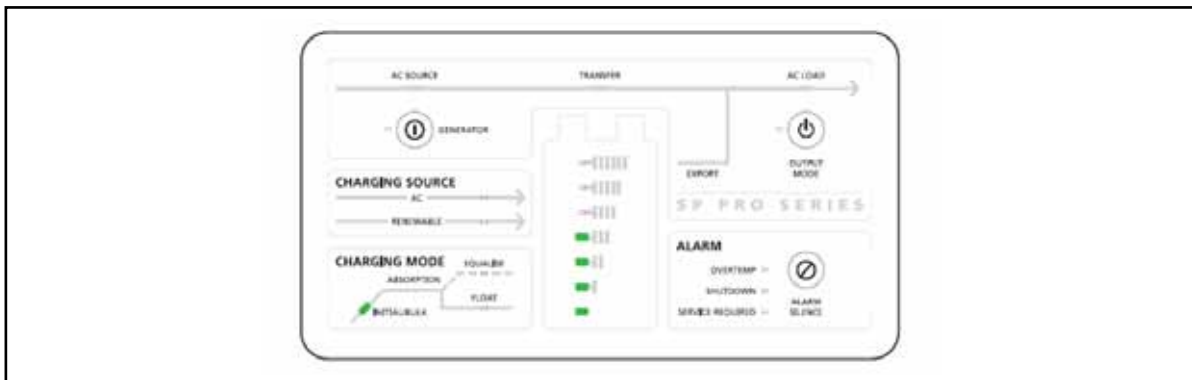
10 - Important points

- Failure to fill any holes in the gland plate will compromise IP rating and the thermal design.
- Protective cover on Expansion Card MUST be fitted.
- Installation of the battery temperature sensor is imperative for the correct and accurate charging of your batteries.



11 - Initial Switch On.

- Verify all connections tight and correct polarity.
- Battery Sense switch (under Expansion Card) must be closed and pre charge complete before DC Breaker will close.



12 - The SP PRO is ready to go.



Battery Cabling Requirements

Minimum Recommended Copper Battery Cable Sizes

Total distance of one conductor from the SP PRO to the battery terminals	Minimum Size Copper Battery Cables based on cable loss < 2% (V-75, V90 OR V-90HT INSULATION)
	SPLC 1201
< 5 m	50 mm ²
5 - 10 m	70 mm ²
> 10 m	Note 1

Note 1: This cable length/product combination is not recommended.

Note 2: V-75, V90 or V-90HT insulated cables are required to be spaced apart by at least the diameter of the cable. For cables with higher grade insulation, no spacing is required.

Primary DC Terminal Connections

M8 copper lugs are required to connect battery wiring into the SP PRO. 70 mm² lugs may need to be reduced in width to fit within circuit breaker terminal.

Fusing

Recommended Battery Fuse Sizes

Product	SPLC 1201
Battery Fuse Rating (A)	250



The DC Breaking Capacity (normally specified in kA at a maximum DC voltage) of the fuse must be greater than the maximum potential DC Short Circuit current for the battery system.



DC Wiring

The SP PRO contains a 250 A DC circuit breaker and a low current Battery Sense/Pre charge DC switch. It may be necessary to fit additional fusing or circuit breakers to protect the battery system. Any additional fuse or circuit breaker must be located in a user accessible position and be in close proximity to the battery system. The battery system is hazardous and must not be accessible by the user.

DC wiring should be fed through the appropriate gland and terminated to the correct terminals.

Battery B+ and B- connections. Connect the battery negative lead using M8 copper lug to the SP PROs B-terminal. Tighten the hex screw including load washer with the 6mm Allen key such that load washer flattens. Repeat the same process with the positive battery lead. The terminal labelled “NC” provides no internal connection.

Battery Sense/Pre charge B+ and B- and optional MID connections. These connections can be made with light duty cable (2.5 mm²) - cable MUST be double insulated. Connect the battery negative lead with the insulation stripped back 12 mm to the SP PROs Pre charge negative screw terminal. Repeat the same process with the positive battery lead and optional mid point lead.

Copper wiring must be used through out.



Multiple Hazardous Energy and Voltage Sources - 120 V Battery

DC wiring is fed from multiple sources including internal capacitors. Care must be taken to ensure that under no circumstances can the user access or touch wiring even after the operation of external circuit breakers or fuses assemblies.

AC Wiring

The AC cabling should be sized according to maximum demand through (consumed by the AC Load) and consumed by the SP PRO (consumed by the charging of batteries). The SP PRO is fitted with terminals which are suitable for accepting up to 50 mm² cables. The fitted 125 A circuit breakers will protect 35 mm² cables but additional external protection must be provided if a lighter duty cable is used.

AC wiring should be fed through the appropriate gland and terminated to the SP PRO. Connect the AC load wiring to the SP PRO: earth to the load earth terminal (strip length 18 mm), neutral to the load neutral terminal (strip length 18 mm), and active to the Load Circuit Breaker (strip length 15 mm). Connect the AC source wiring to the SP PRO.

Copper wiring must be used though out.



Multiple Hazardous Energy and Voltage Sources

AC wiring is fed from multiple sources. Care must be taken to ensure that under no circumstances can the user access or touch wiring even after the operation of external circuit breakers.

Earth Wiring

The inverter shall be earthed to the installations Earth system. A minimum copper earthing conductor of 16 mm². For further information see AS3000 Table 5.1 – Earthing conductor size.

Earth the inverter by connecting earth wiring from the switchboard to the inverter Earth terminal. The SP PRO is suitable for Multiple Earth Neutral (MEN) systems.

Copper wiring must be used through out.



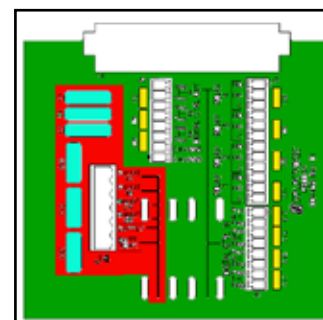
Expansion Card Warning



Hazardous Voltage - 120 V Battery

Expansion card connects to both Hazardous and Safety Extra Low Voltage (SELV) wiring. The connector and wiring to J4 (marked in RED) MUST be treated as Hazardous and be physically segregated from other wiring connected to expansion card.

Protective cover MUST be installed on the Expansion card.



Current Shunt Wiring



Hazardous Voltage - 120 V Battery

Current shunts connections are both internally and externally connected to battery negative terminal and MUST be treated as Hazardous. Double insulated sense cabling MUST be used.

DC Shunts MUST be installed into the battery negative lead. Ensure that the shunt ONLY measures the renewable or other DC load current and not any current feeding to or from the inverter.

The sense wires for the externals shunts should be fed through the appropriate gland and terminated to the removable terminal block on the SP PRO expansion card. The sense cabling should be kept as short as possible. Remember that these small cables are connected to battery negative and an inadvertent short circuit with either lead to battery positive would short circuit the battery bank. It is recommended that both these wires be fused. Fuses should be a sand filled type with suitable DC breaking capacity.

The polarity of these shunt leads is not important if they are set to either "Load" or any of the input selections, such as "Solar"; however polarity is important when using the shunt in "Dual" mode – that is where the shunt is used for both input and output measurement to obtain a nett result.

In "Dual" mode, the sense leads must be connected correctly – expansion card shunt terminal 1A or 2A to the solar and load side, 1B or 2B to the battery negative side.

Battery Temperature Sensor



Hazardous Voltage - 120 V Battery

Battery temperature sensor is internally connected to battery negative terminal and MUST be treated as Hazardous. Sensor cable is double insulated.



The battery temperature sensor will be pre-wired to the removable terminal block on the expansion card and must be installed in thermal contact with the centre of a side of a battery, insulated from external temperature effects for accurate charging results.

Generator Control Wiring

Generator control wiring should be fed up through the appropriate gland and terminated to the SP PRO Expansion card - at a minimum; one of the four relay outputs for a generator run signal. "CAT5" type cabling or any multi conductor multi strand cable is suitable for all control wiring. The Expansion Card can be plugged in and out of the SP PRO for ease of wiring.

Serial Port Connection

The communication cable can be attached to either of the RJ45 sockets marked Serial Port 1 or Serial Port 2 on the edge of the circuit board. Serial communication connections are not connected to the battery.



Gland Plate Fitout

To maintain the IP rating and safety approval of the SP PRO, all gland plate holes must be completely filled. For any unused holes, plug these with the supplied blanking plugs. If the plug is metal; once installed from the underside of the gland plate, ensure that it is secured in place by bending all of the inner fingers tabs over flush.

Initial Start up Procedure

Before turning on the SP PRO double check all connections, paying particular attention to correct polarity. Give each cable a firm tug to ensure it is securely fitted. If satisfied everything is well, attach the terminal cover plate.



Protective cover **MUST** be installed on Expansion card.

Switch battery feed on to the battery sense/pre charge and the main battery connection. Close Battery Sense/Pre charge switch - under the expansion card - and wait until all LEDs are lit and stable.



DC Circuit Breaker will not close until pre charge is complete.

Close DC Circuit Breaker.

Press output mode button (long press > 1 second) once, AC Load LED will be steady blue. You can now start to use your SP PRO by turning on both AC Source and AC Load circuit breakers.

Replace top cover and tighten thumb screws.



To maintain IP rating, thumb screws must be tightened enough that they require a screw driver to loosen.

Labelling

Regulations mandate the application of warning and control labels to the various circuit breakers, isolators and switch boards in the installation.

The SP PRO behaves like a UPS and will continue to provide power to the load upon interruption of mains supply. Warning signs must indicate which circuits or switchboards operate in this manner. For further information see AS4777.1 section 5.6 Additional Requirements for UPS systems.

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SELECTRONIC

Instruction Manual for
SP PRO Energy Centre

User | Installation | SP LINK | Service



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Using SP LINK

Chapter Six



Overview

“SP LINK is the pathway to the real power of your SP PRO”

SP PRO is really many products in one. You can simply unpack the unit, mount it on a wall, connect the appropriate cables – and you’ve got power.

From there, using SP LINK, you can configure your inverter as simply or with as much sophistication as you wish. SP LINK has clear and friendly instructions and definitions to help you meet your design requirements.



System Requirements for SP LINK

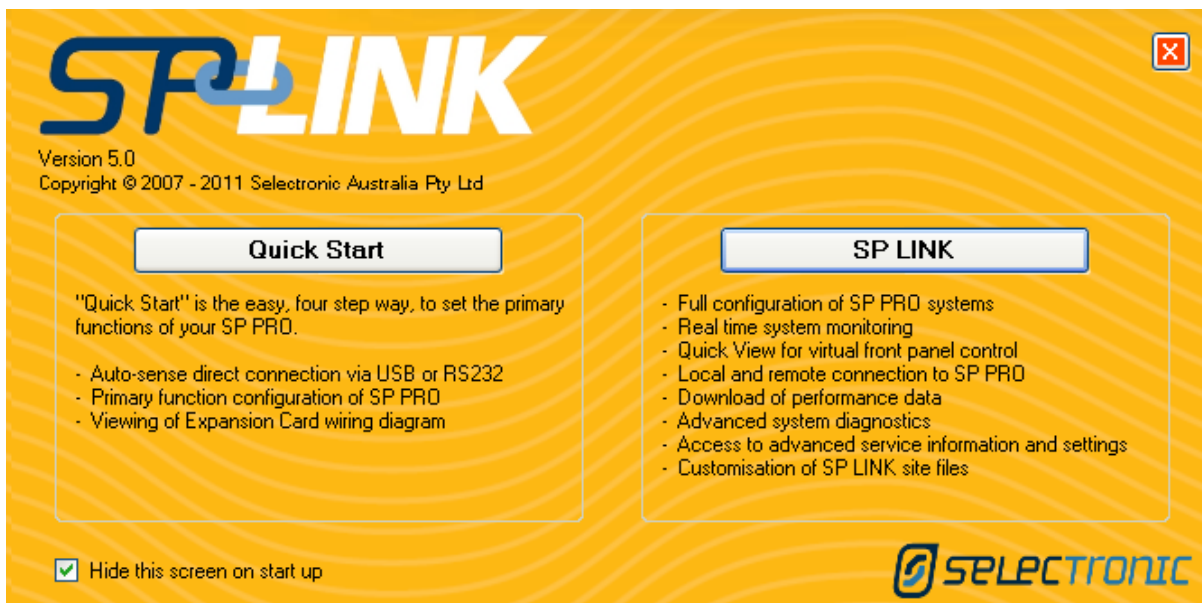
The system requirements include:

PERFORMANCE REQUIREMENTS:

- Microsoft Windows 98 / 2000 / XP / Vista. Other operating systems not supported.
- Internet Explorer 5.01 or higher.
- 10 MB hard disk space
- If Microsoft .NET 4.0 Framework is not already installed then approx. 100 MB of additional disk space will be required.
- 500 MHz or faster processor.
- 64 MB RAM
- Serial Port. USB-Serial adaptors are with every SP PRO.
- Either an external serial modem or a "null modem" (crossover) serial cable.

RECOMMENDED FOR BEST RESULT

- Microsoft Windows XP / Vista / 7
- Pentium 3, 1000 MHz or greater
- 800 x 600 or greater display area
- 256 MB RAM
- We recommend and support only the NetComm Roadster (AM5698 Selectronic Part No ELRM-NCS44) modem, and can supply one if required.

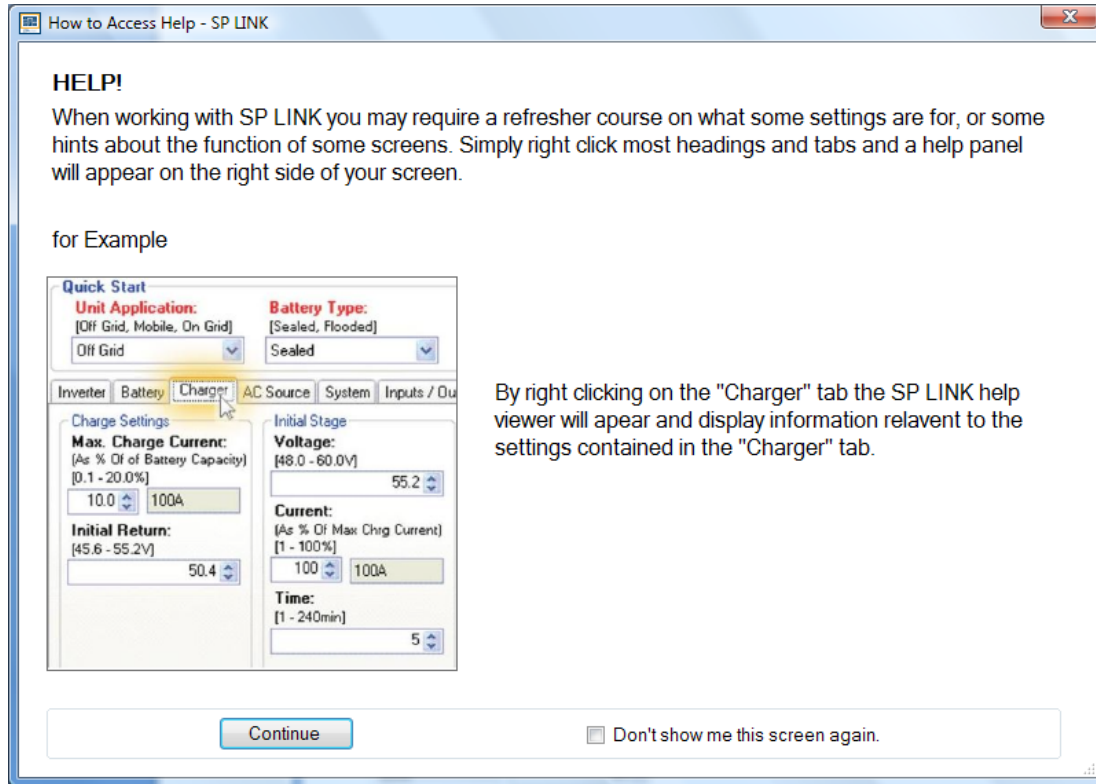




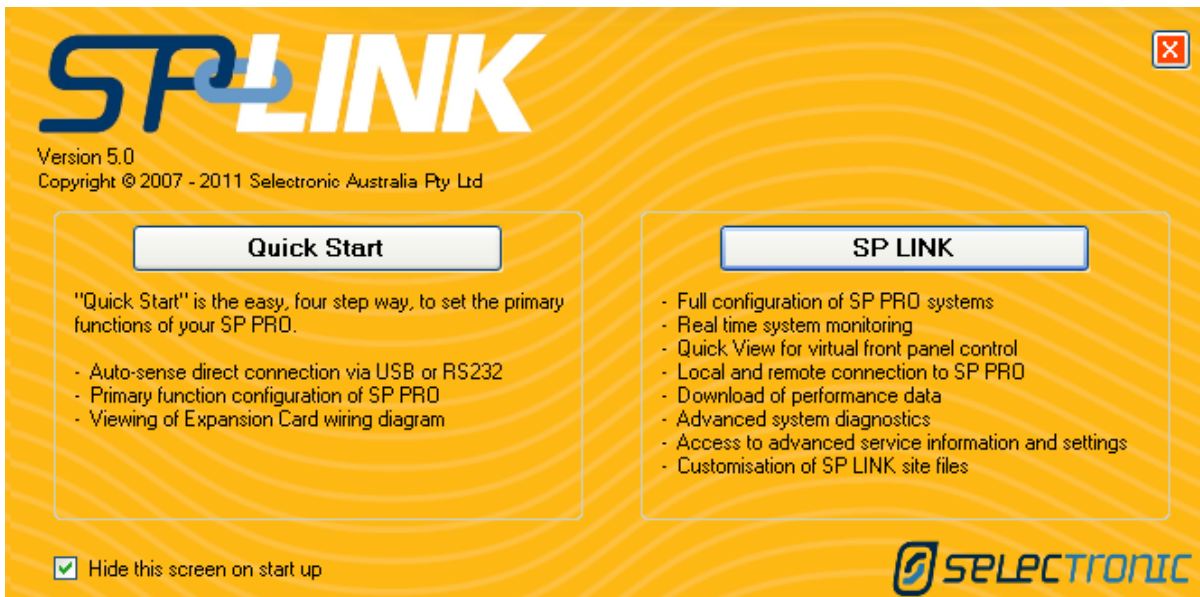
HELP!

When you first open SP LINK you will see the Help guide.

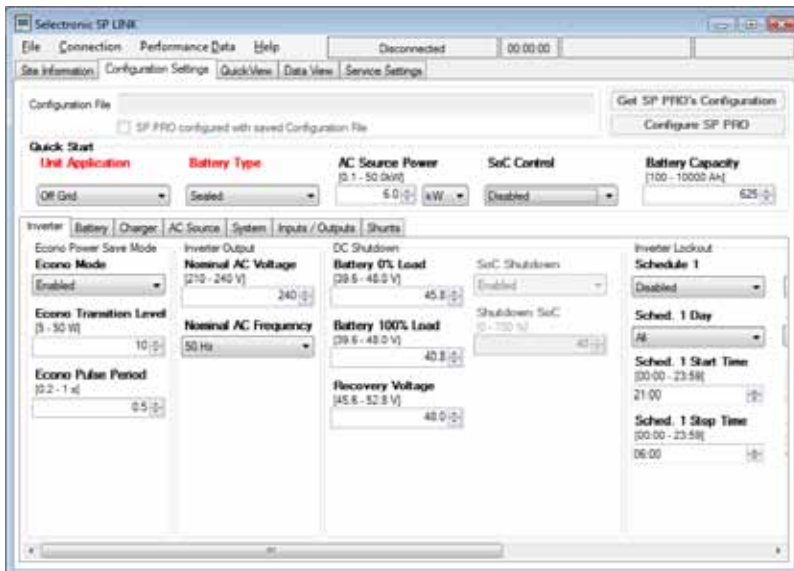
When working with SP LINK you may require a refresher course on what some settings are for, or some hints about the function of some screens. Simply right click most headings and tabs and a help panel will appear on the right side of your screen.



By clicking "Continue" the welcome screen will appear

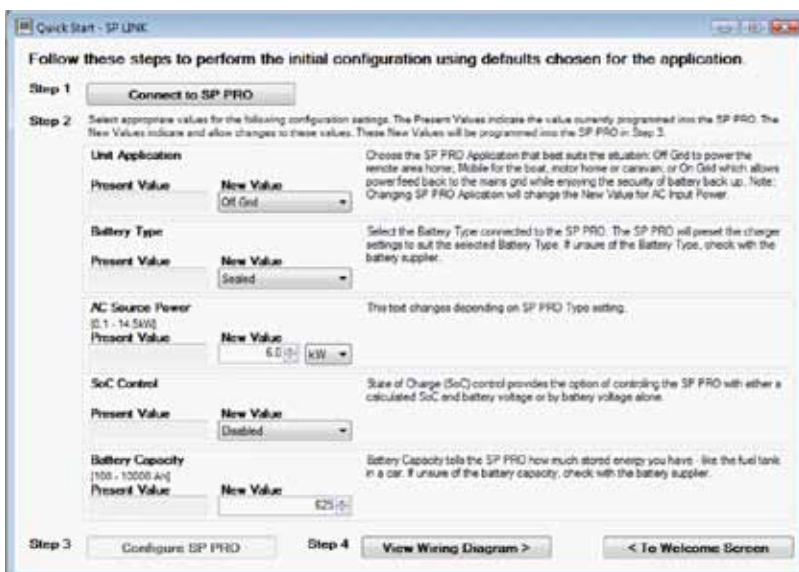


This screen gives you two options upon start up. These are:



SP LINK

Giving you access to over 220 different functions to customise every aspect of your system.



SP LINK QUICK START

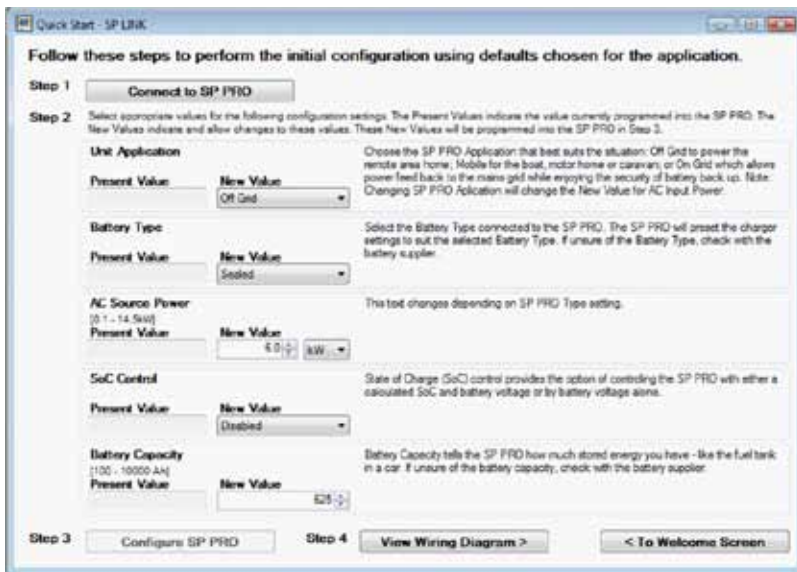
Giving you the ability to program the most important functions, such as Battery type, Generator size and the application for your individual system.



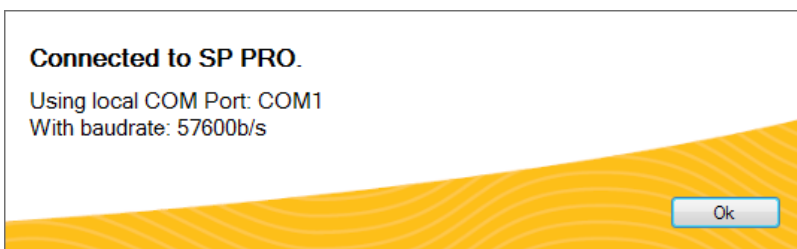
Getting Started

To get you started, we will run through the Quick Start screen to get you used to changing settings in SP LINK.

Once you have installed SP LINK in your computer and attached the cables supplied to communicate with the inverter, it is necessary to begin your programming session by connecting to the inverter. Remember, if you are using a USB to Serial adaptor, you must install the adaptor software before plugging the adaptor into the computer.



Click on CONNECT TO SP PRO and the software will search all available COM ports on your computer to find your SP PRO. Once found the following screen will appear...



SP LINK is now connected to the SP PRO, and you are ready to make your first change.

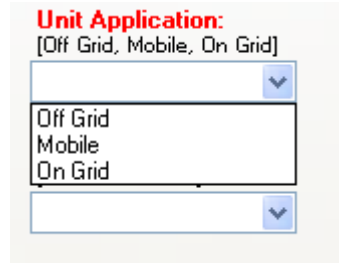


Changing Settings in Quick Start

The first setting determines how you will use your inverter.

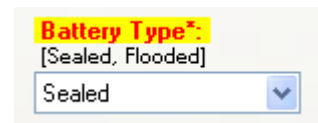
By clicking on a drop down trigger you can select the setting you wish. You will have noted that every time you change a setting the title of that setting becomes highlighted in yellow. This is to remind you that you have changed this setting. This highlight disappears when you perform the next step – programming your inverter.

- Off Grid for remote area homes
- Mobile for Motorhomes, Caravans & Boats
- On Grid where you wish to feed Solar, Wind or Hydro power to the electricity grid. Use this setting if back up power required in case of grid failure



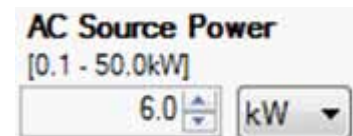
The rest are just as easy.

These two battery types require different charging parameters. Picking one type automatically programs the inverter with a number of charge settings.



If you are unsure of the battery type you own it is best to ask your battery supplier.

With AC Source Power you can program the size of your generator. With the right hand drop down menu you can choose to set the power level in either kW or kVA depending on how your generator is rated. If you are unsure of your generators power rating you should check with your generator supplier.



State of Charge (SoC) control gives you the option of controlling your system with either a calculated state of charge or by the battery voltage.





It is important to note, at this stage, that State of Charge control needs to have extra components added to accurately measure what is going into your system and what is coming out – like a fuel gauge in your car – we will cover this in more detail when we get to “Current Shunts” later in the manual. If you choose to have this control disabled extra battery charging through your generator will be calculated by the voltage of your battery pack.

It is important to include battery capacity as it tells the SP PRO how much reserve power you have available – like the size of the fuel tank in your car.

If you are unsure of the capacity of the battery you own it is best to ask your battery supplier.

Now you’re ready to make these changes to your inverters internal computer. Just click on “Configure SP PRO”

For security purposes, to ensure no-one can tamper with your SP PRO, you will now be asked to enter your passcode.

The default passcode is 74, however you can alter this if you wish. We will cover altering your passcode when we get to “Service Settings”.

Once you have entered your passcode click “OK”

Battery Capacity*:
[100 - 10000Ah]
960

Please Enter Passcode

Ok Cancel

SP LINK will now program the inverter with these changes and report the success of the programming.

Programming Configuration Settings into the SP PRO

You have now programmed your inverter with all the basic information it needs to run your system.

If this is as far as you want to go you can exit this welcome by clicking on “To Welcome Screen” where you can further personalise your settings or just exit the program.



Configuration Settings

Now you have mastered changing parameters within SP LINK we can begin to look at some of the more advanced settings you may wish to alter. To access these settings, from the Welcome screen click on SP LINK then click on the Configuration Settings tab. Please note that only suitably experienced persons or Selectronic Accredited Installers should proceed beyond this point.



The default configuration settings have been carefully considered and will be adequate in most circumstances. The Flooded and Sealed battery defaults provide safe and efficient charging for most common batteries.

Each Tab highlights a different area within the programming you may wish to change.

The screenshot displays the 'Inverter' configuration settings interface. It features a top navigation bar with tabs: Inverter, Battery, Charger, AC Source, System, Inputs / Outputs, and Shunts. The 'Inverter' tab is active, showing several adjustable settings:

- Econo Power Save Mode:** Includes 'Econo Mode' (set to 'Enabled'), 'Econo Transition Level' (set to '10'), and 'Econo Pulse Period' (set to '0.5').
- Inverter Output:** Includes 'Nominal AC Voltage' (set to '240') and 'Nominal AC Frequency' (set to '50 Hz').
- DC Shutdown:** Includes 'Battery 0% Load' (set to '45.8'), 'Battery 100% Load' (set to '40.8'), and 'Recovery Voltage' (set to '48.0').
- SoC Shutdown:** Includes 'SoC Shutdown' (set to 'Enabled') and 'Shutdown SoC' (set to '40').
- Inverter Lockout:** Includes 'Schedule 1' (set to 'Disabled'), 'Scheduled Day' (set to 'All'), 'Scheduled Start Time' (set to '21:00'), and 'Scheduled Stop Time' (set to '06:00').

Now we can start to modify the configuration settings



Inverter Settings

We will start with the “Inverter” tab and progressively work our way through – setting by setting.

WHEN ECONO mode is disabled the inverter will run continuously, when it is enabled, then activated using Output Mode button, the inverter will go into “sleep” mode after 30 seconds and consume much less power if the load is below the pre-set level (5 – 50 watts).

This level is normally chosen to reflect the smallest load you wish to start the inverter, ie you may choose 20 watts if you want the inverter to start when you switch on a lamp or you may choose 5 -7 watts if you want it to run a ‘phone charger’.



Econo mode can only be enabled for single 24V and 48V models.

INVERTER OUTPUT sets the normal NOMINAL AC Voltage and the NOMINAL AC Frequency from the inverter. In Australia this would be usually 240 volts and 50 Hz. If you are unsure consult your local power authority.

When your SP PRO is being used in an “On Grid” application reference to your local grid supply voltage should be considered as this sometimes varies from the national standard.

DC SHUTDOWN These figures control how far you will allow your batteries to become discharged before the inverter will switch itself off. These lower limits are important as discharging batteries too far can make them hard to recharge or, in the worst case, damage the batteries. The first setting outlines the voltage at which the inverter will shutdown with no load applied to the battery, this includes any DC loads. The second setting is the shutdown voltage when 100% load is applied.

100% load is when the battery load current is equal to 20% of the battery capacity (C/5). When the battery load is between these two levels your SP PRO will calculate a shutdown voltage based on the two voltages you program.

RECOVERY VOLTAGE If the inverter shuts down due to low voltage (as in the last section) this setting allows you to determine at what voltage the inverter will start itself again. It is wise to make this voltage high enough to ensure that significant recharging has occurred before it turns on again.

Econo Power Save Mode
Econo Mode
Enabled

Econo Transition Level
[5 - 50 W]
10

Econo Pulse Period
[0.2 - 1 s]
0.5

Inverter Output
Nominal AC Voltage
[210 - 240 V]
240

Nominal AC Frequency
50 Hz

DC Shutdown
Battery 0% Load
[39.6 - 48.0V]
45.6

Battery 100% Load
[39.6 - 48.0V]
42.5

Recovery Voltage
[45.6 - 52.8V]
48.0



SoC SHUTDOWN. You can also program the inverter to shutdown in response to the state of charge. When enabled this figure can be set anywhere between 0 and 100%. A figure of around 40% is usually safe.

The SHUTDOWN SoC also defines the lowest point of Usable Charge which is displayed on the front panel Fuel Gauge LEDs. It is important to set this correctly regardless of whether SoC SHUTDOWN is used or not.

INVERTER LOCKOUT SCHEDULES 1 to 4 is a feature that is normally used when your SP PRO is configured for On Grid use however it may also be used in Off Grid or Mobile use.

The Inverter Lockout enables you to schedule up to four periods, when your inverter will be switched off to minimise the power you are using when there is no solar power to export to the mains grid.

Of course if the mains grid fails your SP PRO will “wake up” and take over the loads. In this mode there is a short delay before the inverter takes up the load. If it is essential to retain power at all times this feature should be disabled.

SoC Shutdown
Enabled
Shutdown SoC
[0 - 100 %]
40

Inverter Lockout
Schedule 1
Disabled
Sched. 1 Day
All
Sched. 1 Start Time
[00:00 - 23:59]
21:00
Sched. 1 Stop Time
[00:00 - 23:59]
06:00



Battery Settings

The Battery Tab contains settings intended to protect and maintain your batteries.

MAX VOLTAGE LIMIT is the absolute maximum voltage produced by the charging section of your inverter in any charge stage.

HI BATTERY ALERT initiates an alarm when your battery voltage exceeds this level. A handy warning if your solar regulator becomes faulty.

When your battery voltage falls to the value set in HI BATTERY ALERT CLEAR the alarm stops.

Limits

Max Voltage Limit
[48.0 - 68.4 V]
61.2

Hi Battery Alert
[54.0 - 68.4 V]
61.7

Hi Battery Alert Clear
[54.0 - 68.4 V]
61.2

Most batteries, in the course of their working life, develop voltage variations between the individual cells. To rectify this problem it is necessary to initiate a charge that exceeds the normal charge levels. If you have a large alternative input source that can perform this task you can disable PERIODIC EQUALISE, if not it should be enabled. The frequency that these, longer, charge cycles take place is determined by EQUALISE PERIOD and can be adjusted from 1 to 100 days.

Battery

Periodic Equalise
Disabled

Equalise Period
[1 - 100d]
28

PERIODIC RECHARGE is for systems that remain on Float charge for long periods of time. Battery banks operating in these conditions benefit from periodically being put through a full charge process. When enabled, after remaining in Float for the number of days set by the Recharge Period, the SP PRO will switch to Initial charge stage.

Periodic Recharge
Disabled

Recharge Period
[2 - 100 d]
28

MID POINT MONITORING is a function designed to highlight any significant voltage variation between one half of your battery bank and the other. If one half of the bank is lower than the other it may suggest that the batteries need an equalisation charge or, perhaps, that there is a cell in one half that is not performing correctly. In MID POINT RANGE you determine how much variation between the two halves you will allow before notification. With this function you can help predict battery problems.

Mid Point

Monitoring
Disabled

Mid Point Range
[2 - 10 %]
5

Equalise Request
Enabled

Often these problems can be solved by an equalisation charge – we have included provision for you to request such a charge on this screen with EQUALISE REQUEST.

The capacity of your batteries alters depending on how much load you are placing on them. Peukert's Constant is part of a calculation that alters the theoretical battery capacity depending on the load placed on the system. This setting should only be changed by a suitably qualified person after the analysis of the battery specifications and system performance.

SoC Setting
Peukert's Exponent
[1.00 - 1.50]
1.15

OVER TEMP. PROTECTION This feature reduces the charge current automatically as the battery temperature rises above the temperature specified in Limit Charge above. It reduces the charge current by the Limit Rate for every degree C that the temperature is above the temperature specified.

Over Temp. Protection
Limit Charge above^{°C}:
[35 - 70°C]
45
Limit Rate[%]:
[0 - 20%]
10

With the settings we program into the inverter at the factory the charge rate will drop 10% for every degree Centigrade over 45°C. eg 0 charge at 55°C

Charger Settings

This tab shows all the settings relating to the voltages and currents used in the various charge stages.

The normal charge cycle involves a four stage charge – Initial, Bulk, Absorbion and Float– while periodically it is necessary to go one stage further, for the performance and longevity of the pack, to the Equalise stage. We will describe each of these stages as we progress. Please note there is a slider at the bottom of this page to move to more settings as this section is quite extensive.



Our default charge settings should be considered as safe for most battery types. Exact charging parameters should be confirmed from your battery supplier

Inverter	Battery	Charger	AC Source	System	Inputs / Outputs	Shunts
Charge Settings						
Max. Charge Current (as % of Battery Capacity) [1 - 100 %] 25 156 A						
Initial Return [45.6 V - Float V] 50.2						
Initial Stage		Bulk Stage		Absorption Stage		Absorb-Float Transition
Voltage [48.0 - 60.0 V] 55.2		Voltage [48.0 - 60.0 V] 56.4		Voltage [48.0 - 62.4 V] 57.6		Net Change (as % of Battery Capacity) 0.1 - 5.0 % 1.0
Current (as % of Max Chrg Current) [1 - 100 %] 100 156 A		Current (as % of Max Chrg Current) [1 - 100 %] 80 125 A		Current (as % of Max Chrg Current) [1 - 100 %] 60 94 A		Change Time [1 - 240 min] 30
Time [1 - 240 min] 5		Time [1 - 240 min] 10				Max Time [1 - 240 min] 120



MAX. CHARGE CURRENT is the maximum charge current that the inverter will send to the batteries under any circumstances (including all external charge currents) at any charge stage. This is expressed as a percentage of your battery capacity. For example if your battery pack is rated at 900 amp hours capacity and your battery manufacturer suggests a maximum charge current of 10% of capacity (quite common) then you would set this figure at 10% and the maximum charge current limit would be set at 90 amps.

This means that if there is 40A of solar charge current when the inverter is charging, then the inverter will only put 50A of charge into the battery.

Initial Return is the voltage level at which the charge cycle will return to the beginning, or Initial, stage of the charge process. The 10 second average battery voltage must remain at or below this level for 2 minutes to switch to Initial. This response time ensures that short term loads do not prematurely cause the charger to reset to Initial. The maximum voltage settable is the lowest float voltage (either Float or Long term Float) minus 5%.

The purpose of the INITIAL STAGE of the charging process is to raise the battery voltage quickly with a large charge current. In this section you set the voltage you wish the batteries to reach, the current you wish to charge at and the length of time the batteries will stay at that voltage until the inverter moves to the next stage of the charge cycle.

The current is expressed as a % of the maximum charge current. Using our previous example if the maximum charge current was 90amps and you wish to charge, in this stage, at ~85 amps you would insert 95 in this area. ie 95% of 90 amps = 85.5amps

Charge Settings

Max. Charge Current
(as % of of Battery Capacity)
[1 - 100 %]

10 90 A

Initial Return
[45.6 V - Float V]

50.4

Initial Stage

Voltage
[48.0 - 60.0 V]

55.2

Current
(as % of Max Chrg Current)
[1 - 100 %]

95 86 A

Time
[1 - 240 min]

5

Bulk Stage

Voltage
[48.0 - 60.0 V]

56.4

Current
(as % of Max Chrg Current)
[1 - 100 %]

90 81 A

Time
[1 - 240 min]

10

BULK STAGE is the part of the charge cycle where the majority of the charging takes place. This is normally set at a higher voltage than the initial stage but at a lower charge current. The time section determines, once the Bulk voltage is reached, how long the batteries stay at this level until the inverter starts the next stage of the charge process. Once again using our example if you wanted this stage to charge at ~80 amps you would insert 90 as the setting because 90% of 90 amps is 81 amps. The time that the charge stage would remain at this voltage would normally be longer than in the initial stage.

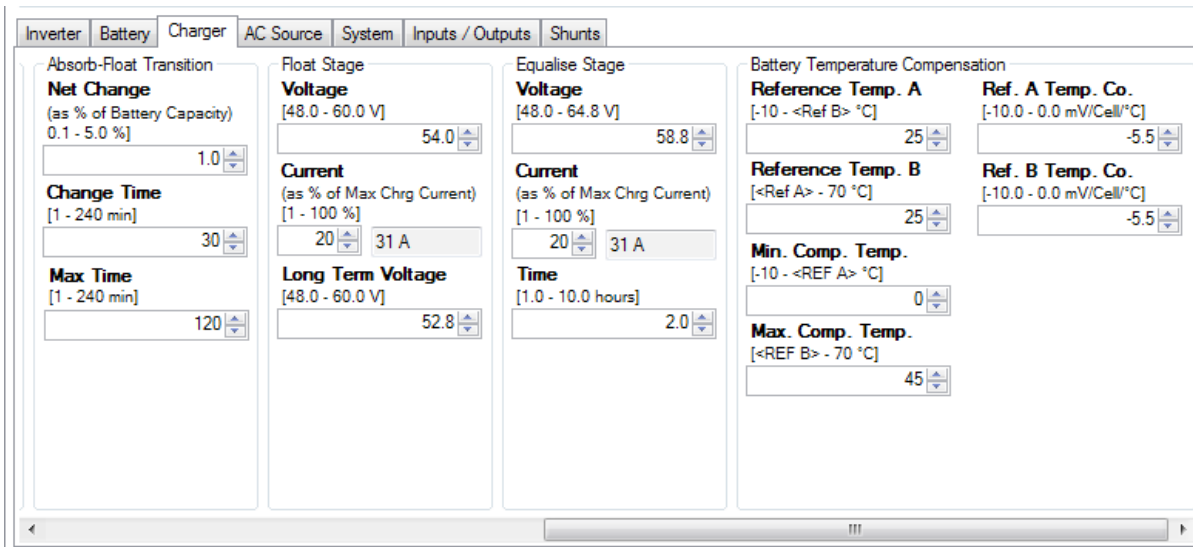
THE ABSORPTION STAGE is the part of the charge process that allows the batteries to maximise the effect of the previous charge stages. This stage is normally set to a higher Voltage than the two previous stages but a lower charge Current. The Max Time it would remain in this stage is longer again than the previous stages.

This section has a further level of control in that it will also end this stage if the charge current does not change below the figure set at Net Change for a period of time (Change Time).

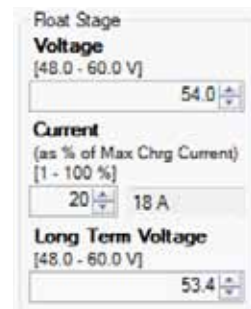
For example if you have set your absorption voltage to 57.6 volts, the current to 60% (54 amps) and the Max Time to 120 minutes, then the battery will be charged at 54A until the battery voltage reaches 57.6 volts. At this point the battery charging process will change from Absorption into Float based on the rate of change in charge current over a period of time.. If for example you have a battery bank of 900Ah, Net change is set to 1% and change time set to 30 minutes, then transition to Float will occur when net battery charge current has not changed by more than 9A in 30 minutes. If transition to Float has not occurred before Max Time expires then absorption stage will be terminated anyway as this may suggest a faulty battery cell.

<p>Absorption Stage</p> <p>Voltage [48.0 - 62.4 V]</p> <p>57.6</p> <p>Current (as % of Max Chrg Current) [1 - 100 %]</p> <p>60 54 A</p>	<p>Absorb-Float Transition</p> <p>Net Change (as % of Battery Capacity) 0.1 - 5.0 %]</p> <p>1.0</p> <p>Change Time [1 - 240 min]</p> <p>30</p> <p>Max Time [1 - 240 min]</p> <p>120</p>
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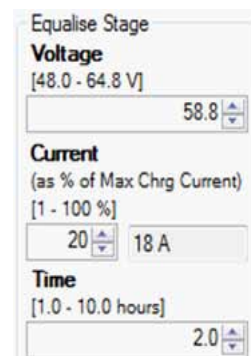
In addition to these stages of charge there are more settings you can access by moving the bottom slider bar.



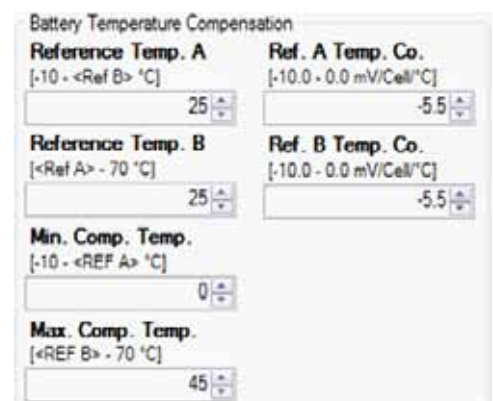
After completion of the charge cycle the inverter will enter the FLOAT STAGE. This setting reflects a voltage that the system can maintain, with a good state of charge, for a long period. If the generator continues to run passed the absorption or equalise stage for any reason, such as maintaining a high load, the inverter will keep the batteries at the float stage voltage – not exceeding the Current set – until the generator is shut off. In situations where a generator or the mains voltage will be present for long periods (ie 24 hours) the inverter will adopt the Long Term Voltage limit to maintain a good state of charge but not over stress the batteries.



THE EQUALISE STAGE is not employed every time you charge your batteries but is a periodic charge process that raises the battery voltage above the normal voltage settings to a point where the batteries will, essentially be in a state of overcharge. This is necessary to overcome any variations in voltage between individual cells that occur naturally in a battery bank that is cycled between load and charge cycles. These variations can cause a drop in performance in the pack and must be "equalised". In flooded cells this process is sometimes called "gassing", that is when the batteries sound as if they are lightly boiling. In flooded cells this bubbling helps to circulate the electrolyte fluid within the cells. The Equalise stage will raise battery voltage to the equalise voltage level and maintain this voltage for the equalise time. The the equalise current will not be exceeded.



All batteries require different charging voltages when the battery temperature is higher or lower than the battery manufacturer's specified temperature. Most manufacturers use 25°C as the point on which they base their charge voltages. As the temperature of the batteries falls below or rises above this point the batteries will need to be charged at higher or lower voltages. This is called temperature compensation. If the manufacturer of your batteries specifies different temperature compensation than those used normally by the SP PRO then those parameters can be changed in the BATTERY TEMPERATURE COMPENSATION settings.





AC Source Settings

The next tab in our settings menu is the AC Source tab. In this section we are able to change important settings relating to either your generator or the mains voltage. We use the words AC Source rather than Generator, Grid or Shore power as the SP PRO can be used in a variety of applications which may include either of those inputs.

There are four sub-tabs within this section the first we will deal with:

- AC INPUT, relates to general settings that apply if either a generator or the mains grid are used as input power.
- GENERATOR AUTO START relates to conditions that will start your generator automatically.
- GENERATOR SCHEDULE START allows you to program scheduled run times you may choose for your system.
- GENERATOR CONTROLLER SETTINGS is used to set up parameters that relate to your motor generator.

AC Input

This tab allows you to change the conditions under which the AC Input will be utilised by the SP PRO and fed through to the AC Load.

The screenshot shows the 'AC Source' settings window with the following sections:

- Primary Source:**
 - Min AC Voltage [-1 - .15 %]: -10, 216 V
 - Max AC Voltage [1 - 10 %]: 10, 264 V
 - Min AC Frequency [-1 - .10 %]: -10, 45.0 Hz
 - Max AC Frequency [1 - 10 %]: 10, 55.0 Hz
- Alternative Source:**
 - Alternate AC Source Power [0.1 - 50 kW]: 2.3 kW
 - Extern. Contactor/CT: Disabled
 - External CT [50 - 250 A]: 50 A : 5 A
- AC Input Capacity Schedule:**
 - Schedule 1: Disabled
 - Schedule 2: Disabled
 - AC Source Power 1 [0 - 100 %]: 50, 3.8 KVA
 - AC Source Power 2 [0 - 100 %]: 50, 3.8 KVA
 - Sched. 1 Day: All
 - Sched. 2 Day: All
 - Sched. 1 Start Time [00:00 - 23:59]: 00:00
 - Sched. 2 Start Time [00:00 - 23:59]: 00:00
 - Sched. 1 Stop Time [00:00 - 23:59]: 00:00
 - Sched. 2 Stop Time [00:00 - 23:59]: 00:00



THE PRIMARY SOURCE window reflects the allowable variation to the nominal AC voltage and frequency we programmed back in the beginning. In that section we used Australia as an example and used 240 volts and 50 Hz as our standard. In this window we can specify the range of voltages and frequency – both higher and lower than the nominal – that we will allow the inverter to work with. Lets assume we insert 10 (10%) into each setting in this window. In that case the input voltage could range between 216 and 264 volts and still be acceptable; while the frequency of the input could be as high as 55Hz and as low as 45Hz.

These limits are important as higher voltages may shorten the life of lights and other appliances; while low voltage and frequency may overheat or overstress motors etc. The settings should not be made too tight or they will exclude the normal variation most generators exhibit.

ALTERNATE AC SOURCE POWER sets an upper limit on how much power the inverter will try to draw from a second generator or the mains grid, limiting the stress on the generator or the mains wiring. The choice of the second generator power level is controlled from a digital input.

EXTERN. CONTACTOR/CT can be enabled when you decide to use an external AC contactor and current transformer to allow you to use a larger generator or draw more power from the grid than the standard inverter wiring will allow. The current rating of the external current transformer is entered in External CT.

THE ALTERNATE AC SOURCE also provides for a separate allowable variation to the nominal AC voltage and frequency. This allows for different limits to be programmed for say the generator feeding in normally but when connected into the marina on the Grid different limits can be used.

Primary Source

Min AC Voltage
[-1 - -15 %]
-10 216 V

Max AC Voltage
[1 - 10 %]
10 264 V

Min AC Frequency
[-1 - -10 %]
-10 45.0 Hz

Max AC Frequency
[1 - 10 %]
10 55.0 Hz

Alternative Source

Alternate AC Source Power
[0.1 - 50 kW]
2.3 kW

Extern. Contactor/CT
Disabled

External CT
[50 - 250 A]
50 A : 5 A

Min AC Voltage
[-1 - -15 %]
-10 216 V

Max AC Voltage
[1 - 10 %]
10 264 V

Min AC Frequency
[-1 - -10 %]
-10 45.0 Hz

Max AC Frequency
[1 - 10 %]
10 55.0 Hz



THE AC INPUT CAPACITY SCHEDULE is a function used in the On Grid (or SGB) configuration. Four schedules can be enabled or disabled for which the AC Input Capacity will be reduced by the percentage set. This can be used in times of high electricity prices or peak punitive tariff times to limit the draw from the grid, reducing costs, and drawing any extra required from the battery bank. Any excess solar is still exported to the full extent possible.

Care must be taken to ensure that there will be enough capacity in the battery bank to support the load during these times. If the battery bank reaches the Low SoC Shutdown or Low Battery Voltage levels, this setting will be bypassed and all power will be supplied from the grid until such time that the battery is able to be recharged.

AC Input Capacity Schedule
Schedule 1

Disabled

AC Source Power 1
[0 - 100 %]
50 3.0 kW

Sched. 1 Day
All

Sched. 1 Start Time
[00:00 - 23:59]
00:00

Sched. 1 Stop Time
[00:00 - 23:59]
00:00

THE AC INPUT CHARGER LOCKOUT SCHEDULE is a function used in the On Grid (or SGB) configuration. Four schedules can be enabled or disabled for which grid charging of the battery bank will be disabled. This can be used to only allow grid charging of the battery bank during times of low electricity prices or off peak tariff times. This has no effect on the renewable input charging or exporting the excess to the grid.

Sufficient time must be allowed in the schedules to be certain that the battery bank can be recharged appropriately in the time given.

AC Input Charger Lockout Schedule
Schedule 1

Disabled

Sched. 1 Day
All

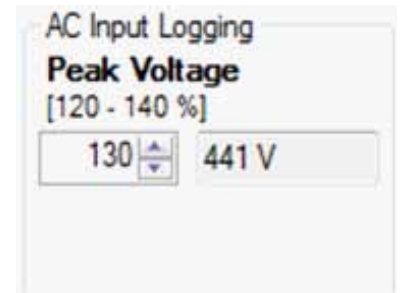
Sched. 1 Start Time
[00:00 - 23:59]
00:00

Sched. 1 Stop Time
[00:00 - 23:59]
00:00



The AC IN LOGGING is a Quality of Service function which sets the threshold at which the inverter will log peak voltage events.

If you have particularly sensitive loads such as computers and plasma TVs, you may choose to set this to a low value to monitor power quality and record any unexpected high voltages coming from external supply sources.



The AC INPUT LOCKOUT is a function used in the On Grid (or SGB) configuration. It can be enabled or disabled to allow a period when the mains grid voltage will be prevented from connecting to the inverter. THE START TIME denotes when the lockout period will begin and END TIME when it will finish.

During this period you will be powering your installation from energy stored in your battery. In variable tariff areas this may relate to the most expensive tariff period of the day. This setting overrides any other start command that may be programmed into the inverter – unless there is significant possibility of damage to the batteries. If the battery voltage falls too low this setting may be ignored.

This setting differs from the AC INPUT CAPACITY SCHEDULE in the fact that the inverter has disconnected from the Grid. This means that all loads are powered from the grid, not just the extra that keeps your input under a limit and no export is possible.

Unless disconnection from the grid is desirable, it is recommended that the AC INPUT CAPACITY SCHEDULE is used in place of AC INPUT LOCKOUT.





Generator Auto Start

The next tab enables you to change the conditions under which the generator will start to improve the state of charge in the batteries or run at scheduled times.

GENERATOR LOCK OUT OVERRIDE During the generator lockout period there is still a point that, below which, your SP PRO will start the generator to prevent battery damage. There are two “failsafe” settings.

One is controlled by battery voltage. With this system the generator will be called on to charge the batteries when your battery voltage falls to a low limit as set by the 0% battery load voltage and the 100% battery load voltage (see section under Inverter Settings). The generator will run for the Minimum Run Time.

When the ON LOW SoC is enabled and the state of charge falls below Start SoC at any time during the lockout period the generator will start and run for the minimum run time or until the SoC reaches Stop SoC.

The ON SoC NORMAL setting applies at times other than when other SoC Start Stop functions are active including during Generator Lock Out times. If SoC falls below Start SoC% the generator will be started and will charge until Stop SoC% or for Generator Min Runtime if Stop SoC% is reached before the minimum runtime has elapsed.



The ON SoC NIGHT ASSIST state of charge control registers your State of charge at the beginning of your highest usage period, usually during the evening. If the battery level has dropped to the Start SoC level at the appointed time your SP PRO will start your generator and raise the state of charge until the batteries reach the Stop SoC level. This prepares your system for the night ahead.

On SoC Night Assist

Night Assist Disabled	Start SoC [1 - 100 %] 80
Start Time [00:00 - 23:59] 18:00	Stop SoC [1 - 100 %] 90
Stop Time [00:00 - 23:59] 18:30	

By moving the bottom slider to the right you can access more settings in this field.

ON SoC RENEWABLE PREFERRED is designed to monitor the input from your solar array and, on a day when your renewable sources may be low in output, on a cloudy day or a day with no wind, start the generator at a lower state of charge to ensure your batteries do not get too low. This setting allows you to set a Start SoC percentage and a Stop SoC percentage that will keep your batteries in a "safe" state of charge.

On SoC Renewable Preferred

Renewable Preferred: [Enabled, Disabled] Enabled	Start SoC: [1 - 100 %] 40
Start Time: [00:00 - 23:59] 08:00	Stop SoC: [1 - 100 %] 50
Stop Time: [00:00 - 23:59] 14:00	

If your solar input does not meet your usual consumption level you can start the day with a compensating charge that will enable your normal solar input to fully charge the batteries.

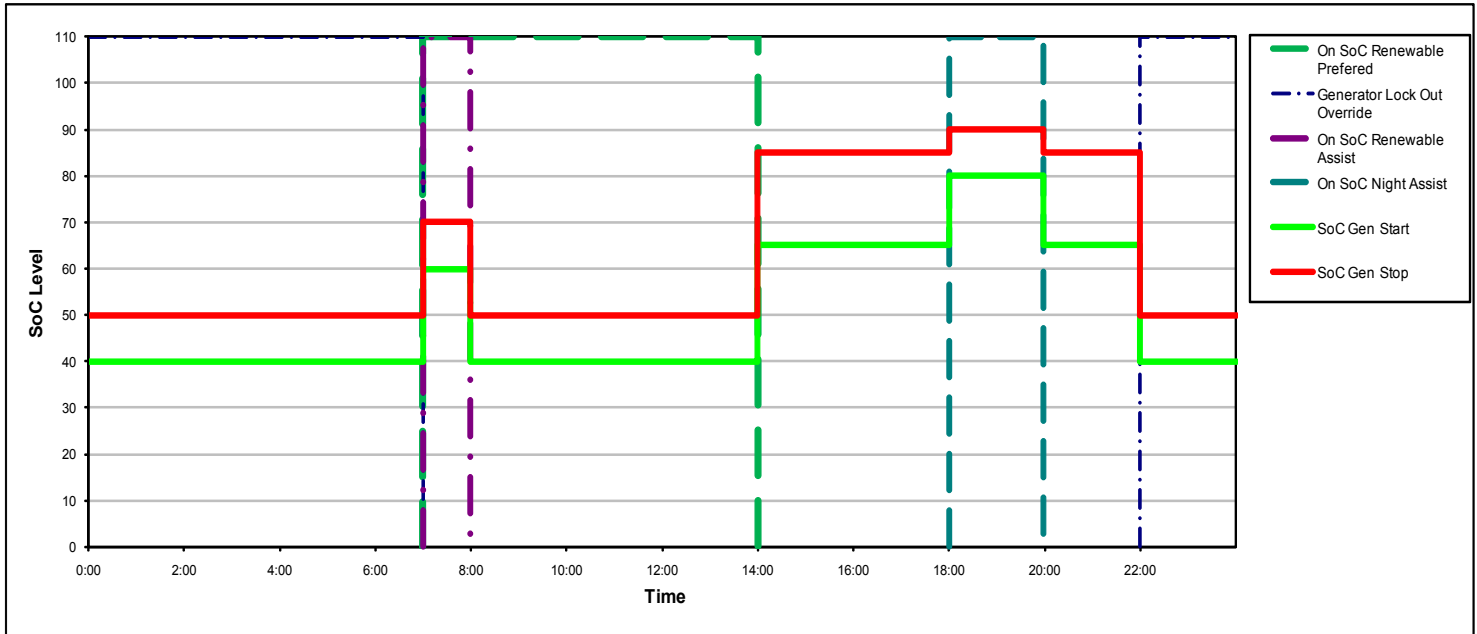
The necessity for this charge can be worked out in conjunction with your Selectronic Accredited Installer.

On SoC Renewable Assist

Renewable Assist: [Enabled, Disabled] Enabled	Start SoC: [1 - 100 %] 60
Start Time: [00:00 - 23:59] 06:30	Stop SoC: [1 - 100 %] 70
Stop Time: [00:00 - 23:59] 08:00	



The combination of all these settings should give you a battery protection program that should look something like this.....



When you get up in the morning, before your solar panels are working at their best, the generator runs for an hour or so while you are cooking, or heating the bathroom for the kids, and starts the day with a support charge (see SoC Renewable Assist).

Then it shuts down during the day when you expect that the solar panels will be carrying the load; then it may start again later that night when your night load is at its highest or if there has been a cloudy day and there hasn't been as much solar input as you would have expected.

Throughout the whole day there is always the lower "safety net" level that will not allow your batteries to get totally flat. Your Selectronic Accredited Installer can help you arrive at the most fuel efficient program to suit your particular needs.

The above system of Generator Auto Start SoC Start and Stop levels prevents the generator from charging the battery bank during the batteries least energy efficient stage; the highest voltage with the least amount of absorbed amp hours. This reduces the amount of time your generator will run for, saving fuel.

This type of system is called Partial SoC control. A battery system will perform well in partial SoC conditions however it is desirable to periodically fully charge a battery bank and bring the SoC to 100% by allowing the charger to complete through to Float stage.

If FOR 100% SoC is enabled it will continue the normal charge process right through to Float stage as often as you require. In this example it occurs every 7 days.

For 100% SoC
Override Stop SoC

Occurs Every
 [1 - 100d]



The generator will also start if there is a persistent load on the batteries. Battery Load sets the level at which the generator will be started if the average load exceeds the preset level for more than 5 minutes.

Battery Load is the actual current being drawn from the battery bank. For example, if say solar is providing all the power to the site load, then no current will be coming from the battery bank i.e. Battery Load is 0kW and the generator won't be started.

On 15min Load is similar to the previous screen except the settings take effect if the average load exceeds the preset limit for more than 15 minutes.

We previously discussed mid point monitoring and its ability to help determine a battery fault. This screen allows you to choose if a mid point Voltage Error should start the generator.

On 5min Load
5 Min Load
Disabled
Battery Load
[0.2 - 15.0kW]
4.0

On 15min Load
15 Min Load
Disabled
Battery Load
[0.2 - 15.0kW]
3.0

On Mid Point
Voltage Error:
[Enabled, Disabled]
Enabled



Generator Schedule Start

Some people have predictable times when they require a generator to run, such as when a regular plant watering routine requires pumps to run, the program contains the ability to pre-determine four different schedules.

Run Schedule	Schedule 2	Schedule 3	Schedule 4	Inverter Unavailable Schemu
Schedule 1 Disabled	Schedule 2 Disabled	Schedule 3 Disabled	Schedule 4 Disabled	Schedule 1 Disabled
Sched. 1 Day All	Sched. 2 Day All	Sched. 3 Day All	Sched. 4 Day All	Sched. 1 Day All
Sched. 1 Start Time [00:00 - 23:59] 00:00	Sched. 2 Start Time [00:00 - 23:59] 00:00	Sched. 3 Start Time [00:00 - 23:59] 00:00	Sched. 4 Start Time [00:00 - 23:59] 00:00	Sched. 1 Start Time [00:00 - 23:59] 00:00
Sched. 1 Stop Time [00:00 - 23:59] 00:00 Enabled	Sched. 2 Stop Time [00:00 - 23:59] 00:00 Enabled	Sched. 3 Stop Time [00:00 - 23:59] 00:00 Enabled	Sched. 4 Stop Time [00:00 - 23:59] 00:00 Enabled	Sched. 1 Stop Time [00:00 - 23:59] 00:00

Each of the four Schedules can be enabled or disabled.

Run Schedule

Schedule 1:
[Enabled, Disabled]
Enabled

Sched. 1 Day:
[Mon-Sun, M-F, S-S, All]
All

Sched. 1 Start Time:
[00:00 - 23:59]
00:00

Sched. 1 Stop Time:
[00:00 - 23:59]
00:00 Enabled

Through Schedule x Day you can choose a day of the week, all weekdays, all weekends or everyday (All).

Schedule 2:
[Enabled, Disabled]
Disabled

Sched. 2 Day:
[Mon-Sun, M-F, S-S, All]
All

Sched. 2 Start Time:
[00:00 - 23:59]
00:00

Sched. 2 Stop Time:
[00:00 - 23:59]
Enabled



A Schedule x Start Time

Schedule 3:
[Enabled, Disabled]
Disabled

Sched. 3 Day:
[Mon-Sun, M-F, S-S, All]
All

Sched. 3 Start Time:
[00:00 - 23:59]
00:00

Sched. 3 Stop Time:
[00:00 - 23:59]
00:00 Enabled

And a Schedule x Stop Time

The Schedule x Stop Time can be enabled or disabled. If the stop time is enabled your SP PRO will automatically turn off the generator at the end of the scheduled time or, if disabled, the generator will continue to run if a full charge cycle has not been completed or until all other generator turn off criteria have been met.

Schedule 4:
[Enabled, Disabled]
Disabled

Sched. 4 Day:
[Mon-Sun, M-F, S-S, All]
All

Sched. 4 Start Time:
[00:00 - 23:59]
00:00

Sched. 4 Stop Time:
[00:00 - 23:59]
00:00 Enabled

As an example, lets imagine you run a yoga class every Saturday morning and you wish to run a reverse cycle air conditioner for the period of the lesson. You may choose to run your generator during this period to prevent stress on your batteries. In this case your schedule would look like this.

[Run Schedule](#)

Schedule 1:
[Enabled, Disabled]
Enabled

Sched. 1 Day:
[Mon-Sun, M-F, S-S, All]
Saturday

Sched. 1 Start Time:
[00:00 - 23:59]
09:00

Sched. 1 Stop Time:
[00:00 - 23:59]
12:00 Enabled



By moving the slider to the right we find a **INVERTER UNAVAILABLE SCHEDULE** table. In the unlikely event that the SP PRO enters a shutdown condition whereby the inverter is unable to operate, the backup schedule can take effect in addition to the existing Run Schedule.

Inverter Unavailable Schedule			
Schedule 1	Schedule 2	Schedule 3	Schedule 4
Disabled	Disabled	Disabled	Disabled
Sched. 1 Day	Sched. 2 Day	Sched. 3 Day	Sched. 4 Day
All	All	All	All
Sched. 1 Start Time [00:00 - 23:59]	Sched. 2 Start Time [00:00 - 23:59]	Sched. 3 Start Time [00:00 - 23:59]	Sched. 4 Start Time [00:00 - 23:59]
00:00	00:00	00:00	00:00
Sched. 1 Stop Time [00:00 - 23:59]	Sched. 2 Stop Time [00:00 - 23:59]	Sched. 3 Stop Time [00:00 - 23:59]	Sched. 4 Stop Time [00:00 - 23:59]
00:00	00:00	00:00	00:00

A typical example would be to run a freezer four times a day, for two hours – every day, say with the first as an example from 6am to 8am.

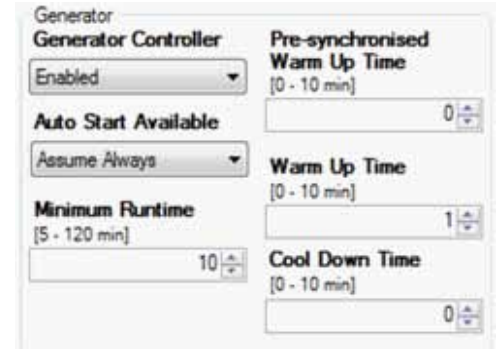
Inverter Unavailable Schedule
Schedule 1
Enabled
Sched. 1 Day
All
Sched. 1 Start Time [00:00 - 23:59]
06:00
Sched. 1 Stop Time [00:00 - 23:59]
08:00

Generator Control Settings

The last tab in the AC Source section is the Generator Controller Settings



If there is an automatic generator permanently connected to the system the generator Control Setting should be set to Enabled. If there is no automatic generator connected it should be disabled. The Generator Available control allows 2 states. Follow Input allows you to switch the generator availability on and off with an input signal (normally 12 volts from the generator) Assume Always allows the inverter to operate as if the generator is always available. Minimum Runtime determines the shortest time the generator will run. This is to ensure the generator wont start and stop too frequently.

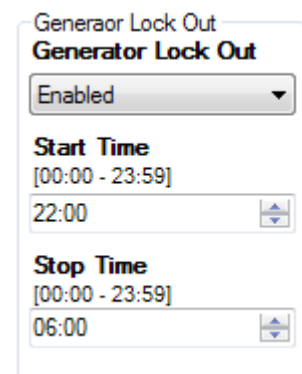


The PRE-SYNCHRONISED WARM UP TIME is the length of time, after the generator starts, before the generator is connected to any load.

This is then followed by the WARM UP TIME, the length of time, after the PRE-SYNCHRONISED WARM UP TIME, before a charging sequence starts. Once synchronised, the AC Load is transferred to the generator during the WARM UP TIME. The staged warm up sequence allows the generator to circulate the oil within the motor thoroughly and to allow the motor to reach operating temperature before being loaded then heavily loaded by the charger.

COOL DOWN TIME disconnects the load from a generator for a period of time before shutdown to allow turbochargers to cool down before switching off. The COOL DOWN is overridden if generator is stopped using front panel push button.

GENERATOR LOCK OUT provides a “quiet time” when the generator will not run unless the batteries get to a dangerously low level. This setting is generally used for overnight operation.





If your system design calls for very little, or infrequent generator input it is wise to run the generator sometimes to keep the internal parts of the motor covered with oil and to keep the starting battery charged.

In this screen you can choose whether to have the Exercise feature enabled or disabled, what Start Time you choose and Max Days determines how many days between generator starts. In this example the generator would start 30 days after the last time the generator was called for, would start at 18:00 and would run for the period set in Minimum Runtime.

Generator Exercise

Generator Exercise

Enabled

Start Time
[00:00 - 23:59]
18:00

Max Days
[1 - 100d]
30

This feature allows you to determine what size load will keep your generator running rather than shutting down after a stop limit has been achieved, thus avoiding significant battery discharge. This term is expressed as a percentage of your inverter size. In this example the inverter is a 6kW inverter so 80% of that would mean that if the load on the system exceeded 4.8 kW the generator would continue to run.

Generator Remain on

AC load (50 - 100%) of SP PRO rating
[50 - 100%]
80

The START OUTPUT DELAY setting determines the length of time after the generator run signal is initiated by the inverter, either by an external request, load requirement or by a battery charge requirement, before the generator start pulse is initiated.

START OUTPUT TIME is the length of time a start pulse is sent. This output can be used in a pulse start/pulse stop type generator control.

CONFIRM START TIME is the time the SP PRO waits before deciding the generator hasn't started. The SP PRO will try a total of three times to get the generator running with a 60 second pause between each attempt.

Signal Timing

Start Output Delay
[0.5 - 30.0 s]
2.0

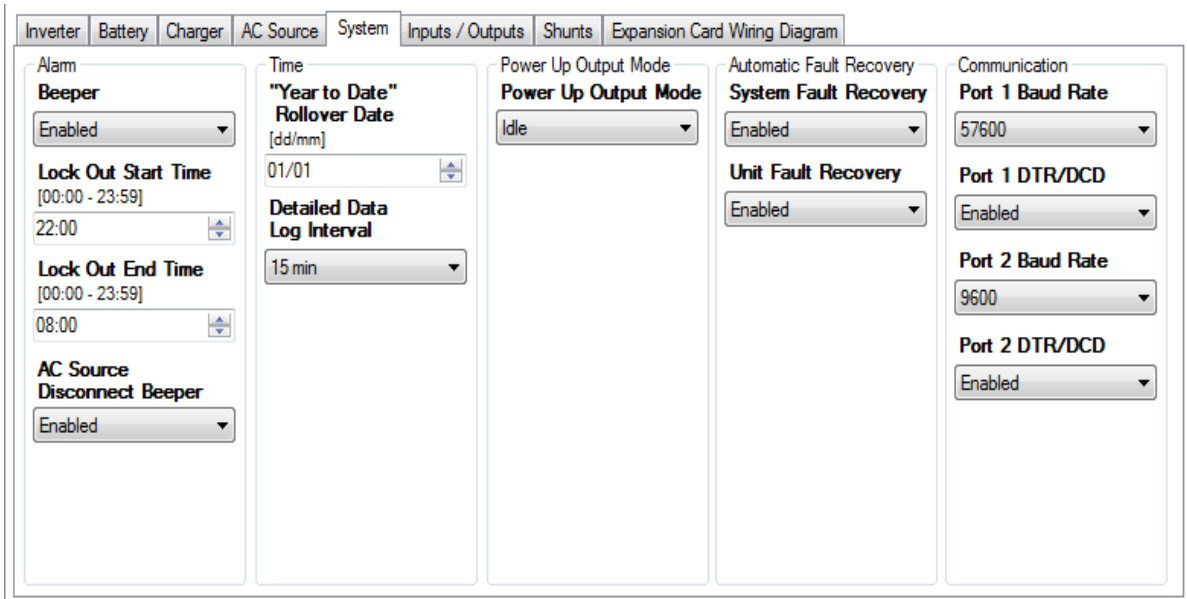
Start Output Time
[0.5 - 30.0 s]
2.0

Confirm Start Time
[15 - 120 s]
30

System Settings

Back to the main tabs and we now look at some system requirements.

In this section we will look at how the inverter works with the whole system. Whether the inverter will automatically recover from system faults, how it will alert you of problems and how it communicates with your computer and modem.



The screenshot shows the 'System' tab in a web interface. It contains several panels with the following settings:

- Alarm:**
 - Beeper: Enabled
 - Lock Out Start Time: 22:00
 - Lock Out End Time: 08:00
 - AC Source Disconnect Beeper: Enabled
- Time:**
 - "Year to Date" Rollover Date: 01/01
 - Detailed Data Log Interval: 15 min
- Power Up Output Mode:** Idle
- Automatic Fault Recovery:**
 - System Fault Recovery: Enabled
 - Unit Fault Recovery: Enabled
- Communication:**
 - Port 1 Baud Rate: 57600
 - Port 1 DTR/DCD: Enabled
 - Port 2 Baud Rate: 9600
 - Port 2 DTR/DCD: Enabled

Your inverter is programmed to recognise, and report, a number of events that can cause damage to your inverter or your system, such as overloads, low voltage batteries etc. These events can be announced by a beeper within the inverter.

The first option in this section, Beeper, gives you the choice of turning the beeper on, off or only on during a specific period. In this way you may ensure the beeper does not annoy the household during the lockout period. You may set a LOCKOUT START TIME and a LOCKOUT END TIME.

The AC SOURCE DISCONNECT BEEPER provides an alert signal, once per minute, if the SP PRO is not synchronised to the AC Source. This is enabled by default when On grid is selected and is used to indicate that the system is running on battery supply during grid outages.

The Year to Date feature of the unit is used to monitor the inverters performance on an annual basis. You can choose the start date of that year with "YEAR TO DATE" ROLLOVER DATE. This could be the day you installed it, the first day of the year or another date that is relevant to your installation.

Through DETAILED DATA LOG INTERVAL you can choose how often an entry is made. A short interval of 1 minute will give more detailed information, but for only four days. A long interval of 30 minutes will give less detail but 120 days of records. A 15 minute setting records for 60 days and gives a good balance between detail and the number of days recorded.



Close-up of the Alarm section settings:

- Beeper: Locked Out
- Lock Out Start Time: 22:00
- Lock Out End Time: 08:00
- AC Source Disconnect Beeper: Disabled



Close-up of the Time section settings:

- "Year to Date" Rollover Date: 01/01
- Detailed Data Log Interval: 15 min



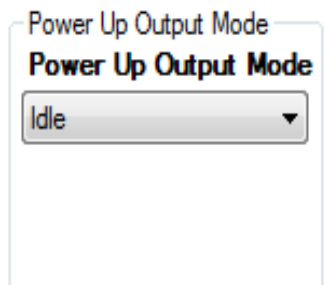
The Output Mode front panel button is used to choose whether the inverter is

- Idle - Inverter is monitoring but providing no output,
- ON - Inverter output is operating normally, or
- Econo - Operating normally plus sensing load conditions.

By default, when the battery supply is connected, the inverter will power up in Idle mode.

With the POWER UP OUTPUT MODE setting, this can be changed to power up and come On, or power up in Econo mode, without having to press the Output Mode button.

The Output Mode button operation is unaffected by this setting.

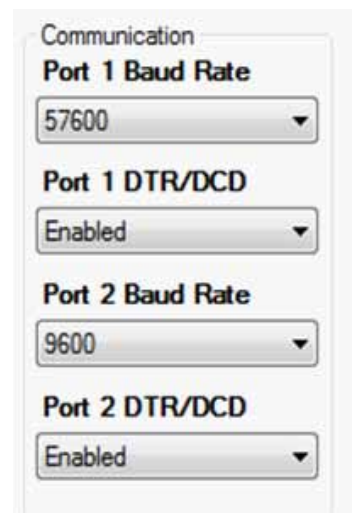


Your inverter has the ability to automatically attempt to recover from a fault situation. If SYSTEM FAULT RECOVERY is enabled the inverter will monitor the situation that created the fault, such as low battery voltage, and return the inverter to operation if the battery voltage returns to a suitable level. Similarly if Unit Fault Recovery is enabled an internal problem within the inverter, such as overheating, is monitored and normal operation continued if the problem is resolved.



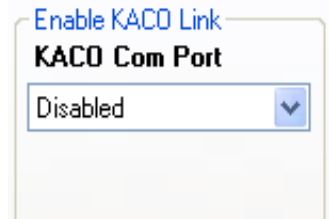
Your inverter is designed to communicate with an external computer, either directly connected or via a modem to a distant location. There are two ports for this data transfer. When connecting through a modem DTR/DCD control signals allow the modem to signal the inverter that a modem connection has been established and when that connection has been dropped.

These control signals can be enabled through Port 1 DTR/DCD and Port 2 DTR/DCD while the speed of the data flow can be set with Port 1 Baud Rate and Port 2 Baud Rate. If you are not sure to what speed your modem should be set you should seek the advice of the supplier of the device however, most devices will operate at your SP PRO's default setting of 9600 bps. When connecting directly with a computer through data cables the rate would normally be set at 57600 bps.

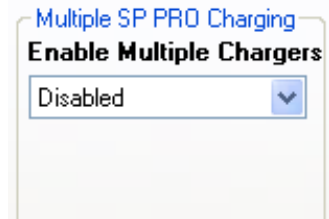




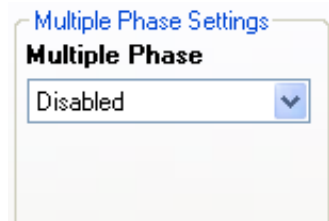
KACO Link allows the SP PRO to communicate with your KACO Powador 02 series grid feed inverter. Set which SP PRO Communications Port the Powador is connected to. When a port is set to KACO Link mode, the port will no longer be available for SP LINK communications.



Systems with more than just one SP PRO, have to be set to accommodate multiple SP PRO charging sources. For each SP PRO connected into the same battery bank, Enable Multiple Chargers.



The SP PRO can operate in a Multiple Phase configuration. Each SP PRO in these configurations must be set to either be the Primary controller and L1 or Secondary devices L2 or L3.



Multiple Phase configurations required the use of a separate SP SYNC device, consult instructions with the SP SYNC device for specific configuration requirements.



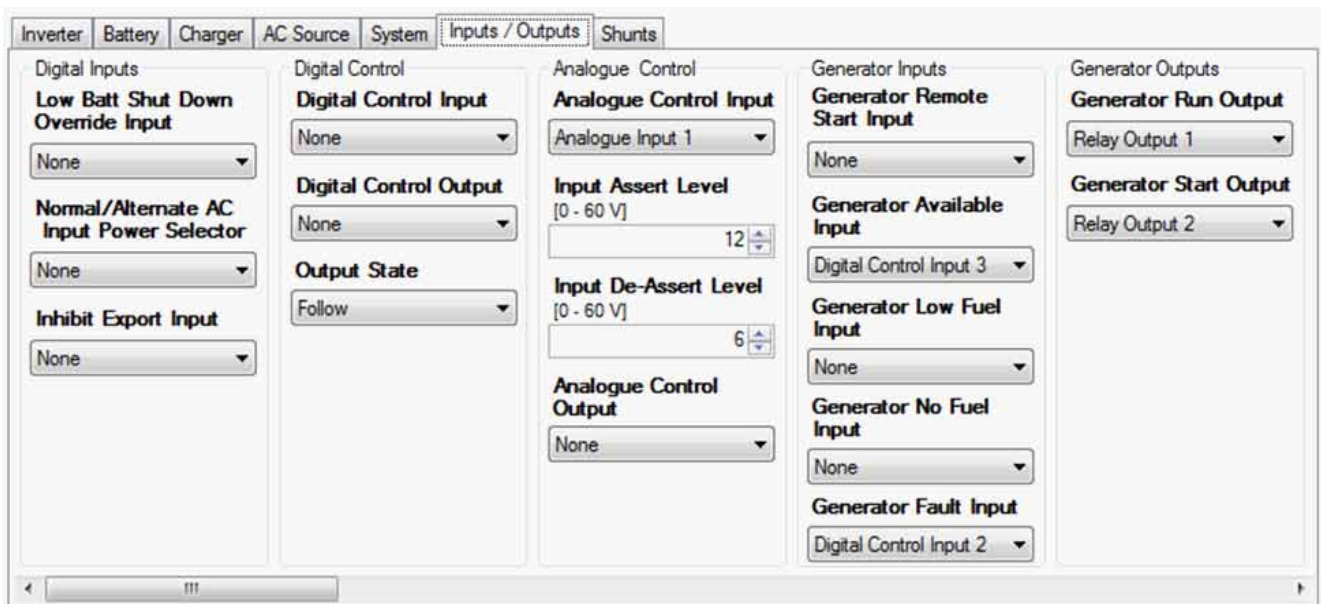
Input and Output Settings

The next main tab is Inputs / Outputs.

Your inverter contains 4 digital inputs, 4 relay outputs, 2 analogue inputs (excluding 120 V models) and 3 digital outputs, and these form the heart of the flexibility and sophistication of your inverters interface with the outside world. See Appendix A for input and output specifications.

With these controls you can monitor when various set points are reached, switch on appliances when certain criteria are met, protect your generator from damage due to low oil pressure, schedule a watering system to switch on and off and many other functions.

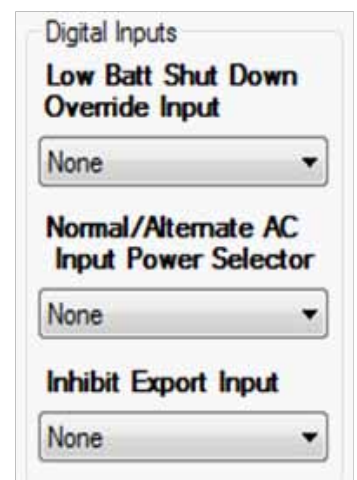
We will give you a few examples of how to use these functions later in the manual, however your individual needs will vary and, if necessary, your local Selectronic Accredited Installer will be able to assist you with advanced system design.



The LOW BATT SHUTDOWN OVERRIDE INPUT function is known here at Selectronic as the “Just Go” control. In case of emergency, even if the batteries would normally be considered too flat to safely run the inverter, activating this input will force the inverter to run, until there is insufficient battery power left to maintain the load. This is considered essential if, say, phones or a fire pump MUST be operated.

When a second AC Source with a different capacity to the primary AC Source, is available to the system, use the NORMAL/ALTERNATE AC INPUT POWER SELECTOR setting to set the input that you wish to use to select the secondary power level. The secondary source power level is selected in Alternative AC Source Power back in the AC Source section. When Alternate is selected, AC Input Charger and Capacity plus Inverter Lockout Schedules no longer apply.

In some circumstances you may wish to prevent the SP PRO from exporting excess energy to the grid such as when the grid has failed and you have connected a diesel generator into the system. Using INHIBIT EXPORT INPUT in conjunction with the Normal/Alternate AC Input you can switch to a different power level and know that the SP PRO will not try to export power to your generator.



The Digital Control section is used to switch an output on or off with a digital input. Eg. In this case if a positive input, from a level switch in a water tank, was received by DIGITAL INPUT 2 RELAY OUTPUT 4 would be activated to switch on a water pump. This output can be reversed in the Output State section. In the given example a positive input from an upper float switch could switch off a water pump.

In short you can control many different types of appliances or warning devices from digital inputs. The switching of a digital input is recorded as events on the event log and can be monitored by downloading data.

Your SP PRO has two analogue inputs that can control the full range of output options. An analogue input differs from a digital input in that instead of reacting to an on/off type signal as a digital input does, an analogue input reacts to a pre-programmed upper and lower voltage level.

As an example if a suitable moisture sensor was connected to Analog Input 1 the output from Relay Output 3 could be used to switch a watering system on and off depending on the moisture content of the soil.

Your Selectronic Accredited Installer can help you with specific applications that you may require.

Sometimes it is convenient to be able to remotely start your generator when you are away from the power area. With this function you can program one of your digital inputs to perform this function. See Appendix B for a typical wiring example.

Your digital inputs can be used to protect your motor generator. One or more of the digital inputs can be programmed to activate actions, warnings and shut down protection. In the Available control you can determine whether your generator is available for automatic control. This is particularly useful to prevent the generator from starting during maintenance.

The LOW FUEL input will initiate an alarm when a suitably positioned sensor provides a warning that the fuel level within the fuel tank is low. The NO FUEL input will either stop the generator or prevent your SP PRO from attempting to start the generator when there is no fuel.

The FAULT input can detect signals from your generator control system to either stop the generator or prevent your SP PRO from attempting to start the generator when a fault is present in the generator.

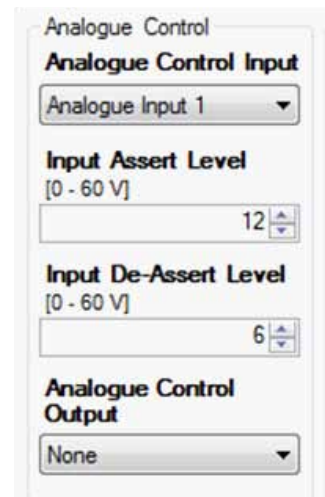


Digital Control

Digital Control Input
None

Digital Control Output
None

Output State
Follow



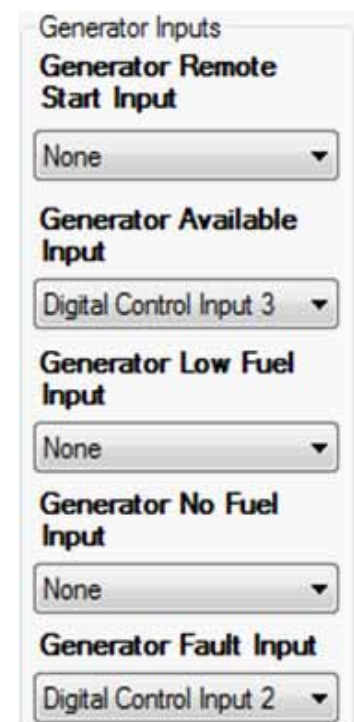
Analogue Control

Analogue Control Input
Analogue Input 1

Input Assert Level
[0 - 60 V]
12

Input De-Assert Level
[0 - 60 V]
6

Analogue Control Output
None



Generator Inputs

Generator Remote Start Input
None

Generator Available Input
Digital Control Input 3

Generator Low Fuel Input
None

Generator No Fuel Input
None

Generator Fault Input
Digital Control Input 2



In Generator Outputs you can program the Run and Start outputs to suit the starting requirements of your motor generator. The Run output will provide a start and stop signal for a 2-wire generator controller. The Start output provides a “Crank” signal for 3-wire generator controllers. See Signal Timing under the Generator Controller settings.

Generator Outputs

Generator Run Output
Relay Output 1 ▼

Generator Start Output
Relay Output 2 ▼

Your SP PRO can recognise and alert you to many potential situations that may prejudice the smooth operation of your power system.

You can program one of the outputs in your inverter to activate an external alarm, visual or audible, to alert you there may be a problem.

Alarm Output

Alarm Output
Relay Output 4 ▼

Alarm Type
Alert + Shutdown ▼

The OUTPUT field allows you to choose which output will be activated while the ALARM TYPE field lets you choose if you will be advised of Alerts (warnings of potential problems), Shutdowns (events that have caused the inverter to shut down) or both.

Your SP PRO can help you to manage your system by advising you when certain output levels have been exceeded.

For the purposes of demonstration let's assume your system has been designed to provide 10 kilowatt hours a day and you consider any load exceeding 5 kilowatts is considered excessive.

In the example given AC LOAD ENERGY OUTPUT has been set to Digital Control Output 1 and this output will be activated when your daily usage reaches 9 kilowatt hours, as programmed into ENERGY ASSERT LEVEL.

AC Load Outputs

AC Load Energy Output
Digital Control Output 1 ▼

Energy Assert Level
[1 - 1000 kWh]
9 ▲▼

AC Load Power Output
Digital Control Output 2 ▼

Power Assert Level
[0.1 - 15.0 kW]
4.5 ▲▼

Set at this level your inverter will advise you when you are approaching the design limit of your system and allow you to choose if you wish to modify your power consumption for the remainder of the day. Similarly AC LOAD POWER OUTPUT has been allocated to Digital Control Output 2 and this output will be activated if the AC load on your system reaches the POWER ASSERT LEVEL of 4.5 kilowatts

External Regulator Bypass Output can be used to control a relay that will bypass your solar or wind generator regulator to allow the full renewable output to be forwarded to the battery or exported to the grid.

The External Regulator Control Output provides a PWM signal to drive an external solar regulator

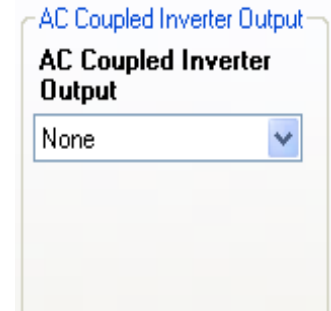
Extern. Regulator Outputs

External Regulator Bypass Output
None ▼

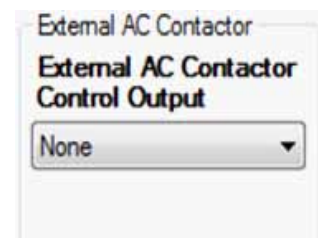
External Regulator Control Output
Digital Control Output 1 ▼



The AC Coupled Inverter Output drives an external solid state relay to controls when the AC Coupled inverter feeds to the grid, local AC Load and battery bank.

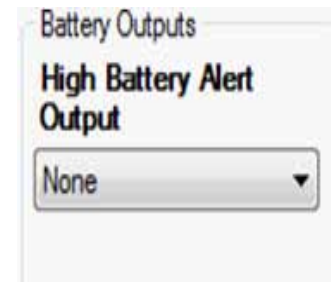


If you are using an external contactor this output provides a control signal for actuating the contactor coil.



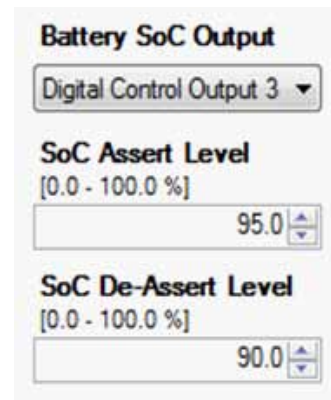
The next section within Inputs/Outputs covers output activation relating to the condition of the battery.

HI BATTERY ALERT initiates the chosen output when the battery voltage reaches the point set at Hi Battery Alert in the Limits section in the Battery Settings Limits section.

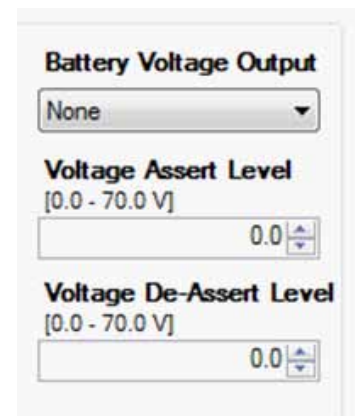


BATTERY SOC OUTPUT initiates the chosen output when the SoC Assert Level reaches the programmed level then switches off the output when the SoC De-Assert Level is reached.

An example of this would be if you wanted to provide a “Computer games allowed” light for the kids. The light could be switched on when the state of charge reached, say, 95% and switched off when a lower level was reached.



This setting is similar to the prior setting but is based on battery voltage instead of state of charge.





BATTERY CHARGER INPUTS are used in a variety of ways to help integrate the SP PRO charger with other renewable chargers. All work in a similar way but just move the charger to a different charging mode.

Care must be taken when using these inputs as improper use can prevent the charger working correctly. Consult your Selectronic Authorised Installer for assistance.

The most commonly used would be the Float Stage Input.

FLOAT STAGE INPUT. Using the drop down menus you can choose which Digital Input you wish to use to control a function. Making this input high or active (> 6 VDC) will force the inverter charge controller into the “Float” stage of the charging process.

FLOAT STAGE EDGE Consult your regulator manufacturer to determine the output signal your chosen regulator provides.

Battery Charger Outputs also help with integration of external chargers but also be used to turn on or off various loads depending on what charge stage the charger is in. All outputs work in a the same way, when the charger is in that charging phase, the corresponding output will turn on and subsequently turn off when no longer in that charging phase.

For example, you may wish to only turn on any pumping equipment when the charging process is nearing completion and whilst the charger remains in Float. By selecting the same output “Digital Control Output 3” for both Absorb Stage and Float Stage and the output will remain on during both of those charging stages.

Battery Charger Inputs

Initial Stage Input	Initial Stage Edge
None	Rising
Bulk Stage Input	Bulk Stage Edge
None	Rising
Absorb Stage Input	Absorb Stage Edge
None	Rising
Float Stage Input	Float Stage Edge
Digital Control Input 1	Rising
Equalise Stage Input	Equalise Stage Edge
None	Rising

Battery Charger Outputs

Initial Stage Output
None
Bulk Stage Output
None
Absorb Stage Output
Digital Control Output 3
Float Stage Output
Digital Control Output 3
Equalise Stage Output
None

A timed schedule similar to the generator run schedule is also provided for a digital output. This facility allows you to control the regular operation of appliances around your home. A typical example would be to turn on a watering system every night for a fixed period.

The final section controls the On Grid function allowing for a Backup Generator to be automatically controlled during times of Grid failure.

These settings must be used in conjunction with an optional external controller supplied by Selectronic. Full details of correct settings will be supplied with the optional controller.

Current Shunt Settings

The Current Shunts tab contains fields required to configure the current shunts that measure other DC currents current coming into and going out of your system. The readings obtained from these shunts are essential to accurately calculate the state of charge of your batteries. These shunts can be configured to read inputs, such as Solar or wind generator input or DC loads such as a low voltage pump or lighting.

A shunt is NOT required to measure the inverter current. This is measured internally.

All shunts are calibrated for the maximum current they will carry and the number of millivolts that can be measured across them at that maximum current. If you are unsure of these figures please seek the advice of the supplier of the equipment.

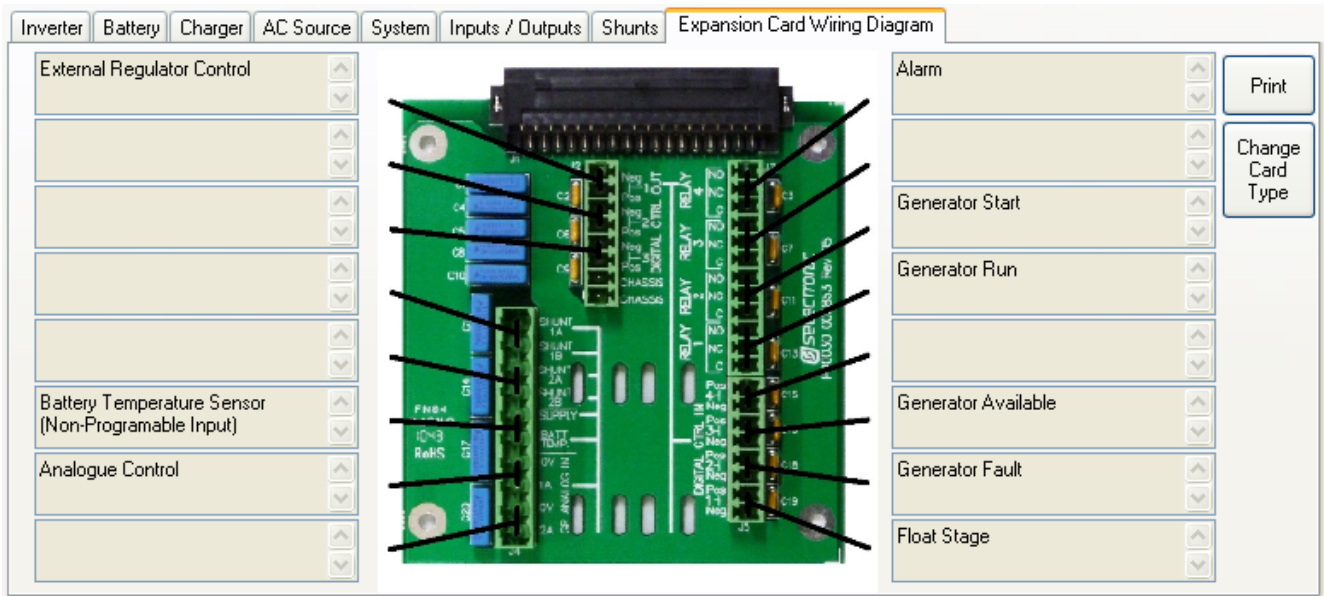


Configuration Expansion Card Wiring Diagram

The Expansion Card Wiring Diagram shows how you have allocated the input and output functions. It can be used as a guide to placement of control wiring. This diagram is a display of the Configuration Settings on the PC, not the actual settings in the inverter.

This guide can be printed for reference during installation and will also include the Site Information.

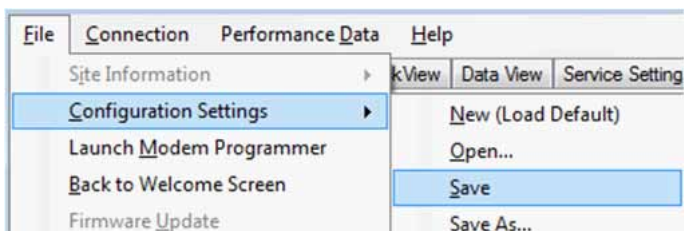
Expansion card picture may vary depending on SP PRO model. Click Change Card Type to change display to suit your model.



Default configuration shown.

Save and Configure SP PRO Settings

Your new settings may now be saved to file or uploaded to the inverter using the Configure SP PRO button.



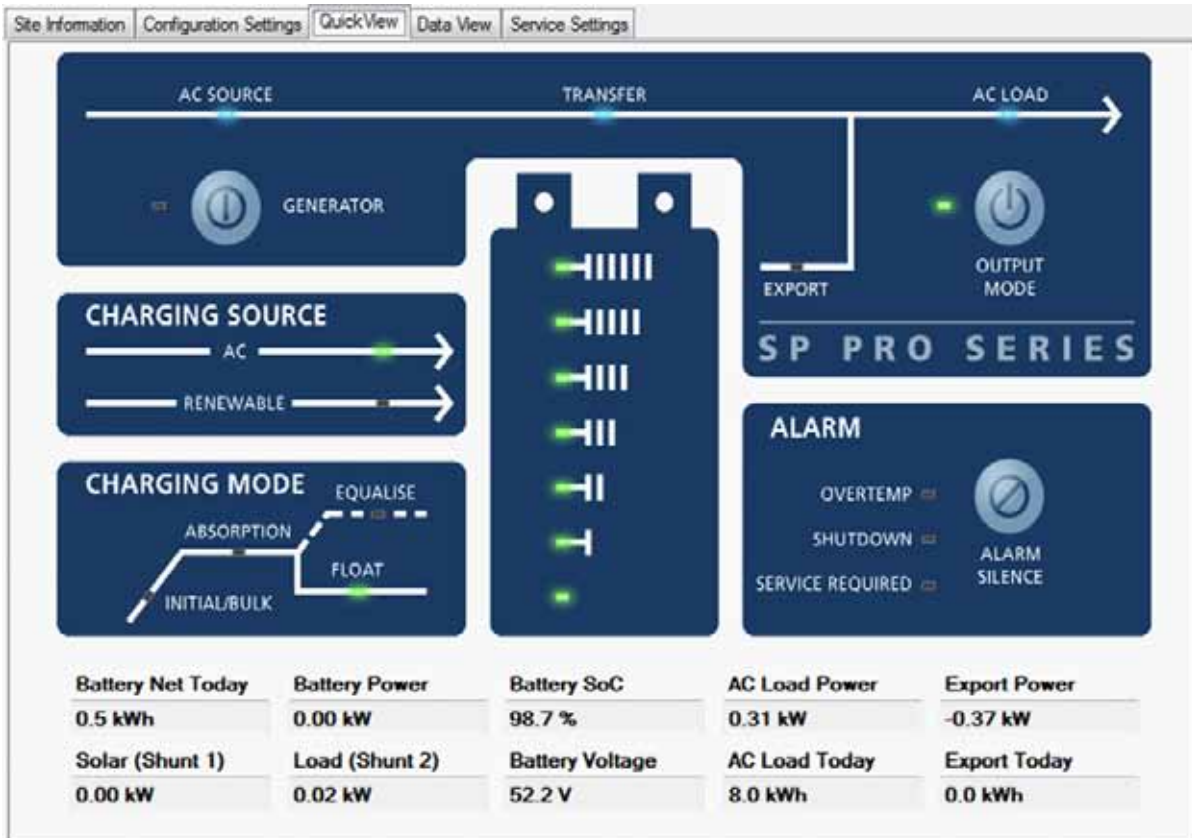
To configure the SP PRO, ensure SP LINK is connected (via connection menu) before uploading the settings.

Remember that all settings are sent to the SP PRO, not just the ones you have changed. The default passcode is 74. It can be changed in Service Settings.



Quick View

Once your SP PRO inverter is correctly configured to suit your needs your use of SP LINK changes to a monitoring function for your system. If you open the tab marked Quick View you are presented with a screen that mimics the front panel of your SP PRO along with a real time overview of the condition of your system.



The overview shown is for a Grid Connected system. It shows how much power is being produced and exported as well as the load and battery state - not a very good solar day though.



Data View

If you require more detailed data about your system clicking on Data View opens a screen containing comprehensive data about your SP PRO and your system

Now Tab

The Now tab gives you live information about what is happening to your system now..

Status		DC	AC Source	Inverter AC
Output Mode	AC Load Power	Batt SoC %	Power	Power
Sync	0.16 kW	98.7 %	0.18 kW	0.10 kW
AC Source Status	AC Load Voltage	Battery Voltage	Power (5 min Average)	
Charger Lockout Active	249 V	52.2 V	0.18 kW	
Generator Status	AC Load Frequency	Battery Current	Voltage	
AC Source Present	50.0 Hz	0.1 A	249 V	
Generator Started by	Generator Running Reason	Inverter Current	Current	Current
Disabled	Disabled	-0.5 A	1.0 A	0.2 A
Attention Required		Solar (Shunt 1)	Frequency	
		0.0 A 0.00 kW	50.0 Hz	
		Load (Shunt 2)	Available Power	
		0.4 A 0.02 kW	14.94 kW	
		5 min Battery Load	Apparent Power	
		0.00 kW	0.25 kVA	
		15 min Battery Load		
		0.00 kW		

STATUS

The first panel shows the OUTPUT MODE in which your SP PRO is running, such as Idle, On or Synchronised, the GENERATOR STATUS – Available, Not Available or AC Present. The reason the generator has started such as high load etc is displayed in GENERATOR STARTED BY: then the reason that it is still running in GENERATOR RUNNING REASON. If you feel that your generator has been running too long this is the area to check first.

If the Service Required LED is flashing on the front panel you can check in this area to find out what Attention is required.

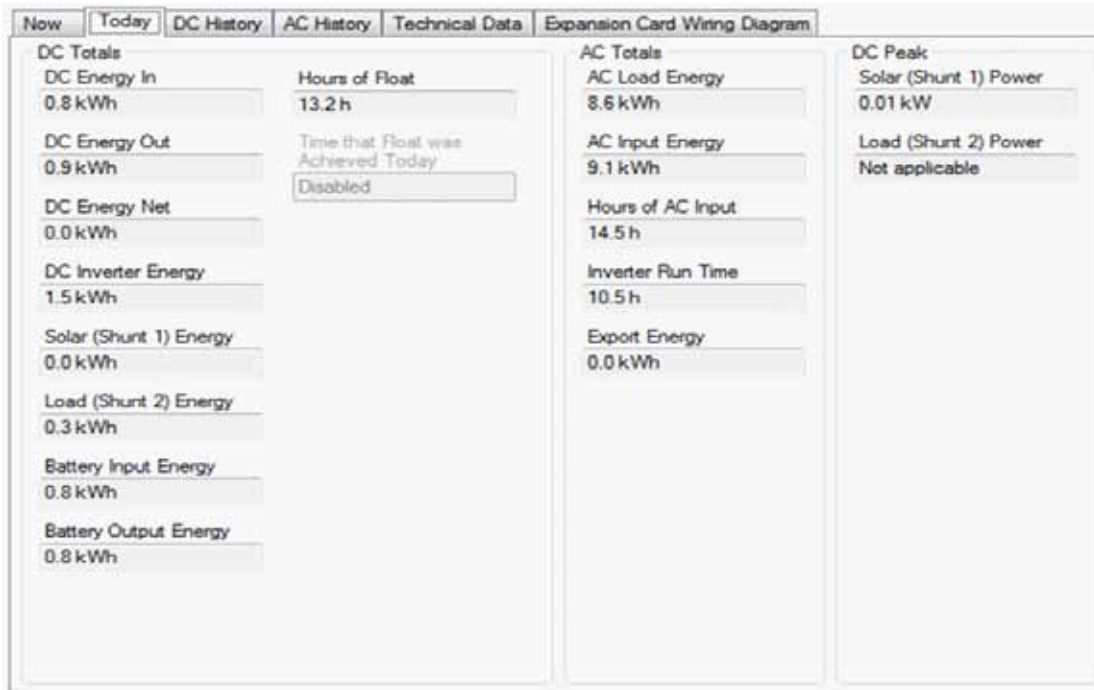
In addition this panel shows AC LOAD POWER, VOLTAGE and FREQUENCY. The AC Load power allows you to differentiate between the total Inverter Power which may include a battery charging or grid exporting component. That is if Inverter Power is greater than AC Load Power the difference will be the charge or export power.

Status	
Output Mode	AC Load Power
Sync	0.16 kW
AC Source Status	AC Load Voltage
Charger Lockout Active	249 V
Generator Status	AC Load Frequency
AC Source Present	50.0 Hz
Generator Started by	Generator Running Reason
Disabled	Disabled
Attention Required	



Today Tab

The TODAY tab gives you data about your system for the current day.



DC TOTALS

This panel is a summary of today's totals of inputs and outputs through your battery pack. DC ENERGY IN is compared to DC ENERGY OUT to arrive at DC ENERGY NET and the results are recorded in kW hours.

DC Inverter Energy is a total of the work the inverter has done, whether that is supplying a load or charging.

If you wish to monitor the day to day performance of your system Time That Float Was Achieved Today can be compared with yesterdays in the DC HISTORY tab.

This can be a handy comparative reading. You can record daily how long it takes your system to replenish the previous days usage.

AC TOTALS

This is also a summary page, but this time of the AC kW hours through the system.

AC LOAD ENERGY records the total power consumption by your site during that day.

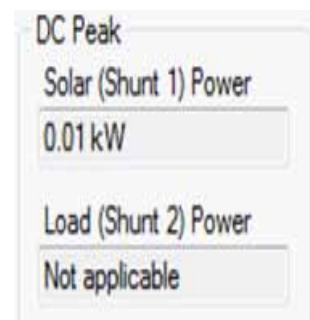
AC INPUT ENERGY shows the total contribution by your generator or the mains grid, while HOURS OF AC INPUT records the running time of your generator or the length of time the mains grid was connected to your SP PRO.

INVERTER RUN TIME is the length of time the inverter has run today – this should be all the time unless you have programmed in an Inverter Lockout period.

In grid connected systems EXPORT ENERGY is the total power your system has contributed to the mains grid in that day.

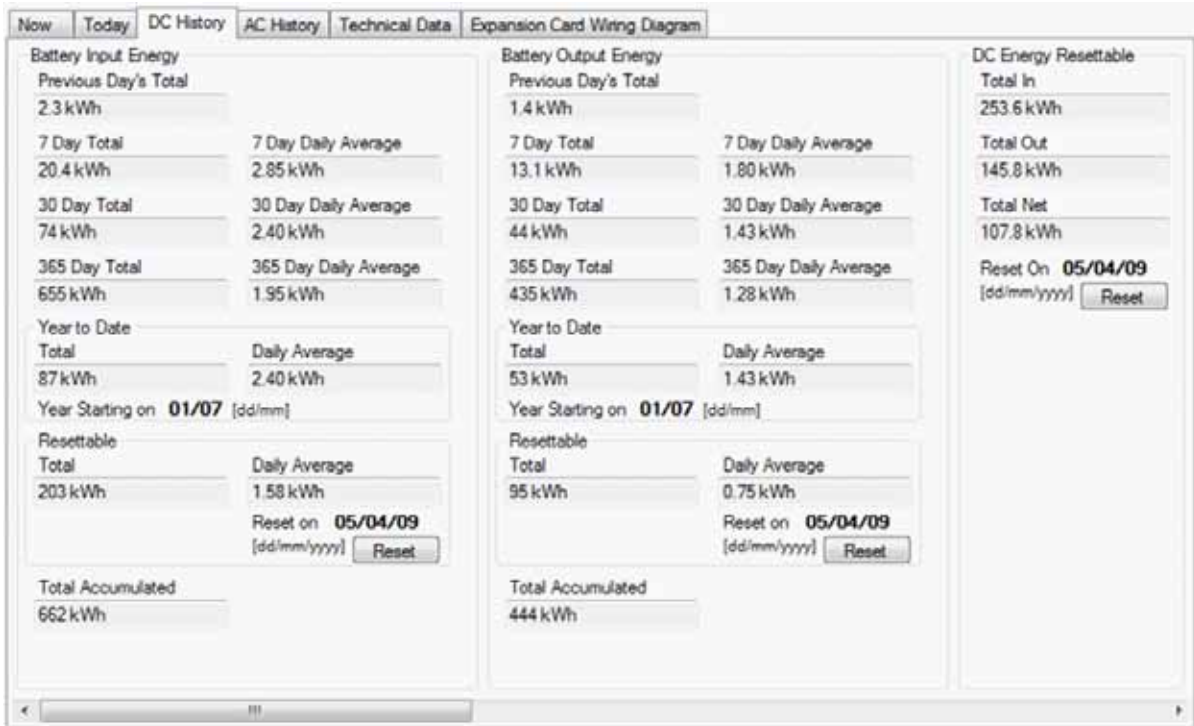
DC PEAK

This screen records the peak power level that has passed through the shunt(s) that day. Not Applicable means the shunt isn't configured for measuring renewable.



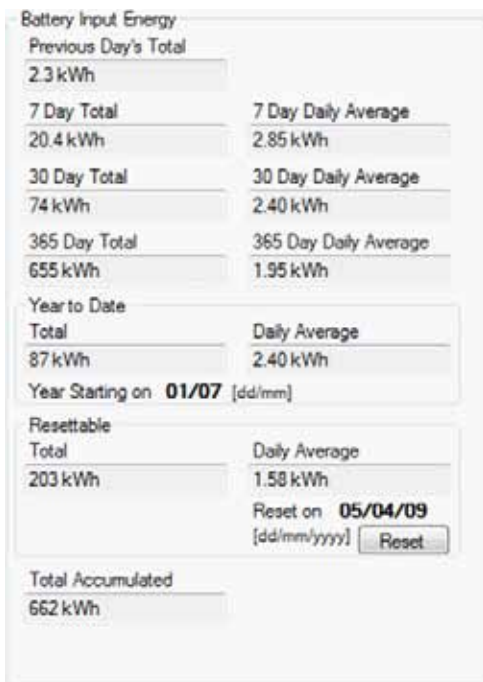
DC History Tab

The next tab is the DC HISTORY screen. As the name implies this screen gives you data from the previous day, the last seven days, the last 30 days, the last year and the whole period since installation.



The screenshot shows the DC History screen with three main sections: Battery Input Energy, Battery Output Energy, and DC Energy Resettable. Each section displays various energy metrics over different time periods.

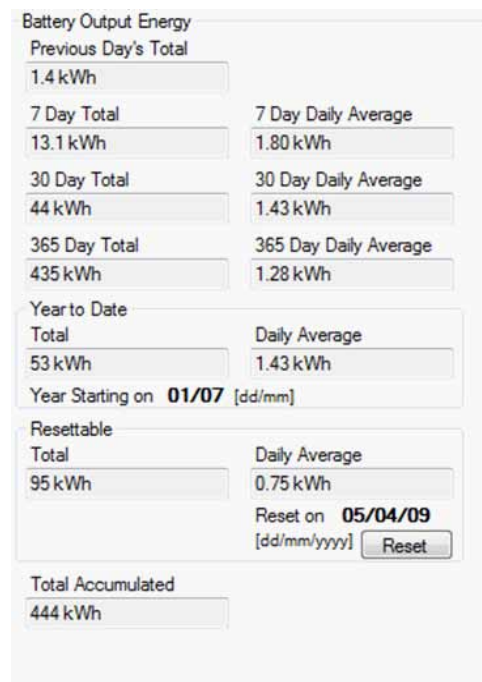
Section	Time Period	Value
Battery Input Energy	Previous Day's Total	2.3 kWh
	7 Day Total	20.4 kWh
	7 Day Daily Average	2.85 kWh
	30 Day Total	74 kWh
	30 Day Daily Average	2.40 kWh
	365 Day Total	655 kWh
	365 Day Daily Average	1.95 kWh
	Year to Date Total	87 kWh
	Year to Date Daily Average	2.40 kWh
	Year Starting on	01/07 [dd/mm]
Battery Output Energy	Previous Day's Total	1.4 kWh
	7 Day Total	13.1 kWh
	7 Day Daily Average	1.80 kWh
	30 Day Total	44 kWh
	30 Day Daily Average	1.43 kWh
	365 Day Total	435 kWh
	365 Day Daily Average	1.28 kWh
	Year to Date Total	53 kWh
	Year to Date Daily Average	1.43 kWh
	Year Starting on	01/07 [dd/mm]
DC Energy Resettable	Total In	253.6 kWh
	Total Out	145.8 kWh
	Total Net	107.8 kWh
	Reset On	05/04/09 [dd/mm/yyyy]
	Reset Button	Reset



This close-up shows the Battery Input Energy section with the following data:

Time Period	Value
Previous Day's Total	2.3 kWh
7 Day Total	20.4 kWh
7 Day Daily Average	2.85 kWh
30 Day Total	74 kWh
30 Day Daily Average	2.40 kWh
365 Day Total	655 kWh
365 Day Daily Average	1.95 kWh
Year to Date Total	87 kWh
Year to Date Daily Average	2.40 kWh
Year Starting on	01/07 [dd/mm]
Resettable Total	203 kWh
Resettable Daily Average	1.58 kWh
Resettable Reset On	05/04/09 [dd/mm/yyyy]
Resettable Reset Button	Reset
Total Accumulated	662 kWh

All the input to your battery pack



This close-up shows the Battery Output Energy section with the following data:

Time Period	Value
Previous Day's Total	1.4 kWh
7 Day Total	13.1 kWh
7 Day Daily Average	1.80 kWh
30 Day Total	44 kWh
30 Day Daily Average	1.43 kWh
365 Day Total	435 kWh
365 Day Daily Average	1.28 kWh
Year to Date Total	53 kWh
Year to Date Daily Average	1.43 kWh
Year Starting on	01/07 [dd/mm]
Resettable Total	95 kWh
Resettable Daily Average	0.75 kWh
Resettable Reset On	05/04/09 [dd/mm/yyyy]
Resettable Reset Button	Reset
Total Accumulated	444 kWh

All the output.



DC ENERGY RESETTABLE is like a trip meter in your car. When reset this records DC energy in and out of the system and gives a net total.

RESET ON: shows the date when last reset so you can calculate how many days have elapsed. By clicking the Reset tab all totals in this reading are zeroed and accumulation of data starts again on the date of the reset.

DC Energy Resettable

Total In	253.6 kWh
Total Out	145.8 kWh
Total Net	107.8 kWh
Reset On	05/04/09 [dd/mm/yyyy]
<input type="button" value="Reset"/>	

HOURS OF FLOAT records what time float was achieved on the previous day and how much time has been spent in float since installation.

This data can be used for future system improvement design. If your system never reaches float, you may need to increase your solar array size, if your system regularly enters float before lunch you may be able to consider adding extra "luxury" loads to the system.

Hours of Float

Previous Day's Total	9.6 h	Previous Day Float Achieved at	Disabled
7 Day Total	95.7 h	7 Day Daily Average	13.7 h
30 Day Total	443.6 h	30 Day Daily Average	14.8 h
365 Day Total	6298.0 h	365 Day Daily Average	19.5 h
Year to Date		Daily Average	
Total	541.1 h	Daily Average	15.1 h
Year Starting on 01/07 [dd/mm]			

This panel gives a picture of the effect that Shunt 1 has had on your system. For the sake of clarity we will assume that Shunt 1 measures your solar input. This, then, records the solar contribution to your system since the system was installed. Once again you can compare today's solar input with other averages to see if you've had a good or a bad solar day.

As with the previous screen you can collect data over a period you determine with the use of the RESETTABLE feature.

The TOTAL ACCUMULATED is all the solar input to the system since installation.

Solar (Shunt 1) Energy

Previous Day's Total	0.0 kWh	Previous Day's Peak Power	0.00 kW
7 Day Total	0.0 kWh	7 Day Daily Average	0.0 kWh
30 Day Total	0 kWh	30 Day Daily Average	0.00 kWh
365 Day Total	466 kWh	365 Day Daily Average	1.43 kWh
Year to Date		Daily Average	
Total	0 kWh	Daily Average	0.00 kWh
Year Starting on 01/07 [dd/mm]			
Resettable		Daily Average	
Total	465 kWh	Daily Average	1.35 kWh
		Reset on	12/09/08 [dd/mm/yyyy]
		<input type="button" value="Reset"/>	
Total Accumulated		465 kWh	



This panel is the historical record of the Shunt 2s effect on your system, either through a renewable contribution, if it is measuring input through a wind turbine or micro hydro, or as a deduction through DC loads. In the case shown, DC Loads.

Load (Shunt 2) Energy

Previous Day's Total	Previous Day's Peak Power
0.5 kWh	Not applicable
7 Day Total	7 Day Daily Average
3.5 kWh	0.5 kWh
30 Day Total	30 Day Daily Average
13 kWh	0.38 kWh
365 Day Total	365 Day Daily Average
176 kWh	0.53 kWh
Year to Date	
Total	Daily Average
16 kWh	0.38 kWh
Year Starting on 01/07 [dd/mm]	
Resettable	
Total	Daily Average
64 kWh	0.45 kWh
	Reset on 05/04/09 [dd/mm/yyyy] <input type="button" value="Reset"/>
Total Accumulated	
184 kWh	

This panel shows historical data of all of the DC energy that has passed into or out of the inverter.

This panel also gives you the ability to accumulate this data from a date you determine. By pressing the Reset tab all totals in this reading are zeroed and accumulation of data starts again on the date of the reset.

A particular feature of this panel is the ability to compare your previous days total with the averages over a week, a month or a year.

DC Inverter Energy

Previous Day's Total	
4.0 kWh	
7 Day Total	7 Day Daily Average
35.2 kWh	5.03 kWh
30 Day Total	30 Day Daily Average
125 kWh	4.13 kWh
365 Day Total	365 Day Daily Average
799 kWh	2.40 kWh
Year to Date	
Total	Daily Average
148 kWh	4.05 kWh
Year Starting on 01/07 [dd/mm]	
Resettable	
Total	Daily Average
335.5 kWh	2.70 kWh
	Reset on 05/04/09 [dd/mm/yyyy] <input type="button" value="Reset"/>
Total Accumulated	
796 kWh	



AC History Tab

The AC HISTORY SCREEN, as with the DC History screen gives you data from the previous day, the last seven days, the last 30 days, the last year and the whole period since installation

AC Load Energy	AC Input Energy	AC Export Energy
Previous Day's Total 14.0 kWh	Previous Day's Total 16.0 kWh	Previous Day's Total 0.0 kWh
7 Day Total 135.5 kWh	7 Day Total 150.6 kWh	7 Day Total 0.0 kWh
7 Day Daily Average 19.33 kWh	7 Day Daily Average 21.52 kWh	7 Day Daily Average 0.0 kWh
30 Day Total 521 kWh	30 Day Total 581 kWh	30 Day Total 0 kWh
30 Day Daily Average 17.36 kWh	30 Day Daily Average 19.40 kWh	30 Day Daily Average 0 kWh
365 Day Total 5246 kWh	365 Day Total 5847 kWh	365 Day Total 1 kWh
365 Day Daily Average 16.23 kWh	365 Day Daily Average 18.06 kWh	365 Day Daily Average 1 kWh
Year to Date Total 623 kWh	Year to Date Total 693 kWh	Year to Date Total 0 kWh
Daily Average 17.29 kWh	Daily Average 19.26 kWh	Daily Average 0 kWh
Year Starting on 01/07 [dd/mm]	Year Starting on 01/07 [dd/mm]	Year Starting on 01/07 [dd/mm]
Resetable Total 2141 kWh	Resetable Total 2381 kWh	Resetable Total 0 kWh
Daily Average 17.29 kWh	Daily Average 19.19 kWh	Daily Average 0 kWh
Reset on 05/04/09 [dd/mm/yyyy] <input type="button" value="Reset"/>	Reset on 05/04/09 [dd/mm/yyyy] <input type="button" value="Reset"/>	Reset on 05/04/09 [dd/mm/yyyy] <input type="button" value="Reset"/>
Total Accumulated 5255 kWh	Total Accumulated 5856 kWh	Total Accumulated 1 kWh

This is a record of the total AC loads presented by your home to your power system.

This is the total AC input contributed by your motor generator or by the mains grid.

AC Load Energy

Previous Day's Total
14.0 kWh

7 Day Total
135.5 kWh

7 Day Daily Average
19.33 kWh

30 Day Total
521 kWh

30 Day Daily Average
17.36 kWh

365 Day Total
5246 kWh

365 Day Daily Average
16.23 kWh

Year to Date
Total
623 kWh

Daily Average
17.29 kWh

Year Starting on 01/07 [dd/mm]

Resetable
Total
2141 kWh

Daily Average
17.29 kWh

Reset on 05/04/09 [dd/mm/yyyy]

Total Accumulated
5255 kWh

AC Input Energy

Previous Day's Total
16.0 kWh

7 Day Total
150.6 kWh

7 Day Daily Average
21.52 kWh

30 Day Total
581 kWh

30 Day Daily Average
19.40 kWh

365 Day Total
5847 kWh

365 Day Daily Average
18.06 kWh

Year to Date
Total
693 kWh

Daily Average
19.26 kWh

Year Starting on 01/07 [dd/mm]

Resetable
Total
2381 kWh

Daily Average
19.19 kWh

Reset on 05/04/09 [dd/mm/yyyy]

Total Accumulated
5856 kWh



In grid connected systems you can monitor the amount of energy you are exporting to the mains grid. You can compare today's total with the last week, the last month or the whole year.

AC Export Energy	
Previous Day's Total	0.0 kWh
7 Day Total	0.0 kWh
7 Day Daily Average	0.00 kWh
30 Day Total	0 kWh
30 Day Daily Average	0.00 kWh
365 Day Total	1 kWh
365 Day Daily Average	0.00 kWh
Year to Date	
Total	0 kWh
Daily Average	0.00 kWh
Year Starting on 01/07 [dd/mm]	
Resetable	
Total	0 kWh
Daily Average	0.00 kWh
Reset on 05/04/09 [dd/mm/yyyy]	
<input type="button" value="Reset"/>	
Total Accumulated	1 kWh

A record of how many hours your generator has run or for how long the mains grid was connected.

Hours of AC Input	
Previous Day's Total	24.0 h
7 Day Total	167.7 h
7 Day Daily Average	24.0 h
30 Day Total	718 h
30 Day Daily Average	24.0 h
365 Day Total	7503 h
365 Day Daily Average	23.3 h
Year to Date	
Total	860 h
Daily Average	24.0 h
Year Starting on 01/07 [dd/mm]	
Resetable	
Total	2964 h
Daily Average	24.0 h
Reset on 05/04/09 [dd/mm/yyyy]	
<input type="button" value="Reset"/>	
Total Accumulated	7542 h



Technical Data Tab

The TECHNICAL DATA tab provides you with information relating to maintenance and updating your SP PRO.

Now	Today	DC History	AC History	Technical Data	Expansion Card Wiring Diagram
Inverter					
SP PRO Model		Power Module 1 Serial Number		Component Life	
SPMC482-AU		77423		Power Module 1 Capacitor Life	
SP PRO Ratings		Power Module 1 Revision		1 %	
48V DC, 6kW, 240V AC		3		Power Module 2 Capacitor Life	
SP PRO Serial Number		Power Module 1 Mod Status		1 %	
76123		1		Fan Life	
SP PRO Revision		Power Module 2 Serial Number		0 %	
3		77423		(Component Life: component's rated life consumed so far)	
SP PRO Mod Status		Power Module 2 Revision		Battery	
1, 11		3		Charging Mode	
Software Version		Power Module 2 Mod Status		Short Term Float	
1.63		1, 7		Charge Eff. Index	
Control PCA Serial Number		SP PRO Total Run Time		0.411	
76122		6130.1 h		Days to Equalise	
Control PCA Revision		Grid Connect SW Version		26	
4		1.00		Days Since Equalise	
Control PCA Mod Status				3	
1				Sense Voltage	
				51.7 V	
				DC Inverter Voltage	
				51.7 V	
				Midpoint Voltage	
				25.4 V	
				Power	
				0.01 kW	
				Cable Loss	
				0 W	
				Temperature Control	
				Transformer Temperature	
				32 °C	
				Heatsink Temperature	
				37 °C	
				Internal Temperature	
				30 °C	
				Power Module Temp.	
				29 °C	
				Battery Temperature	
				11 °C	
				Fan Speed	
				0 %	
				Reactive Inverter Power	
				0.00 kVAr	
				Apparent Inverter Power	
				0.13 kVA	

In the INVERTER section we show you the SOFTWARE VERSION and hardware that is currently installed in your inverter. From time to time, as Selectronic designs new features for your SP PRO, new revisions of software may become available from our website. By comparing your current version you can tell if you need to update your inverter over the net.

TOTAL RUN TIME tells you the total number of hours the inverter has run.

Inverter	
SP PRO Model	Power Module 1 Serial Number
SPMC482-AU	77423
SP PRO Ratings	Power Module 1 Revision
48V DC, 6kW, 240V AC	3
SP PRO Serial Number	Power Module 1 Mod Status
76123	1
SP PRO Revision	Power Module 2 Serial Number
3	77423
SP PRO Mod Status	Power Module 2 Revision
1, 11	3
Software Version	Power Module 2 Mod Status
1.63	1, 7
Control PCA Serial Number	SP PRO Total Run Time
76122	6130.1 h
Control PCA Revision	Grid Connect SW Version
4	1.00
Control PCA Mod Status	
1	



Your SP PRO monitors the lifespan of certain components within your inverter. By advising you of the amount of CAPACITOR LIFE and FAN LIFE that have been consumed SP LINK allows you to plan for long term maintenance at a time that will not inconvenience you.

Component Life	
Power Module 1 Capacitor Life	1 %
Power Module 2 Capacitor Life	1 %
Fan Life	0 %
(Component Life: component's rated life consumed so far)	

The technical data stored in the BATTERY panel is essential for analysing system problems.

The CHARGING MODE window advises what stage of charge your SP PRO is at, or will start from next time the generator starts.

We have previously discussed how battery problems can be isolated using Battery MIDPOINT VOLTAGE.

SP LINK records how long it has been since your batteries received an equalising charge and how long before such a charge is due.

The CHARGE EFFICIENCY INDEX describes how well your batteries are receiving the charge current presented; another factor in determining your battery maintenance / replacement program.

The DC INVERTER VOLTAGE is compared to the SENSE VOLTAGE (a measurement taken right at the battery bank) and calculates how much CABLE LOSS is present.

If this loss figure is too high it may indicate the loads placed on the inverter are higher than the design criteria and the cable size may need to be increased.

POWER is the actual load on the batteries, expressed in kW. This figure should be used in comparison with the battery cable loss figure to determine the relevance of the loss figure.

Battery	
Charging Mode	Short Term Float
Charge Eff. Index	0.411
Days to Equalise	26
Days Since Equalise	3
Sense Voltage	51.7 V
DC Inverter Voltage	51.7 V
Midpoint Voltage	25.4 V
Power	0.01 kW
Cable Loss	0 W

The Days to Recharge and Days Since Recharge tracks, if Periodic Recharge is enabled, how many days between switching to Initial stage and how long before the SP PRO will switch to initial.

The TEMPERATURE CONTROL panel records the power the inverter is dissipating and allows your Selectronic Authorised Installer to compare this reading with the temperature of various hardware items within your SP PRO, in conjunction with the ambient temperature around the inverter and refer this data to the internal fan speed to analyse system performance.

Temperature Control	
Transformer Temperature	32 °C
Heatsink Temperature	37 °C
Internal Temperature	30 °C
Power Module Temp.	29 °C
Battery Temperature	11 °C
Fan Speed	0 %
Reactive Inverter Power	0.00 kVAr
Apparent Inverter Power	0.13 kVA



The INPUTS panel monitors which of your digital and analogue inputs are on (Active) and which are off (Inactive).....

Inputs	
Digital Control 1 Status	Inactive
Digital Control 2 Status	Inactive
Digital Control 3 Status	Inactive
Digital Control 4 Status	Inactive
Analogue 1 DC Voltage	-0.1 V
Analogue 2 DC Voltage	0.4 V

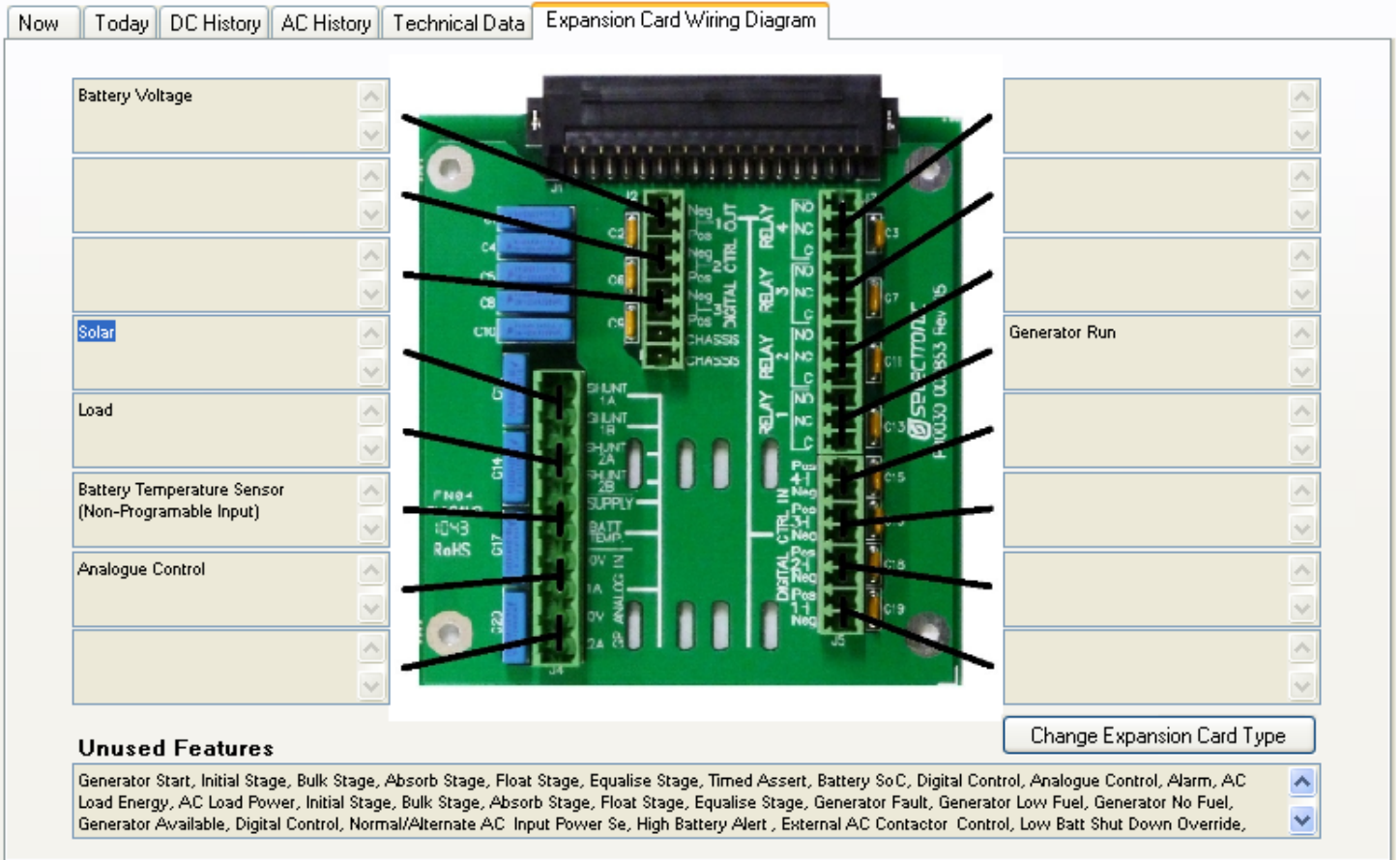
and, similarly, the OUTPUTS panel records which output is on (Active) and which is off (Inactive).

Outputs	
Digital Control 1 Status	Active
Digital Control 2 Status	Inactive
Digital Control 3 Status	Inactive
Relay 1 Status	Inactive
Relay 2 Status	Inactive
Relay 3 Status	Active
Relay 4 Status	Active

Expansion Card Wiring Diagram Tab

The Expansion Card Wiring Diagram shows you how the input and output functions are programmed and allocated in your SP PRO. This display is only active when you are connected to the SP PRO.

Now Today DC History AC History Technical Data **Expansion Card Wiring Diagram**



Unused Features

Generator Start, Initial Stage, Bulk Stage, Absorb Stage, Float Stage, Equalise Stage, Timed Assert, Battery SoC, Digital Control, Analogue Control, Alarm, AC Load Energy, AC Load Power, Initial Stage, Bulk Stage, Absorb Stage, Float Stage, Equalise Stage, Generator Fault, Generator Low Fuel, Generator No Fuel, Generator Available, Digital Control, Normal/Alternate AC Input Power Se, High Battery Alert, External AC Contactor Control, Low Batt Shut Down Override,

The Unused Features display lists all input and output functions that have not been allocated to an input or output.

Expansion card picture may vary depending on SP PRO model. Click Change Expansion Card Type to suit your model.



Service Settings

Certain readings within your SP PRO must be correctly configured at the time of the original setup. These include the time and date, an approximation of the state of charge and that the current shunts are zeroed.

The screenshot displays the 'Service Settings' interface with the following sections:

- Set SP PRO date/time:** Includes 'SP PRO's Present Date and Time' (Date [dd/mm/yyyy], Time [hh:mm]), 'Use Computer Date and Time With Offset' (Offset [hh:mm]), and 'Manually Set Date and Time' (SP PRO Date [dd/mm/yyyy], SP PRO Time [00:00 - 23:59]).
- Reset SoC:** Shows 'Present SoC' and 'New SoC [1.0 - 99.9%]' (85.0) with a 'Set SoC' button.
- Expansion Card:** Shows 'Present State' and 'New State [Enabled, Disabled]' (Enabled) with a 'Set Exp. Card State' button.
- Settings Passcode:** Includes 'Type New Passcode [1 - 65535]' and 'Retype New Passcode' with a 'Set Passcode' button.
- Shunts:** Contains 'Shunt 1 Current' and 'Shunt 2 Current' (Zero Shunt 1, Zero Shunt 2), and 'Fan' settings for 'Present Fan Type', 'New Fan Type [0 - 0]', and 'Fan Life' (Reset Fan Life).
- AC Input Safety Monitor:** Shows 'Present Monitor State' and 'New Monitor State [Enabled, Disabled]' (Disabled) with a 'Set Monitor State' button. Includes a warning: 'Warning: Changing the position of the "E-N DISCONNECT" slide switch or the "AC Input Safety Monitor" state should only be performed in limited circumstances. A hazardous situation may result. Read and understand the relevant section of the SP PRO Manual or consult a Selectronic Accredited installer before changing the switch position or the state of the setting. Click here to view relevant section of the manual.'
- Battery Equalise:** Shows 'Present Equalise State' and a 'Change Equalise State' button.
- Login Password:** Shows 'Type New Password [up to 32 character long]' and a 'Set Login Password' button.

To ensure that various timed functions within the SP PRO, such as generator run schedules, perform as expected it is important to have the correct date and time recorded in your SP PRO. You have the option of automatically uploading the time and date from your computer – including the facility to allow for an offset if your computer is set to a different time zone to the area of installation – or to manually set the time and date.

If you are adjusting the date manually click on the circle adjacent to MANUALLY SET DATE / TIME and use the drop down menu to select the correct date. The time can be set by clicking on the hour or minute section and use the up/down arrows to adjust.

When you have completed adjustment click on SET SP PRO TIME to record the change.

This close-up shows the 'Set SP PRO date/time' section with the following details:

- 'SP PRO's Present Date and Time' (Date [dd/mm/yyyy], Time [hh:mm])
- 'Use Computer Date and Time With Offset' (Offset [hh:mm])
- 'Manually Set Date and Time' (SP PRO Date [dd/mm/yyyy], SP PRO Time [00:00 - 23:59])
- 'Set SP PRO Time' button



When first setting up your SP PRO an initial estimation of the state of charge must be programmed to enable the SP PRO to facilitate all the functions that are determined by the state of charge measurement from the first day. As the period of operation increases any small error from the original estimation will be corrected.

The current status of the EXPANSION CARD is displayed. The SP PRO can be set to use (Enabled) all the connected functions from the expansion card like shunts and battery temperature sensor etc or to ignore (Disabled) them. By default the Expansion Card is enabled.

If you are concerned that the standard passcode does not provide the level of security you desire for changing settings, you can change the passcode in your SP PRO to one that is uniquely yours.

Please note that if this passcode is lost or forgotten it can only be reset by a procedure that requires someone to be on site.

If you require assistance resetting your passcode please consult your Selectronic Accredited Installer.

To accurately measure and calculate inputs and outputs to and from the batteries your SP PRO needs to start its measurements knowing what is Zero. To set this parameter you must ensure all inputs and outputs are switched off – that is no solar, wind or other inputs coming into the system and all DC loads are switched off – then the ZERO SHUNT 1 and ZERO SHUNT 2 buttons should be pressed.

The figures above the buttons indicate what the onboard computer in your SP PRO perceives the relative current to be before zeroing.

If you are concerned that the default login password does not provide the level of security for any access to the SP PRO, you can change the Login Password in your SP PRO to one that is uniquely yours.

Like the passcode, if the Login Password is lost or forgotten it can only be reset by a procedure that requires someone to be on site.

SP LINK will automatically update the Connection settings in Site Information when you set your new Login Password.

Reset SoC

Present SoC

85%

New SoC
[1 - 100%]

85

Set SOC

Expansion Card

Present State

New State
[Enabled, Disabled]

Enabled

Set Exp. Card State

Changing The Passcode

Type New Passcode
[1 - 65535]

Retype New Passcode

Set Passcode

Shunts

Shunt 1 Current

Zero Shunt 1

Shunt 2 Current

Zero Shunt 2

Login Password

Type New Password
[up to 32 character long]

Set Login Password



The cooling fan within your SP PRO is a long life, high quality component. As the control section of your SP PRO calculates the hours of life left in the fan (along with other components) it is important that the fan – when it is eventually necessary – is replaced by an authorised spare part. However we are aware that components become obsolete and other fans may need to be used, so we have allowed settings for 4 different fan types. These settings are based around all the fan types available at this time and we will clearly mark any replacement fans with their fan type as they become available.

Fan

Present Fan Type

[Empty field]

New Fan Type
[0 - 0]

[0]

Set Fan Type

Fan Life

[Empty field]

Reset Fan Life

The AC INPUT SAFETY MONITOR assesses the presence of an earth/neutral link in your generator or the mains grid connected to your SP PRO and will prevent this source of power connecting to your system if it is not present. This important safety feature is included for your protection and should never be ignored. This being said there are certain marinas around the world that have isolation transformers in their shore power connection that will trigger this feature. If you have your SP PRO installed on a boat and encounter this situation it is possible to disable this function temporarily to allow you to use the shore power connection. An alert will periodically sound to remind you that this safety feature is disabled.

AC Input Safety Monitor

Present Monitor State

[Empty field]

New Monitor State
[Enabled, Disabled]

Disabled

Set Monitor State

State of Actual Switch

[Empty field]

Warning: Changing the position of the "E-N DISCONNECT" slide switch or the "AC Input Safety Monitor" state should only be performed in limited circumstances. A hazardous situation may result.

Read and understand the relevant section of the SP PRO Manual or consult a Selectronic Accredited installer before changing the switch position or the state of the setting.

[Click here to view relevant section of the manual.](#)

The BATTERY EQUALISE display shows whether the SP PRO will perform an equalise charge when it next achieves Float (Equalise Pending). Pressing the button will toggle between Equalise Pending and No Equalise Pending. Pressing the button will also stop a current Equalise process.

Battery Equalise

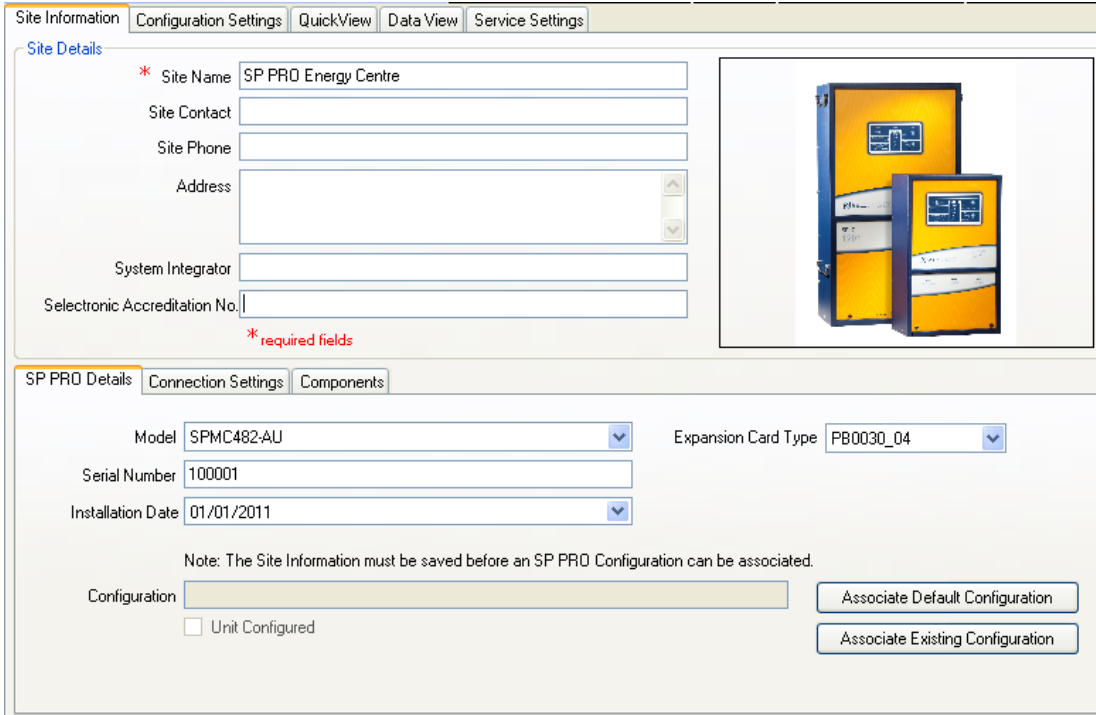
Present Equalise State

[Empty field]

Change Equalise State

Customising SP LINK to suit your site

The SITE INFORMATION screen on SP LINK allows you to record specific site details that are individual to your installation, such as the SITE NAME, the SYSTEM INTEGRATOR, the inverter SERIAL NUMBER as well as including a photo of your site.




The SP PRO DETAILS screen you can choose from saved configuration files. As an example, you may have two sets of settings for your inverter saved within SP LINK; one for NORMAL everyday use, and one for HOLIDAY use. In your holiday file you may have included automatic garden watering, switching security lights on and off or even switching off the inverter for periods of time. Changing these settings is as easy as browsing the saved files through the FILE menu at the top of the SP LINK menu and selecting the appropriate configuration then clicking on OPEN.



The Components screen allows photos and details of the major components to be stored.

Type in details and click on photo area to select image. Selected image is copied and stored with site information.



CONNECTION SETTINGS

All of these fields can be completed by simply clicking in the appropriate area and typing or pasting the details. Details for all connection types are stored with the site allowing multiple connection method to be retained in one site file.

LOGIN PASSWORD

A LOGIN PASSWORD is required for connecting to the SP PRO. SP LINK can only connect through to the SP PRO with the correct password. The default password is "Selectronic SP PRO".

Once connected, the default password may be changed under Service Settings.

Note: Login password is for SP PRO software version 2.07 and later. SP LINK is backward compatible will connect to earlier SP PRO software versions without a password.

DIRECT - Local SP PRO connection.

For DIRECT connections, once all cables are connected and in place, press FIND SP PRO - this will search through all PC ports and find the connected SP PRO and set port and speed as required.

Otherwise, select the PC COM port that is connected to the SP PRO and set the port speed to match the SP PRO.

Note: Default SP PRO port speeds are:
Port 1:57600
Port 2:9600

MODEM - Remote dial-up SP PRO connection.

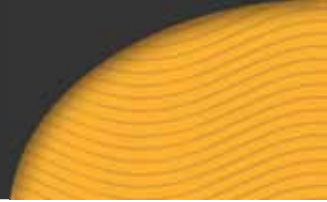
For MODEM connections, select the PC COM port that the modem is connected to and set the modem port speed. The modem port speed is normally automatically detected by the modem so can be left at 57600. Enter the MODEM PHONE NUMBER. This is the number that SP LINK will dial when you select CONNECT. MODEM INITIALISATION can be left blank when using Selectronic supplied modems but may be required for other modem types.

Consult your modem supplier if unsure.

NETWORK - IP connection.

For NETWORK connections, enter the HOSTNAME or IP ADDRESS of the serial/ethernet adaptor and the IP PORT number of the serial connection to the SP PRO.

Note: Using network connection requires knowledge of IP networks and router configuration and data encapsulation. SP LINK communicates in RAW format to the set IP port via with no embedded serial/ethernet device control. All data sent and received by the serial/ethernet device must be passed through. Serial/Ethernet device must be set to match port speed of SP PRO. Consult your IT specialist for further information.





SP LINK Communications

Chapter Seven



The SP PRO provides two isolated serial communications ports for monitoring and controlling the SP PRO. Either port can be used to connect to a local PC or to connect to a modem and since the ports can be used simultaneously, this enables the user via a local PC and the installer via a modem to connect and discuss system operation and performance.

Each unit is supplied with suitable cables for connecting to the serial port, one, to connect from the SP PRO to a modem and two, a “cross-over cable” to connect from the modem cable into a PC. The modem cable can be installed into the unit under the front access cover at any time. If unsure, check with your Selectronic Authorised Installer.

Serial Port Setup

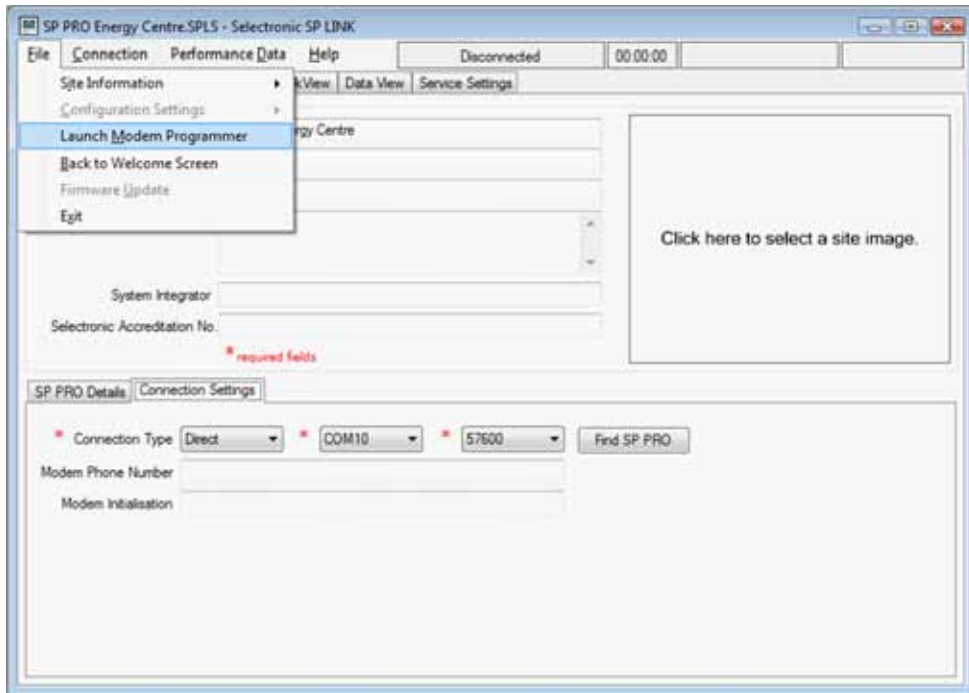
The SP PRO serial ports can be set from 1200 to 57600 baud. Serial port 1 by default is set to 57600 and is typically used for local or Direct PC or Laptop connection. Serial port 2 defaults to 9600 for modem connections. The PC/Modem must be set to match these parameters.

For Direct connections, the speed in SP LINK must be set to match the port. The easiest way to set the port and speed is to use the Find SP PRO button - when pressed, SP LINK will search all serial ports at all speeds on the PC looking for a response from a connected SP PRO. This function only works for Direct connections.

For Modem connections the remote modem port speed must match the SP PRO port speed, the SP LINK speed on the PC will be automatically detected by the PC's modem and can be left at default.

SP PRO Modem Initialisation

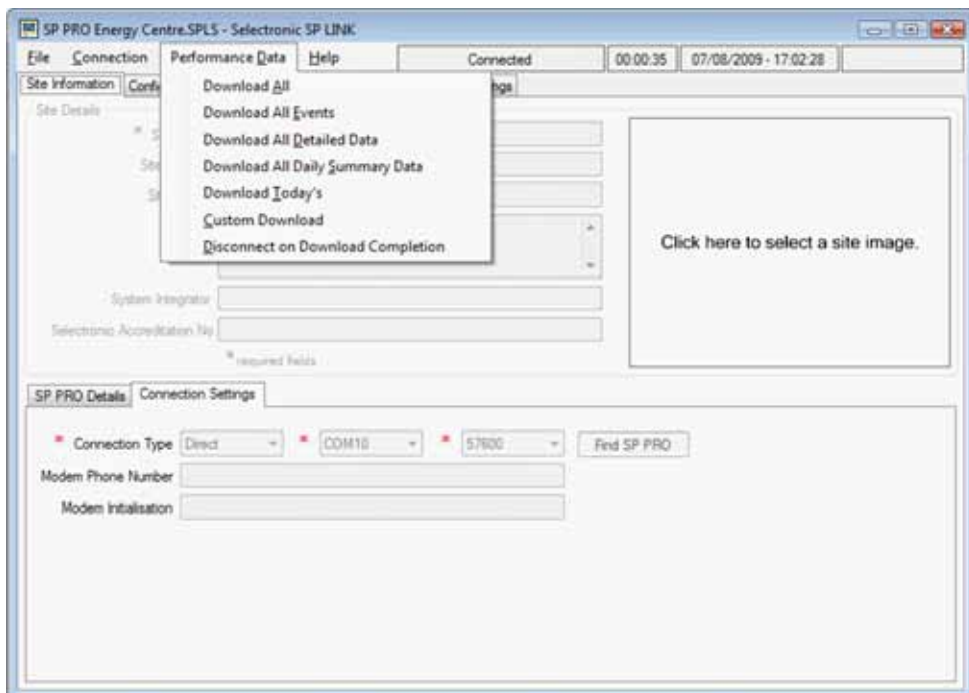
You can initialise either a Netcomm V.92 modem or a Maxon “Next G” modem using the Modem Programmer in the “File” drop down menu. This programs the modem so it can be connected to the SP PRO. There is no need to program the modem connected to SP LINK at the local PC.



In the Modem Programmer window, Select the modem model, the PC COM port it is connected to, and the baud rate that the modem is to be programmed to. This baud rate must be the same baud rate of the SP PRO Serial Port it will connect to.

Performance Data Retrieval

From the drop down menu in “Performance Data” you can choose what, and how much, data you wish to recover from the extensive information stored in your SP PRO.



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SELECTRONIC

Instruction Manual for
SP PRO Energy Centre

User | Installation | SP LINK | Service



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Service and Maintenance

Chapter Eight



If fan filter cleaning is required:

1. Ensure fan is stationary
2. Remove the four retaining nuts that hold the fan filter in place.
3. Clean the filter mesh with a soft brush or similar implement.
4. Replace filter and tighten the four retaining nuts.

All other maintenance on your SP PRO should be performed by a Selectronic Accredited Installer.



Above the fan filter is a safety grill. Do not remove this grill – fast moving fan blades can cause injury.



Monitoring the Operation of your SP PRO

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 recharging will have to take place, this will maximize battery life
- EVENT LOG – unexpected events.
- SYSTEM TEMPERATURES should be kept as low as possible.

Maintenance of your SP PRO

Very little is required in order to maintain your SP PRO, however, partaking in the following steps will ensure smooth operation of the system.

- Cleaning. Large particles of dirt can be removed with a soft brush or similar implement. Dust can be removed with a damp cloth. Solvents, abrasives or corrosive chemicals must not be used for cleaning.
- When the fan filter requires cleaning the Service Required LED will illuminate. Check in the NOW tab of the DATA VIEW section to determine what type of service is required.

All other maintenance on your SP PRO should be performed by a Selectronic Accredited Installer.



Changing Configuration Settings

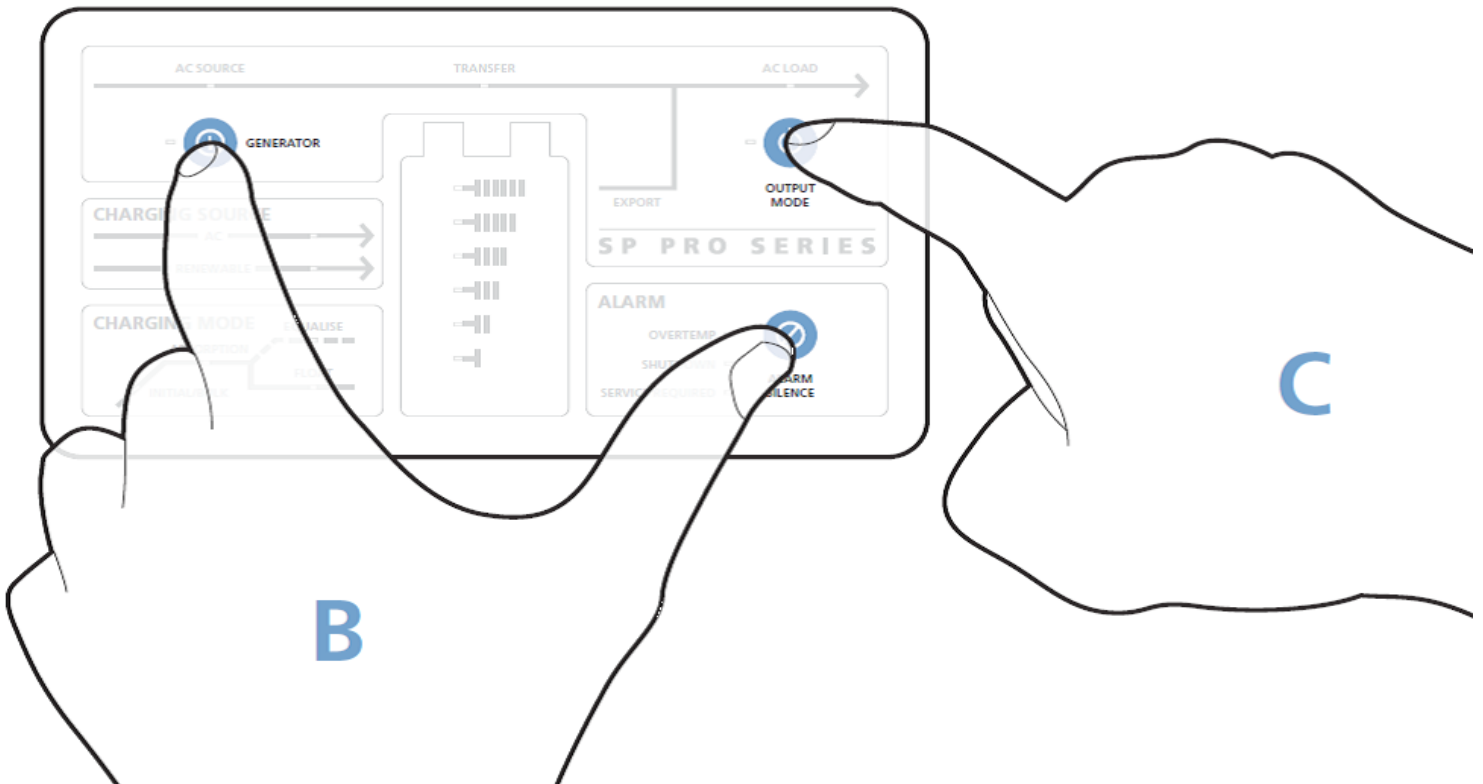
The following is recommended when adjusting system settings:

- Save existing configuration file
- Change the minimum set of parameters at any one time then check for expected results.
- Save new configuration file.

Restoring to Factory Default settings

The following procedure will restore factory defaults - Off Grid, Voltage Control mode - with the choice of either flooded or sealed battery voltage defaults.

- Set SP PRO in Idle mode with a long press of the Output Mode button (AC Load LED OFF)
- Press and hold buttons B as shown, all LEDs will go off.
- Whilst continuing to hold B, press C to select from following options -
Green LEDs = Flooded batteries
Red LEDs = Sealed batteries
No LEDs = Factory default settings will NOT be restored and with no change to any setting
- Release all buttons, wait 10 seconds until LED display is stable.



- Factory Defaults as selected have been restored.

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.



Operating Without the Generator

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

- TURN ON ECONO MODE. The SP PRO 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 SP PRO 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 SP PRO will automatically stop supplying AC power to the load, to prevent battery degradation or damage. Switching on the Low Battery Override function will restore power for a time at the expense of discharging the battery even more deeply.



Note: The SP PRO 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.

Installer Maintenance

Other than ensuring all AC and DC connections are always tight, there are only three areas that may require maintenance.

- FAN ALERT – This can be checked in the “Now” tab of the “Data View” section. A fan alert generally indicates that the fan is stationary when it should be running. This will mean that either the fan needs replacement or that a foreign body is stuck in the fan. Either situation is unlikely as the SP PRO is protected against pest infestation and the fan life monitor should predict fan failure.
- FAN LIFE is recorded in the “Technical Data” section of the “Data View” tab (see below). Fan life is expressed in the percentage of fan life used ie The figure starts at 0% and rises the longer the fan runs. As fan life is projected to be in excess of 40,000 hours quite a high percentage of fan life can be used before replacement is necessary.
- CAPACITOR LIFE is measured on both halves of the power module and is expressed, as before, in percentage of life used. The power module should be replaced when capacitor life, in either half, reaches 95%.



There are no user replaceable parts within your SP PRO. Any maintenance, other than fan filter cleaning, should be performed by a Selectronic Authorised Installer.

System Maintenance

Your Selectronic Accredited Installer will advise you of the maintenance required for the balance of your system components.



Troubleshooting



Chapter Nine

Service and Support

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

General

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

- Check if the front panel “Alarm” LEDs indicate a problem, and take the recommended action as described in “Service Required” section of the “Now” tab of “Data View”.
- Switch the SP PRO off via the ON/OFF pushbutton for a few seconds then back on. If this does not restore normal operation, check the event log for a cause.

Generator Starting/Stopping Problems

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. Using SP Link check the “Generator Running Reason” section of the “Now” tab of the “Data View” section.

If the reason does not seem to relate to what is actually happening in your system consult your Selectronic Authorised Installer.



IF THE GENERATOR RUNS MORE OFTEN THAN NORMAL OR EXPECTED:

There are several possible causes:

- 1.** The system average load has increased:
Using SP LINK check the “7 DAY DAILY AVERAGE” figure in the “AC LOAD ENERGY” section of “AC HISTORY” within the “DATA VIEW” tab and compare it with the value displayed when the system was operating satisfactorily.
Using SP LINK compare the “7 DAY DAILY AVERAGE” figure in the “AC LOAD ENERGY” section of “AC HISTORY” within the “DATA VIEW” tab 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:
Using SP LINK check the POWER and the POWER (5 MIN AVERAGE) in the AC SOURCE area in the NOW tab of the DATA VIEW section while operating any new appliance that has been added to the system. The associated On 5 minutes power and the On 15 minutes power setting in the GENERATOR AUTO RUN TAB may need adjustment by your supplier.
- 3.** The load during late night and early morning periods 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.
- 4.** The battery is not operating correctly (see 9.5 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.
Use the Data View menu to check measured values, particularly the accumulated battery energy in and energy out totals. These will have

to be compared 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 illuminated.

There may be a sustained load on the system. Check to see that appliances have not been left on. The Now, Today and AC History sections of the Data View tab provide information regarding the load power.

Check the generator schedule settings.

If the generator restarts a minute or so after it last stops then the battery is discharged, the battery volts are low or a load is present. Check the Now section of Data view to see the Generator Running Reason. You can shut the generator down permanently by setting the generator to NOT available.



Inverter Start/Stop/Shutdown Problems

SP PRO WILL NOT START

If the LEDs remain dark when the SP PRO is switched on it is likely that DC power is not present. Check that the main battery fuse is closed. Retry the procedure, if it continues to fail contact your supplier for further instructions.

If the SP PRO starts with the Shutdown led illuminated check the reason in the Attention Required window in the Now tab in Data View area of SP LINK, record the fault code indicated and contact your supplier for further instructions.

SP PRO SHUTS DOWN

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

The SP PRO 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 SP PRO front panel Shutdown LEDs indicate a problem, and illuminated check the reason in the Attention Required window in the Now tab in Data View area of SP LINK, record the fault code indicated and contact your supplier for further instructions.

AC POWER PROBLEMS

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

- Check the SP PRO front panel LEDs and Performance data 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 via SP-LINK.
- The SP PRO output may be varying due to switching on and off heavy loads. Check the output voltage reading (Inverter Load Voltage) via SP-LINK.

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

- Check the SP PRO front panel LEDs and Performance Data for information on the cause.
- The SP PRO may be in Power Save mode and the load is too small to detect. In this mode the SP PRO pulses the output until a load is detected. Check the Econo Power Level in SP LINK.
- The SP PRO may be shutting down due to overload or low DC voltage and periodically attempting restarts. If the SP PRO is shutting down switch off any heavy loads that may be causing the shut down. If the SP PRO 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 SP PRO front panel LEDs and Performance Data for information on the cause.
- Check the Attention Required window in the Now tab in Data View section of SP LINK to see if a fault is indicated and contact your supplier for further instructions.



Battery Problems



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

Battery does not charge properly

- Check that the battery charging requirements are correctly set up in the SP PRO.
- 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 DC History in SP LINK.

If 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 SP PRO 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

Appendix



Standards Compliance

AS62040.1.1-2003	Uninterruptible power systems (UPS) - General and safety requirements for UPS used in operator access areas
AS/NZS 61000-6-3:2007	Electromagnetic Compatibility (EMC) - Part 6-3: Generic Standards - Emission Standard For Residential, Commercial And Light-industrial Environments
AS/NZS 61000-6-4:2007	Electromagnetic Compatibility (EMC) - Part 6-4: Generic Standards - Emission Standard For Industry
AS 4777.2-2005	Grid connection of energy systems via inverters - Inverter requirements
AS 4777.3-2005	Grid connection of energy systems via inverters - Grid protection requirements
C-tick Australia	

Product Specifications



Note: Selectronic reserve the right to change specifications without notice. All ratings are at 40°C and nominal battery voltage unless otherwise stated. The product is specified to a maximum altitude of 2000 metres.



SP PRO SERIES SPECIFICATIONS		SPMC 240-AU	SPMC 241-AU	SPMC 481-AU	SPMC 482-AU	SPMC 1201-AU	SPLC 1201-AU	
Nominal battery voltage		24 V	24 V	48 V	48 V	120V	120V	
Continuous, output power	@ 25°C	3,000 W	4,500 W	5,000 W	7,500 W	7,500 W	18,000 W	
Continuous, charge current		125 A	188 A	104 A	156 A	63 A	125 A	
Continuous grid export power		rated output						
20 second load rating	@ 40°C	7,500 W	10,500 W	12,000 W	18,000 W	18,000 W	28,000 W	
20 second output current		28 A	40 A	47 A	70 A	70 A	110 A	
1 minute output power	@ 40°C	5,400 W	7,600 W	8,700 W	13,000 W	13,000 W	20,000 W	
60 minute output power	@ 40°C	3,200 W	4,700 W	5,300 W	8,000 W	8,000 W	20,000 W	
DC input voltage range		20 - 34 V	20 - 34 V	40 - 68 V	40 - 68 V	100 - 170 V	100 - 170 V	
TRANSFER SWITCH (Synchronous)								
AC transfer current capacity		63 A					125 A	
Max AC input source, (generator/grid)		15 kVA					30 kVA	
Max total output to Load, AC source + inverter		15 kVA					30 kVA	
AC transfer time		no-break						
If grid fails		0 - 0.03 seconds						
Battery charger type		Temperature compensated, 5 stage, power factor corrected with dual stage float						
EFFICIENCY								
DC consumption idle		6 W						
DC consumption standby (Econo Mode)		12 - 20 W					n/a	
ON with no load		31 W	36 W	37 W	40 W	38 W	75 W	
Peak efficiency – all modes		95%	95%	95.5%	96%	96.5%	96%	
10% load		90%	90.5%	91%	91%	91.5%	91%	
20% load		92.5%	93%	94%	94%	94%	94%	
50% load		94%	94.5%	95%	95.5%	96%	95.5%	
100% load		90%	91%	92.5%	93%	93.5%	93%	
AC OUTPUT (standalone)								
Range		210 to 240 V+/- 0.5%						
Regulation		<1% droop 0-100% rated load (<2% @ 150%, <5% @200%)						
THD		<3% @ 0-200% rated load						
Frequency		50 or 60 Hz +/-0.005% standalone						
AC SOURCE (input)								
Nominal voltage		240 V~						
AC current (Recharge, Bypass & Normal modes)		63 A					125 A	
Tolerance on nominal voltage		installer programmable 204 to 264 V~						
Nominal input frequency		50/60 Hz						
Tolerance on nominal frequency		installer programmable +/- 1% to 10%						
Generator can be started by		battery SoC, DC voltage, battery load, unit temperature, time & remote control						
FEATURES								
Battery temperature sensor		Included						
Mid point battery voltage sensing		Included						
Inverter display		22 x LEDs with auto adjusting intensity. Display indicates, charger status, remaining useable battery capacity, alarms, AC status. AC status LEDs powered from AC voltage. Generator control button. Output mode button. Alarm silence button.						
Digital Inputs		4 off: Max 60 VDC (Active > +6 V, Inactive < +3 V)						
Shunt Inputs		2 off: +/-75 mV, adjustable 25 A to 500 A						
Analogue Inputs		2 general purpose logged 0-60 V					n/a	
Relay Outputs		4 off: 60 V, 500 mA						
Digital outputs		3 off: 60 V, 5 mA						
Communication ports		2 off RS232 with adjustable baud rate of up to 57600						
Memory retention of settings & data		permanent						
SP LINK configuration and monitoring software		Standard, allows configuration of parameters or customer can view LED display remotely.						
Dimensions (mounted)		345 W x 545 H x 215 D					520 W x 870 H x 300 D	
Weight		29 kg	34 kg	35 kg	40 kg	40 kg	105 kg	
Circuit Breakers (AC Source, AC Load)		double pole 63 A					single pole 125 A	
Standards		AS 62040.1.1-2003, CE pending						
		AS/NZS 61000-6-3 2007				AS/NZS 61000-6-4 2007		
Grid Protection		AS 4777 2005				AS 4777 2005 pending		
Protection		IP43						
Warranty		5 to 7 years (country dependant)						

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