**SP800**
**Installation and Service Manual**

**Summary**

This report shows product specific information about the installation of the SP800 range of controllers. It details the installation of a unit, including troubleshooting and servicing knowledge.

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# Spa Power 800 Description

The SP800 is a microprocessor based spa pool controller capable of implementing the many features of an "intermediate" level spa pool.  It offers the user complete control over the following equipment via one or two poolside control panels.

- 2x Single speed pumps OR
  1x two speed pump
- Single speed blower OR extra single speed pump, etc
- Variable speed blower
- Small 24hr circulation pump *
- Ozone *
- Up to 4 LED Variable colour pool lights
- Pool temperature
- Sleep times
- Filtration cycle
- Clean up cycle



* These are controlled automatically so no user controls are provided.

Inside every SP800 is a 2.0 or 3.0kW flouropolymer coated element, an over temperature cut-out device, a temperature sensor, a water sensor, and a controller circuit board.  To install the unit, a power supply and digital switch are needed along with a suitable pump to circulate water through the heater.

Initial set up of the unit includes setting the clock on the control panel and a target pool temperature.  In addtion to these basic settings, many other options can be adjusted from the control panel.  Filtration times, heating options, sleep times, timers and alarms are all user adjustable from the menu system.  Refer to the User Instruction Manual for details.

As well as setting the user settings on the control panel, the hardware must be configured to suit the required outputs.  The hardware is configurable through adjustment of DIP switches found on the controller PCB.  The switches tell the controller what the ouputs should be, whether the Pump1 is single or two speed, if an ozonator is fitted, if a circ pump is fitted, the load shedding settings to use, etc.  These settings are further explained in the Dip Switch Settings section.

Each SP800 is factory fitted with a temperature sensor inside the heater assembly.  An optional In-Pool temperature sensor can be fitted, this will provide more accurate water temperture regulation because the controller is measuring the pool tempertaure not the temperature of the pipework.  Also, it is less affected by variations in operating conditions.  Both temperature sensors incorporate a digital solid-state sensor.

The water resistant poolside control panel features an overmoulded water proof membrane and a printed polycarbonate overlay that is resistant to pool chemicals. It contains an alarm beeper, soft touch keys and a custom backlit LCD display. All user controls are on this panel. For operation, refer to the User Instruction Manual.

# Model Variations

There are two versions of the SP800: SP800-20 and SP800-30. The only difference between the two models is the rating of the element; each controller has all available output sockets installed. DIP siwtches mounted on the controller PCB are used to either enable an output (eg. ozone) or to change its setting (eg. one or two speed pump).

# DIP Switch Settings

There are a total of 16 DIP switches and these are used to configure the controller's outputs. Some of the switches will only be relevant to the SP1200, as the PCB used in both controllers is similar. For a quick guide see the inside lid label.

**Switch A** Touchpad Count.
This tells the controller how many touchpads are connected.
        ON – One touchpad connected
        OFF – Two touchpads connected

**Switch B** Model Selection.
Used to tell the microcontroller on the controller PCB if it is installed in an SP1200 model or an SP800. The SP1200 is able to control a dual heater assembly as well as having more outputs for pumps. This will be factory set.
        ON – SP1200 model
        OFF – SP800 model

**Switch C** Circ Pump.
This switch tells the controller if a 24hr circ pump is connected. If fitted this must be the pump that circulates water through the heater and filter. Without a circ pump fitted, Pump 1 is automatically controlled to circulate the water. With the circ pump fitted Pump 1 will revert to an on/off pump under user control.
        ON – Circ pump fitted
        OFF – Circ pump not fitted

**Switch D** Pump 1 type.
This is used to tell the controller what type of pump is connected to the Pump 1 socket, either one speed or two speed.  A two speed pump uses two relays on the controller PCB, whereas a one speed only requires one.  For this reason Pump 1 can be set up either as a single two speed pump or a pair of one speed pumps.  A single one speed pump can be connected but must be plugged into the Pump 1A socket so the controller links this pump to the heater function (the same follows for the two speed pump – see lid label).
      ON – 2 x one speed pumps
      OFF – 1 x two speed pump

      **\*\*\*IMPORTANT: Do not install a two speed pump if the DIP switch is set for 2x single speed pumps, this will power both high and low windings.\*\*\***

**Switch E** Pump 2 Fitted.
Only applicable to the SP1200 model.  Leave in OFF position.

**Switch F** Pump 2 type.
Only applicable to the SP1200 model.  Leave in OFF position.

**Switch G** Aux fitted
Used to tell the controller if an Auxilary load is fitted.  This output is on/off control only and can be used to switch a one speed pump, single speed blower or light.
      ON – Aux fitted
      OFF – Aux not fitted

**Switch H** Ozone fitted
This switch is used to enable the ozone output.  If an ozonator is installed, the controller will associate it with the pump that is circulating water through the heater tube (circ or Pump1), and only operate the ozone when the pump is on.
      ON – Ozone fitted
      OFF – Ozone not fitted

**Switch I** Ozone off when spa in use
If ozone is fitted (Switch H is ON), this switch will tell the controller to turn the ozone off when the spa is being used.  If a button on the touchpad is pressed then the controller will turn the ozone unit off and wait 30 minutes before turning it back on.
      ON – Ozone unit will stay on
      OFF – Ozone will turn off when the spa is in use

**Switch J, K, L** Load shedding settings
These three switches set the loadshedding characteristics of the controller.  The table on the following page shows the possible combinations.

| Load shed settings | | | Load Sheding |
|---|---|---|---|
| DIP Switch J L/S option 3 | DIP Switch K L/S option 2 | DIP Switch L L/S option 1 | SP800 HTR 1 |
| OFF | OFF | OFF | - |
| OFF | OFF | ON | 4 |
| OFF | ON | OFF | 3 |
| OFF | ON | ON | 2 |
| ON | OFF | OFF | 1 |
| ON | OFF | ON | 1 |
| ON | ON | OFF | 1 |
| ON | ON | ON | 1 |

Number = Number of pump/aux/blower loads switched ON to load shed the heater element. 2 speed pumps on low and circulation pump are ignored in the load count.
SPVSB ON any speed counts as one Load.

See the SP800 Setup Guide and Loading Calculator for more details.

## SP800 Specifications

| Specifications | |
|---|---|
| SP800 dimensions | 360mm x 220mm x 95mm |
| Heater tube pipe diameter | 50mm |
| Heater pressure, max (head of water) | 300kPa (30m) |
| Temp – max controlled | 41.5°C |
| Temp – thermal cut out | 50°C +/- 3°C |
| Temp – max ambient | 40°C |
| Pool side touchpad – face – retangular & oval | 172mm x 89mm x 5mm |
| Pool side touchpad – body | 135mm x 65mm x 26mm |
| Recommended switch hole | See diagram on next page |
| Switch lead length | 3m |
| | |
| **Supply requirements (Max total loading)** | |
| SP800-20  2.0kW | 220-240V, AC, 50-60Hz, 40A |
| SP800-30  3.0kW | 220-240V, AC, 50-60Hz, 40A |

| Max Outlet Loading 2kW & 3kW | |
|---|---|
| Pump 1A | 220-240V, AC, 50-60Hz, 10A |
| Pump 1B | 220-240V, AC, 50-60Hz, 10A |
| Aux | 220-240V, AC, 50-60Hz, 10A |
| SPVSB | 220-240V, AC, 50-60Hz, 7.5A |
| Circ Pump | 220-240V, AC, 50-60Hz, 2.5A |
| Ozone | 220-240V, AC, 50-60Hz, 2.0A |

**To prevent early system failure, the sum of the outlet loadings plus heater should not exceed the 'Max total load' at any time**. See the SP800 Loading Calculator to check the system in question.

**Switch Cutout**

Ø65 mm

70 mm
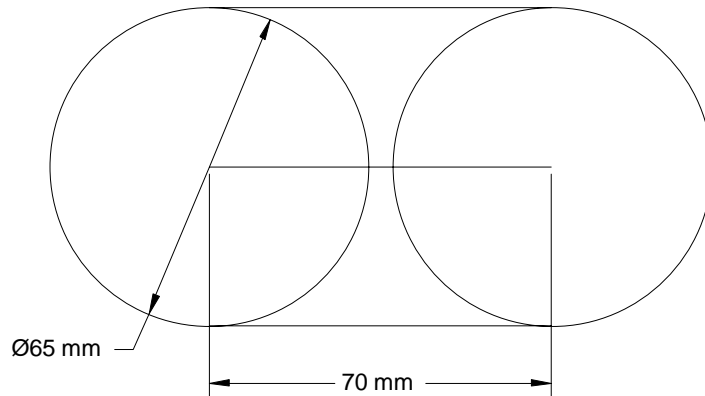
# PCB Sockets

There are seven round "mini-din" connectors situated at the top right of the SP800 PCB. They are provided so that optional equipment (SPVCL, temp sensor, SPVSB) may be connected to the system during installation, or at a later date. It is important that the power to the SP800 be disconnected when connecting or disconnecting any peripheral equipment to reduce ESD or transient damage to the equipment and also to reduce the risk of electrocution.

# General Installation Instructions

### Plumbing

1. The heater should be plumbed so the water flows past it from left to right when horizontally mounted and bottom to top when vertically mounted.  IMPORTANT: If vertically mounted, the water sensor MUST be at the top.
2.  When connecting pipework to the heater make sure the 'O' rings are properly seated in the mac union fitting. Hand tighten only. Using tools will distort the fittings.  Care must be taken to ensure that all joins are inline, otherwise leaks may occur.
3. Make sure the controller is mounted securely so that vibration is minimised.
4. It is recommended that the pipework has shut off valves so the controller and pump can be removed for service without having to empty the pool.
5. Pressure test the installation to check for leaks.
6. Support all pipework to prevent sagging and to prevent movement when pumps turn on or off.
7. Insulate all pipework to decrease heat loss.

Refer to the 'Circulation pump' and 'Ozone system' sections of this manual for information regarding the installation of those systems.

## Electrical

1. The spa pool must be connected to a suitable weather protected supply, equipped with a double pole isolating switch, which is of the correct rating and complies with the local wiring regulations. When installing refer to your local wiring code. In particular refer to ECP2 and ECP25 (AS / NZ). Or EN 60364-4-1 and EN 60364-7-1 (EU). The system must be installed in such a way that live parts are not accessible by a person in the pool.
2. Ensure the system is protected by an RCD.
3. It is recommended that signal and power wiring be separated to prevent interference and that the unit is supplied from a dedicated power circuit.
4. Loop wires before they enter the unit to prevent water running down them and into the unit.
5. Check all connections are correct and tight.
6. Check that the unit and supply are not overloaded.  Use the loading calculator for details.

# System Components

## Water Detection

A water detection system is used to tell the controller when the heater tube is flooded with water and therefore when it is safe to turn the element on. Water detection is achieved by optical means, where an optical bolt  (water sensor) is mounted in the element assembly. Inside the optical bolt is a light source and a light detector.
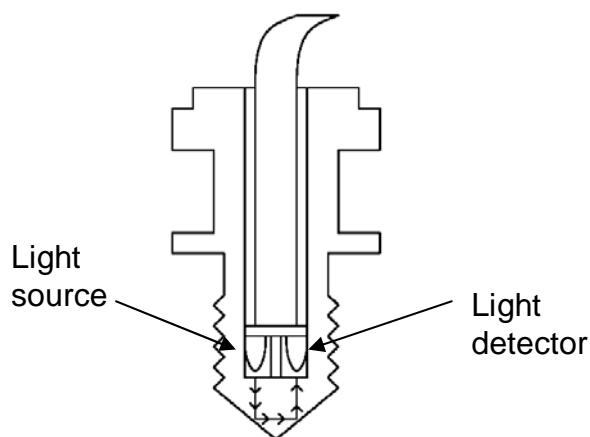


When the tip of the optical bolt is surrounded by air the light emitted by the light source is reflected back to the light detector as the tip acts like a mirror.
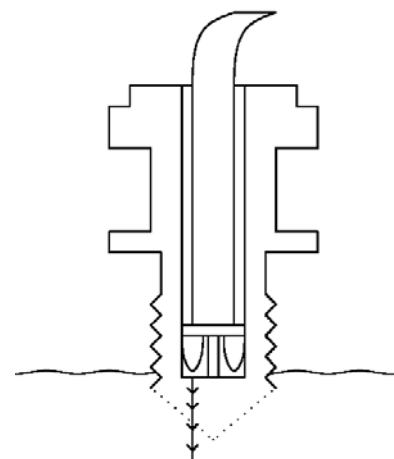
The mirroring effect of the tip is lost once submerged and the detector receives no light

The optical bolt has many advantages over traditional pressure switches and flow switches; there are no moving parts or adjustments required. Once installed, it is very robust and offers a long service life. The optical bolt is also less sensitive to collecting hair and debris. However care must be taken to ensure that air is not trapped in the heater tube during normal operation. This is especially important when low flow rate pumps are used (e.g. low flow circulation pumps), as they may not produce sufficient water flow to clear air from the heater tube. See the 'Circulation pump' section for more information.

The water sensor is connected to the SP800 PCB. Additional circuitry is included on the PCB to check that the water sensor is connected and is functioning correctly.

## Thermal Cut-out

Each SP800 contains a thermal cutout device (also known as a klixon). It is an electro-mechanical device that acts as a switch. When it is heated above 50°C +/-3°C it switches off creating an open circuit. When it cools below 38°C it switches on and creates a short circuit.

It is placed in series with the heating element and tightly coupled (thermally) to the brass element boss. The element will then be switched off if the brass element boss gets too hot.

There is also an associated electronic detection circuit that is used to sense if power is getting to the element. If the thermal cutout has operated the circuit will sense a lack of power and the controller will fault (Error 6). The controller will not attempt to recover from this condition, it will need to have the power turned off and back on again to clear the fault once the thermal cutout has cooled below 38°C.



## Temperature Sensor

The SP800 comes with a temperature sensor built into the element assembly which communicates with the controller via a data link. It is housed in a tubular pocket that extends into the heater tube's water flow. The temperature sensor is sealed into the pocket and plugs into the SP800 PCB. This sensor configuration is known as 'in-heater' temperature sensing.

'In-heater' temperature sensing is the most convenient method of sensing the pool's water temperature as it is built into the controller, however it is not the most accurate. It will generally provide good temperature regulation of the pool if used in conjunction with a high flow rate pump and good pool insulation.

A large hysteresis is required if an In Heater sensor is used. Here the pump and element are turned on when the sensed temperature is below the target temperature by the hysterisis amount and turned off when up to temperature. A large hysteresis is required because the water in the heater will cool down when the pump is off at a different rate to the main body of water in the pool. If the pipe work is poorly insulated the system can cycle rapidly (thermally) resulting in the pump & element turning on and off frequently thus shortening equipment life and irritating the user. If the pipe work or

pool cabinet is well insulated, the heater does not cool down much below the pool temperature and can result in poor temperature control of the pool.

A better method exists.  It is called 'in-pool' temperature sensing.  In this method a temperature sensor is mounted in the pool shell so that it is able to directly sense the pool water temperature.  This is a far more accurate method of detection and allows the use of tighter hysteresis in the temperature control software.  It is much
less affected by differing insulation designs and ambient temperatures.
For both types of temperature sensor, the amount of hysteresis can be altered using the menu system.  See the User Manual.

'In-pool' temperature sensors use the same digital temperature sensing device as the 'in-heater' sensors.  For accurate sensing of the pool water the digital sensor in the 'in-pool' sensor needs to be tightly coupled (thermally) to the pool water and insulated from any other ambient temperature effects i.e. under skirt ambient.  This is achieved by mounting the sensing device to a stainless steel disk and then packing the case of the sensor with insulation.  Additional closed cell foam insulation (supplied) must then be placed around the sensor when mounted in situ.

**Installing an In Pool Temperature Sensor**
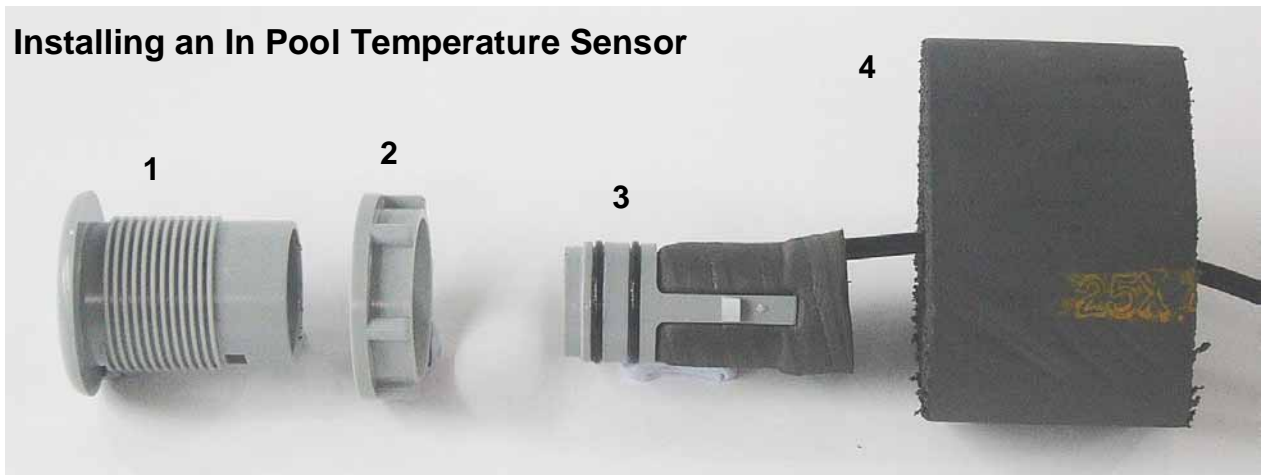
The new design of In Pool temperature sensor installs in the same manner as the existing products.  Fit the body (number 1 in the diagram) into the hole in the shell and secure with the lockring (2).  Use silicone or similar for a water proof seal.  Slide in the sensor slug (3) into the body, there should be enough silicone grease to make it water tight.  It is important that the foam plug is pushed as far as it will go into the body.

Fit the large foam insulation over the entire assembly.  The finished installation should look like the picture on the right, with the sensor insulated from the underskirt ambient temperature.  This will help give an accurate measurement of the water temperature.

## Spa Power Variable Colour Light (SPVCL)

All SP800 controllers can operate up to four 'Spa Power Variable Colour Lights' (SPVCL). Utilising the latest in efficient LED lighting technology, the SPVCL offers long life and a range of vibrant colours to make any pool look stunning. The SPVCL is controlled via the controller's poolside touchpad. The range of colours and modes of operation are dependant on the controller (see the SP800 User Instructions in the appendix). Installation is as per a standard 2.5 inch pool light.

### Features



- Energy efficient design. Maximum 12V power drawn is less than 84mW
- Light output exceeds that of a typical 9W bulb using filter lenses
- Typical LED life of 50,000hrs to 100,000hrs compared to a normal incandescent bulb life of between 5,000hrs to 15,000hrs
- Energy efficient design means the SPVCL runs far cooler than a normal bulb
- Perfectly matched primary colours support smooth colour mixing

## Spa Power Variable Speed Blower (SPVSB)

All SP800 conrollers can control one 'Spa Power Variable Speed Blower' (SPVSB). The SP800 will automatically sense that a SPVSB has been plugged in and will make the variable speed functionality available on the touch pad.



The cleverly designed SPVSB has been produced to accompany the latest Spa Power range of controllers. It contains all the required speed control circuitry and simply plugs into a controller for both power feed and speed control. The SPVSB is then controlled via the controller's poolside touchpad and the user can control the airflow in the pool simply by pressing a button.

SPVSBs are available in two models: with or without a fitted power supply. Those without (models Q5602-XXX) are intended for use only with a Spa Power controller. Where as those with a power supply (models Q5603-XXX) can be used either with a controller or in a stand-alone configuration with their own dedicated touchpad.

## Circulation Pump

The use of small circulation pumps that run for long periods of time with low flow rates is becoming more common in the spa pool industry. These pumps are used to circulate water through the pool's filter, heater and ozone systems and offer low power usage and silent operation. They are generally between 80W to 375W and have flow rates up to about 200l/m.

All SP800 controllers have been designed to operate in conjunction with small circulation pumps but care must be taken to ensure that the following points are considered.

**1) Air must not collect in the heater tube.**
The water detector may sense any air trapped in the heater tube, causing the controller to think the heater tube is empty and resulting in it faulting with 'Err 1 Prime Failed'. Also froth in the heater tube may still activate the water sensor while failing to cool the element boss, resulting in thermal cut-out operation (Error 6).

**2) There must be sufficient water flow through the heater tube.**
If the water is not flowing through the heater tube fast enough then the heat energy will build up in the water and will lead to large temperature rises and at worst will cause the thermal cutout to activate. This will lead to an Error 6 condition and the controller will beep. The controller will then need to be switched off and back on once the heater tube water temperature has dropped below 38°C. The thermal cutout will automatically reset below this temperature.

The thermal cutout is set to operate at 50°C +/- 3°C. This gives a maximum allowable element boss temperature of 47°C. If the pool is set to 41.5°C there is room for a maximum water temperature rise of 5.5°C. From this requirement the pump must be carefully matched to the size of the element. If the pump is too weak, the unit may fail under thermal cutout condition (Er6).

Heating water with low flow rates may cause the layer of water in contact with the element to boil. As the water boils it changes state and produces bubbles. These bubbles must be able to escape from the heater tube or they may gather and finally be detected by the water sensor causing a no water error.

Due to the temperature rise caused by low flow rates, it is advised that an 'in-pool' temperature sensor be used. This will provide the required accurate temperature control of the pool.

When using an injector to introduce ozone gas into the circulation pump's water circuit, it is necessary to consider the water flow rates, both in the heater tube and the ozone injector. It is also important to situate the injector 'down stream' of the controller for air bubble reasons. See 'Ozone systems' for more detail. In order to maintain sufficient water flow it is recommended that an injector bypass system be implemented.

## Plumbing for Circulation Pumps

**It is essential that no air bubbles can collect in the heater tube.**

The following plumbing configurations have proven to be helpful.
- Use step down offset adapters, like that shown on the right hand side of the diagram below, do not use those shown on the left. This will allow any air to flow out of the heater tube and not collect around the water sensor or…
- Mount the controller on a slight incline so that the water outlet is raised. This will aid the air to flow out of the heater tube.
- Plumb the controller with 45° or 90° 50mm elbows (facing up) then step the pipe down to the required diameter.



X           √
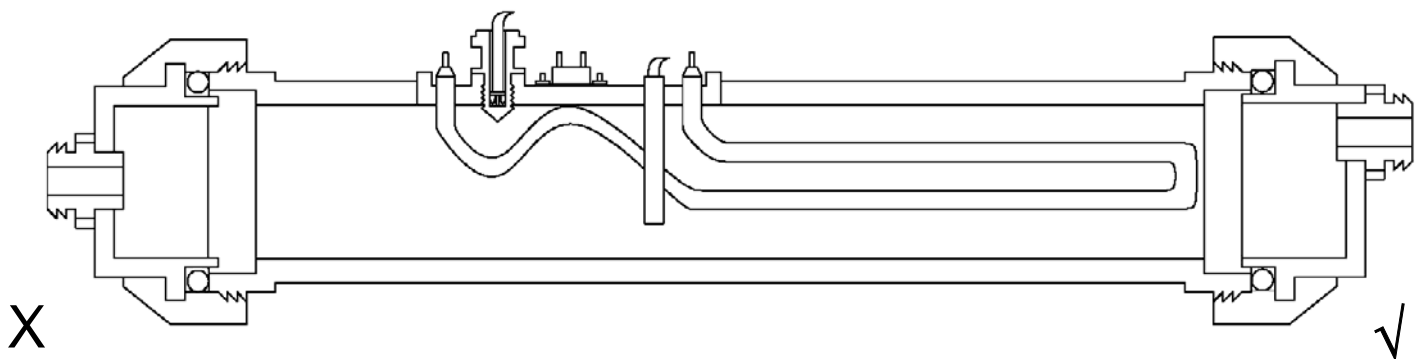
<u>Sectioned drawing of a heater tube with two different
outlet adapters</u>

### Other circulation pump tips
- Like all equipment, circulation pumps have a limited service life that is affected by the environment they work in.  If a pump is used 24hrs/day it will wear out faster than if it were used 12hrs/day.  On SP800 models the circulation pump is turned off when the system is asleep.  This feature may be used to extend the circulation pump's life.
- Circulation pumps are designed for low flow rates so they have small impellers that are easily blocked.   Be careful not to allow debris to enter the pump when changing a filter or use the pump without a filter.
- Due to low flow rates, it is recommended that a skimmer type spa filter be used to allow the pump to remove floating matter from the pool's surface.
- Make sure the pump is not starved for water flow as cavitation and/or air locking may occur.

**Ozone Systems**

All SP800 contollers are equipped with an ozonator outlet socket. This socket is only turned on when the main filtration pump is operating. This will provide ozonation of the pool water during the filtration period. See 'Model Variations' for more details.

**Ozone Background Information**
- Ozone does not affect the pH balance.
- Ozone reduces total dissolved solids in water.
- Ozone helps to reduce the amount of chemicals required to treat a pool.
- Ozone kills bacteria, viruses, cysts, yeast, molds, and mildew.
- Ozone is a gas that is generated from fresh air and is dissolved into the pool water.
- Ozone has more oxidising potential than chlorine gas and bromine.
- Ozone can be generated by UV light or corona discharge (CD). Corona discharge uses a high voltage to produce a spark. Generally CD ozonators produce more ozone than UV ozonators. Both types have a limited service life.

When using an injector to introduce the ozone gas into the water, it is recommended that a water by-pass be used parallel with the injector. See diagram below. A by-pass will allow the water flow rate through the injector to be tailored (by adjusting the ball valve) so that the correct ozone gas flow and therefore gas to water mixture is delivered. It will also ensure the water flow rate through the heater is maximised. Refer to your ozonator's installation instructions for more information.
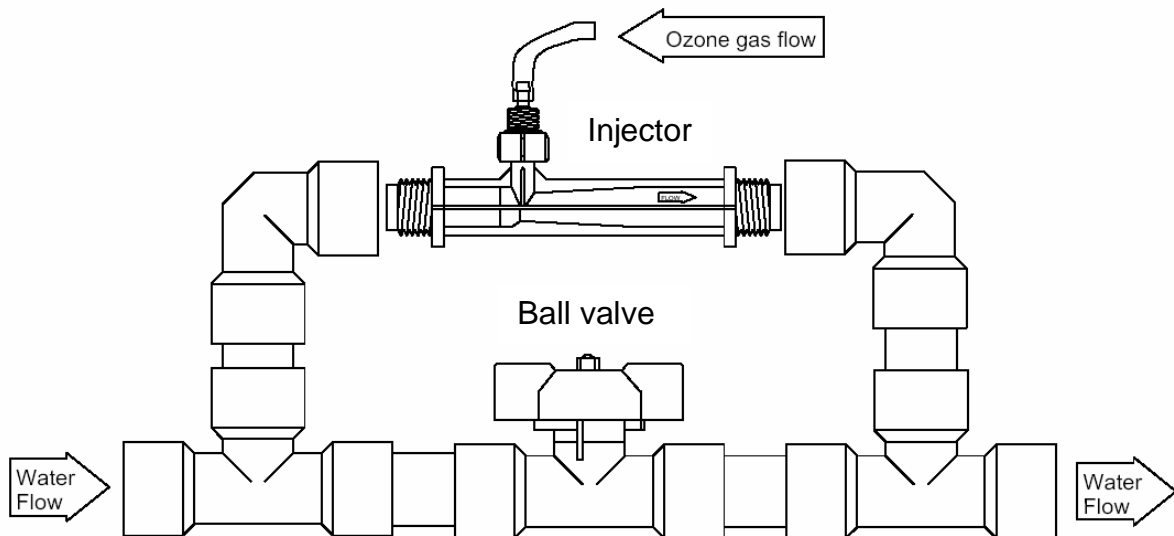


The best use of any generated ozone gas, is to dissolve it into the water and try to keep it dissolved in the water as long as possible.

Tips:
- A low water flow rate through the injector produces a low gas flow rate and results in higher ozone gas concentration and better ozone absorption into the water.

- Also a low injector water / gas flow rate produces small fine bubbles that are suspended in the water. This is better than large bubbles that rise straight to the pool's surface and let the gas escape.
- Ozone production is dependant on the condition of the air fed into the ozonator. Try to keep the air clean, dry and cool. Try to pipe the air into the ozonator's input from outside the spa shell.
- Be careful of ozone when in the gaseous state as it will damage unsuitable plastics very quickly.
- Ozonators (UV and CD) have a service life. This can be prolonged if they are not used 24hrs a day. Most CD systems producing 50mg/hr of ozone gas need to run for about 4-8hrs per day at most to treat the water.
- Some ozonators require a minimum air flow rate to cool the ozone unit. Refer to your ozonator's instructions for more detail. Some ozonators require the injector to produce a slight suck when blocked off with a finger whereas others require a specific flow rate that can be estimated by timing the injector sucking water out of a bottle.

## AMP Plugs

All SP601, SP800 and SP1200 controllers are fitted with AMP style connectors. All peripheral equipment can be ordered with AMP cordsets for use with these controllers. Each cordset will have an identiying label on the side. It is important that the locking mechanism is engaged on the AMP plug to secure the connection and to protect against mechanical vibration and water ingress. The plug is pushed home and the plastic tabs engage onto the socket as shown on the right. All plug and socket pairs should have a silicone gasket seal to protect against water and any socket without a plug should have a bung as shown in the picture on the right.
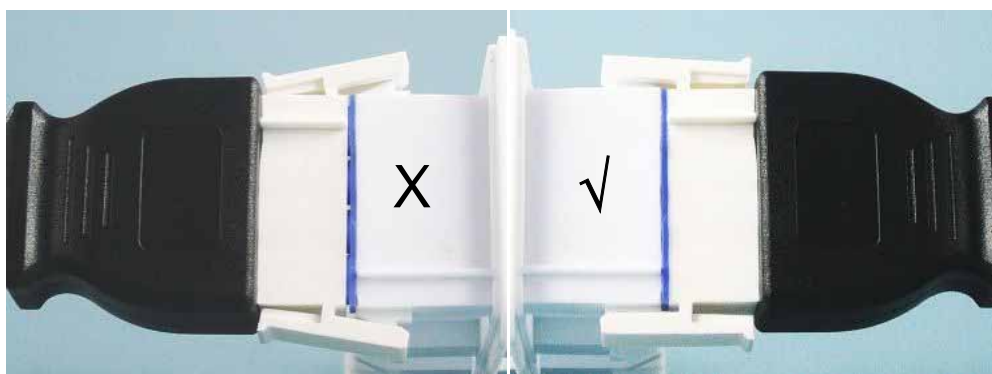
## Cable Entry

Both the SP800 and SP1200 are supplied without glands for the mains power supply into the unit. Different setups and intsallations will require different types of glands/fittings. It is the intaller's responsibility to ensure that the cable entry gland meets IPX4 requirements.

# Diagnostics

The SP800 controller has extensive self-diagnostic capabilities. In the event of a problem it will sound an alarm (beep) and indicate an error number according to the nature of the problem. Pushing the scroll button will mute the alarm but if left alone it will stop after four minutes. The error numbers and their meanings are listed below.

Error 1  = PRIME FAILED
This is a special case in that it is not a latching error. It is not necessarily a problem with the SP800 itself but indicates that no water is being detected in the heater. The LCD display will show three options on the bottom line of text: Retry:Mute:Demo. Pressing the Down button (Retry) will run the pump associated with the heater (Pump1 or Circ Pump) for 10 or 60 seconds respectively, to try to flood the heater tube. Normal operation will resume if successful. If unsuccessful, Error 1 (H20) will be indicated again.

- *Check valves and jets are open correctly, filter is not blocked, pumps are working and that there is enough water flow through the heater tube.*
- *Check that air is not trapped in the heater tube. See the 'Circulation Pump' section.*
- *Check for leaks (water or air) in pipework, O-rings, seals and loose fittings. If there is air around the water sensor the controller will think the heater is empty. This may occur if there is a small leak so that the water drains out of the heater over time.*
- *If there is water flow then the water sensor may be dirty or faulty. Remove and inspect, replace if necessary. Check the water sensor to circuit board connection for water, corrosion or fouling.*
- *When all other options have been exhausted change the circuit board.*

Error 2 is not used.

Errors 3-8 are latching errors.
Operation will stop and will not continue until the controller is reset (switched off and on again at the main power supply).

Error 3 = STUCK BUTTON
This error indicates that one of the buttons in the control panel is stuck or has been held down for more than one minute. This may be caused by water getting into the panel or by damage to the control panel or its cable, or by the pool cover pressing on the touchpad.

- *Inspect the control panel for damage; test the operation of each button by checking that they all feel the same.*
- *Check the control panel to main circuit board connection and the cable itself for any damage or corrosion.*
- *Disconnect the control panel and run the controller for one minute. If it cuts out on Error 3, then the problem is in the controller.*
- *When all other options have been exhausted change the main circuit board.*

Error 4 = NO WATER SENSOR
This error indicates a problem with the optical water sensor in the heater. It may be caused by the sensor being disconnected or by damage to the sensor.

- *Check the water sensor to circuit board connection for water, corrosion or fouling.*
- *Remove the water sensor and inspect, replace if necessary.*
- *When all other options have been exhausted change the circuit board.*

Error 5 = OVERTEMPERATURE

This error indicates that the digital temperature sensor in the heater or pool has detected a temperature of 45°C or more. This is not necessarily a problem with the SP800 itself. It might be caused by excessive pump use during hot weather. In this case reduce the filtration time and increase the sleep time.

- *Check that another source of heat is not heating the pool excessively. Look at pumps operating for long durations, solar heating, heat pumps, lighting etc.*
- *Check that the ambient temperature is not above or close to 45°C.*
- *If an in heater temperature sensor is used check that there is adequate water flow through the heater. Check that the filter and pump are not blocked and that the jets and valves are open.*
- *Measure the pool temperature and verify the controller's reading. If the controller has an in heater sensor then circulate the water for a few minutes first. If the controller is reading an incorrect temperature then the temperature sensor may be damaged or faulty. Connect another sensor and check that the controller is operating correctly. If it is then change the temperature sensor, if not change the circuit board.*

Error 6 = THERMAL CUTOUT TRIPPED

This error indicates that the safety electromechanical over temperature cutout on the heater has operated. This is not necessarily a problem with the SP800 itself. It may have been caused by high temperatures during shipping or by disconnection or failure of the pump. Waiting for the heater to cool below about 38°C and switching the power off and on again will clear this error.

- *Check valves are open correctly; pumps are working and that there is adequate water flow through the heater tube.*
- *Check that filters are clean and jets are open.*
- *Check thermal cutouts in pumps and other equipment. (Run pump directly from mains to see if it over heats and cuts out.).*
- *Check all connections in the controller are tight and clean.*
- *Make sure air cannot collect in the heater tube. Refer to the 'Circulation Pump' and/or 'Ozone' sections of this manual when using these systems.*
- *When all options have been exhausted change the circuit board.*

Error 7 = STUCK RELAY

This error indicates a problem with the heater control circuitry inside the unit.

- *Check that there are no short circuits across the relay terminals or associated wiring.*
- *Check that all internal wiring is correct and that terminals are tight and clean.*
- *When all options have been exhausted change the circuit board.*

Error 8 = NO TEMPERATURE DATA

This error indicates a problem with the digital temperature sensor in the heater or pool. It might be caused by the sensor being disconnected or by damage to the sensor or cable.

- *Use the diagnositc display to determine which temperature sensor is at fault (see Diagnotsic Displays section).*
- *Check the temperature sensor to circuit board connection for water, corrosion or fouling.*
- *Connect another sensor and check that the controller is operating correctly. If it is then change the temperature sensor, if not change the circuit board.*

Error 9
This error indicates a problem with the real time clock within the SP800.
- *Try reseting the unit by disconecting the power.*
- *If fault continues to occur, change PCB.*

# Troubleshooting

1) The thermal cutout keeps operating.
- *Check that there is adequate water flowing through the heater tube and that the plumbing is not blocked.*
- *Check that filters are clean and jets are open.*
- *Check thermal cutouts in pumps and other equipment.*
- *Turn the power supply to the unit off and allow the unit to cool. Turn the power back on.*
- *Check the pump is not heating the pool. A large pump running continuously will heat the pool until the power to it is cut.*
- *If a small circulation pump is in use check there is enough flow through the heater tube and that air is not collecting in the heater tube. Try to measure the flow from the circ pump outlet jet. This can be done by holding a hose on the jet's outlet and timing how long it takes to fill a bucket. Aim for more than 50 L/m. i.e. it should take no longer than 24 seconds to fill a 20 litre bucket.*
- *The unit is faulty and needs to be returned for service.*

2) The unit won't power up.
- Check there is power to the unit and that the control panel is plugged in correctly.
- *Check the control panel for damage or corrosion. Try another control panel.*
- *Check all connections are correct, tight and clean.*
- *Replace the unit.*

3) The unit leaks.
- *First ascertain where the leak is.*
- *Mac-unions. Check that there are O-rings in the mac-unions. Check that the unions are tight, aligned and not distorted.*
- *Heater tube. Inspect the water sensor body for cracks and O-ring location. Tighten or replace if necessary. Tighten the element boss screws to compress the O-ring.*
- *Replace the heater tube if required.*

4) The RCD or Ground Fault Device keeps tripping out.
- *Check for shorts to earth and loose, dangling wires. Check the element earth leakage. Try disconnecting equipment piece by piece until you can identify what is causing the fault.*

- *Check that the RCD is not also an overcurrent circuit breaker. If it is, make sure it is rated for motor start up surges and is not overloaded.*
- *Make sure the unit is not drawing too much current from the supply – see loading calculations.*
- *Check for damage to wiring, pumps, blowers, and lights.*
- *Check for leaks around live parts.*
- *Check earth connections.*
- *Check the supply is wired correctly.*
- *Some older switchboard ELCBs are not compatible with EMC filtered equipment and must be replaced.*
- *The ELCB may be faulty and require replacement.*

5) My pool is getting too hot.
- *Check that another source of heat is not heating the pool excessively. Look at pumps operating for long durations, solar heating, heat pumps, lighting etc.*
- *In extreme climatic conditions where there is a high ambient temperature the normal operation of the unit and pump can cause the pool to over heat. To counter this, remove the pool cover over night to allow the pool to cool. Be sure the pool is safe to leave uncovered. Consider access by children, animals etc.*
- *Increase sleep time and minimise filtration time.*

# Diagnostic Displays

The SP800 and 1200 controllers have four diagnostic/information displays that may be of use during service and installation.  These displays provide information about:

1) Software versions (firmware) in the controller and switches
2) DIP switch settings
3) Temperature sensor readings and their operational status
4) Logged error codes

The diagnostic displays can only be activated in two display states:

1) When the controller is displaying an error code:
 Press and hold down the SCROLL button for approximately five seconds (until a double beep is produced).  The first diagnostic display will be shown.

2) When viewing the default display (no error raised and not within the menu system):
 Press and hold down the SCROLL button.  The main menu should be displayed. While viewing the main menu, keep holding down the SCROLL button for approximately five seconds (until a double beep is produced).  The first diagnostic display will be shown.

Once the first diagnostic display is shown, you may step through the remaining three displays by pressing the SCROLL button.  One additional press of the SCROLL button will return you back to the previous display state (error or default display).  There is no automatic timeout while viewing the diagnostic displays.

## Diagnostic display descriptions

Note: In the text below "L1:" and "L2:" refer to text line one (top) and text line two (bottom) on the switch LCD.

### 1) Software versions

L1: " **Vxxx DD/MM/YY** " (controller software version)
L2: " **Vxxx DD/MM/YY** " (switch software version)

Where xxx is the software version (1 and beyond) and DD/MM/YY is the release date.

Note 1:  The switch software version is created by the switch itself and not the controller. If more than one switch is connected their versions may differ because each switch will display its own version.

### 2) DIP switch settings

L1: " **DIP SWITCHES:   ** "
L2: "**BCDEF--------P**"

Each DIP switch is represented by a character on line two of the LCD.  There are a total of 16 DIP switches, but switch "A" cannot be read by the micro-controller and is therefore not displayed.

If the letter "B" to "P" is displayed then the given DIP switch is ON.  If a "-" is displayed in place of the letter then the DIP switch is OFF.  Refer to the DIP Switch Settings section for interpretation of the DIP switch settings and how they affect the controller's configuration.  Note that the way the controller interprets the DIP switches may change with different controller software versions.

### 3) Temperature sensor readings and their operational status

L1: " **TMP-H: *tt.tt,xy*** " (in-heater temperature)
L2: " **TMP-P: *tt.tt,xy*** " (in-pool temperature)

Where tt.tt is the current temperature reading, x is the presence digit and y is the status digit (see below).

Presence digit:
    0: Sensor presence not logged
    1: Sensor presence has been logged (currently, or previously fitted)

Status digit:
    0: Sensor present and responding OK
    1: Data line always high, no presence pulse (sensor not fitted)
    2: Data line always low (or shorted to GND)
    3: Data error (Bad data checksum or configuration byte)
    4: Sensor returned reset value of 85.00°C

Note 1: After power is applied to the controller or the defaults are loaded, it takes approximately one minute for the controller to log that a given sensor is fitted (presence digit = "1").

Note 2: Once a sensor starts producing errors, it takes approximately one minute for user to be notified by means of messages on touch pad etc. This only occurs for sensors with a presence digit of "1".

**4) Logged error codes**

L1: **" LOGGED ERRORS "**
L2: **"14------------"**

Displays the last 15 error codes recorded by the controller. The most recent error is shown first on left hand side of display up to the oldest error on right hand side. Error codes are single digit numbers 1 to 9. If no error has been logged in a given slot then a dash "-" is shown instead.

Note 1: When the defaults are loaded all logged errors are cleared (display will show all dashes).

Note 2: Errors are stored approximately 4 seconds after they are generated. If power is lost before 4 seconds elapse the error may not be logged.

# Language Selection

The software inside the controller is capable of displaying three languages: English, German and French. To change the active language, first hold the down button for four seconds and the selection menu will be shown. Use the up and down buttons to scroll through the available choices and the set button will select the language displayed.

# Parts Replacement

Every precaution has been taken to insure the highest quality and reliability is delivered in each SP800. However in the unlikely event that something does go wrong, it is normally a simple operation to replace the faulty section of the controller or the entire controller if necessary.

To avoid unnecessary part replacement it is important that the fault be diagnosed correctly. Refer to the diagnostics and trouble shooting sections before attempting to change any parts. Only authorised service agents should attempt to change parts.

Most problems are caused by something obvious so remember to check the obvious first: connections, power supply, pumps, water flow, and leaks… Refer to the wiring diagram when checking connections.

## Heater Tube

<u>Removal</u>
Disconnect from the supply. Close the water valves so that the unit can be removed without draining the pool or causing a flood. Loosen the locking rings on the mac-unions and disconnect the pipe work (don't loose the O-rings). Note the connections in the unit so that they may be disconnected and reconnected later on.



Disconnect the heater tube wiring using a pair of pliers to grip each terminal in turn– don't pull on the wire itself. Disconnect the two wires from the thermal cut out, disconnect the earth wire, disconnect the element phase and neutral wires and unplug the water sensor and temperature sensor from the PCB. Unscrew the two mounting screws that locate the heater tube in place so that it can be removed.
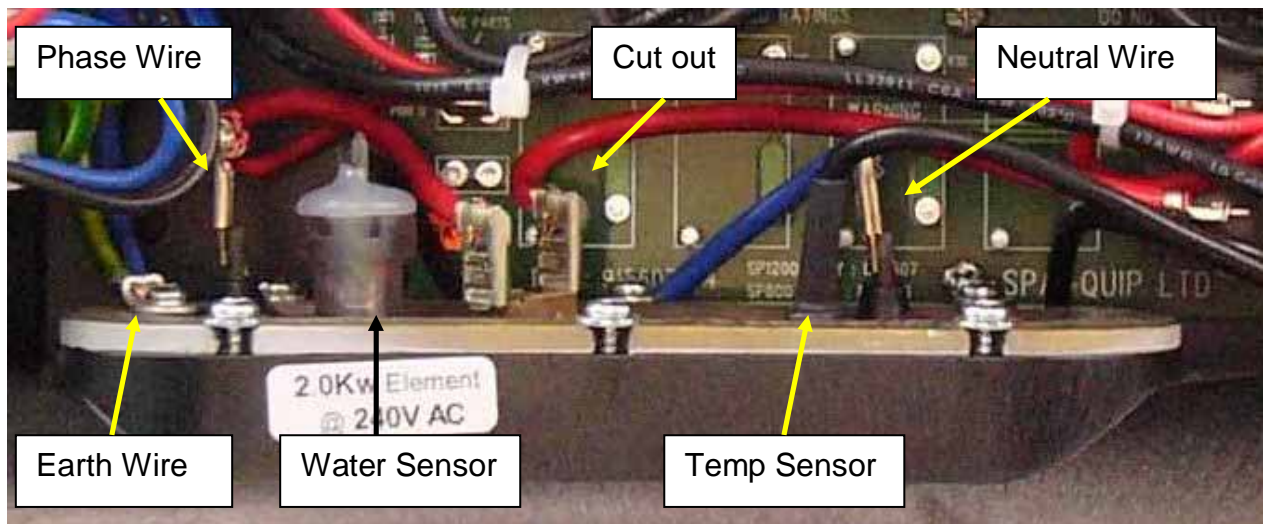


<u>Installation</u>
Installation is the reverse of removal, but remember to soak up any water in the unit. Check the replacement element is the same rating as the old one and check the connections are correct and tight. (Refer to the appropriate wiring diagram) Turn the water back on, bleed air from pipe work and reconnect power. Check the operation of the unit and check for leaks.

**Water Sensor**

Removal
Disconnect from the supply. Isolate the water supply and drain the heater tube so that the water sensor can be removed without draining the pool or causing a flood. Cut the cable ties on the sensor's leads and disconnect the plug from the circuit board. Unscrew the sensor from the element boss.

Installation
Lubricate the water sensor O-ring with a little silicon grease if it is not already lubricated. Slide the O-ring over the water sensor and screw the water sensor into the element boss until the O-ring is seated inside the recess and the sensor body starts to tighten up on the O-ring or boss. Then back the sensor off ¼ of a turn. This will insure that the water sensor's body is not in contact with the element boss and is not under too much tension. If the water sensor is over tightened or it's body is hard up against the element boss it will crack and leak.

Plug the sensor into the circuit board and cable tie the leads into place. Soak up any water in the unit, reconnect the water, bleed air from pipe work and reconnect power supplies. Check the operation of the unit and check for leaks.

**In Element Temperature Sensor**

Removal
Unplug from the PCB and the sensor should pull out from the element boss. The heatshrink may hold on to the metal but it will wiggle free.

Installation
Insert the sensor all the way into the element pocket and use a sleeve of heatshrink tubing (or similar) to hold the sensor in place and to seal the pocket. The pocket must be sealed to ensure that the sensor is reading the water temperature accurately and is not affected by the enclosure temperature.

**Circuit Board**

Take anti-static precautions.

The main anti-static precaution to take is to make sure your body is at the same electric potential as the circuit board. To do this **first disconnect the power**, then touch the neutral terminal on the mains terminal block. Now you can handle the circuit board.

Removal
Disconnect from the supply. Note where each wire is connected on the circuit board and relays. Disconnect all wires, the cable ties will hold the wires in position for reassembly so don't cut them. When disconnecting terminals, use a pair of pliers to grip the terminals, not the wire, and then pull the terminal off. The heater tube assembly will need to be removed first to allow access to the screws holding the PCB in place. It can be left wired as there is enough play in the cables.

Remove all of the twelve screws that hold the circuit board to the housing and lift the circuit board out of the unit.

Installation

Taking antistatic precautions as above, screw the circuit board into place using the twelve screws. Reconnect all wires and check that all connections are correct and tight. (Refer to the appropriate wiring diagram) Reconnect the power to the unit.

Reset the set temperature and filtration as desired and check the DIP switches are set correctly.
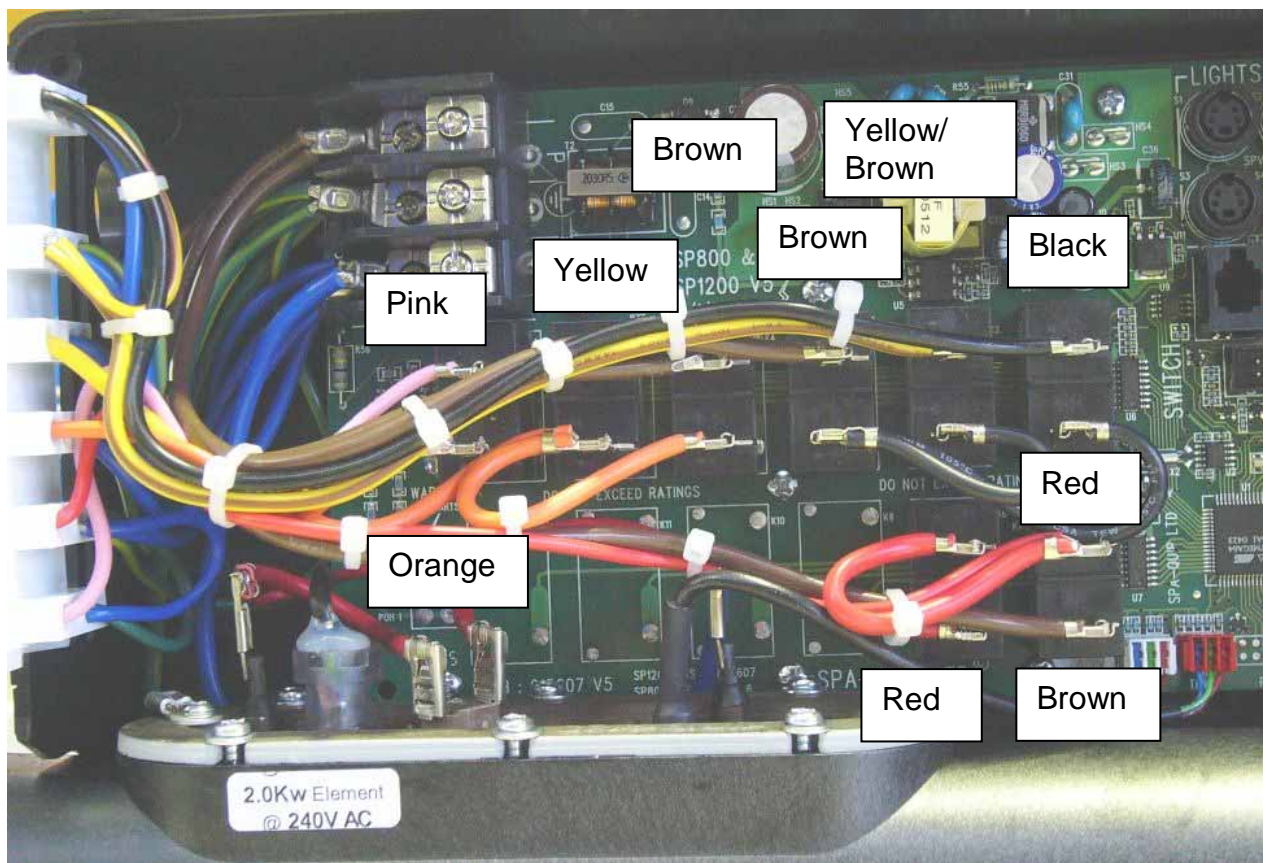
# Frequently Asked Questions

1) Can I make it load shed?
*Yes, refer to the dipswitch settings information on the inside lid label or the DIP switch settings in this manual.*

2) Can I mount the SP800 on its side?
*Yes, the SP800 can be mounted so that its heater tube is vertical with the water senor at the top. The water must flow from the bottom of the tube to the top. This will force out all air in the tube. Note that an in pool temperature sensor is recommended in this configuration, especially if a small circulation pump is used.*


3) Can I mount the SP800 on it's back / front / upside down?
*No, any of these mounting positions will cause the water detection system to operate incorrectly.*

4) Can I run a standard incandescent pool light from the SP800?
*Yes, but it must be used with a separate transformer and controlled by an on/off outlet such as the Aux outlet.*

# Warranty information

**SPA-QUIP product warranty for Australia and New Zealand.**
The Spa-Quip warranty is very simple and is designed to protect your purchase over the first two years, as follows. The first 12 months after purchase there is a full in-field warranty cover on faulty parts or workmanship. Over the following 12 months there is a bench warranty. The product must be returned, freight paid, to Spa-Quip where it will be repaired at no cost and returned to you free of charge. A bench warranty does not include the cost of local service people to remove or re-install the equipment.

**Terms and conditions.**

1 This warranty applies to all states and territories of Australia and New Zealand only and is subject to the provisions of the Trade Practices Act (Aust), the Goods and Consumer Protection Legislation of the various Australian states and the Consumers Guarantee Act 1993 (NZ) as applicable.

2 The warranty period commences on the date of original purchase of the equipment. Evidence of this date of original purchase must be provided when claiming repairs under warranty. It is recommended you retain all receipts in a safe place, as failure to provide proof of purchase will result in warranty being refused.

3 This warranty is subject to due compliance by the original purchaser with all directions and conditions set out in the installation and Operating Instructions. Failure to comply with these instructions, damage or breakdown caused by fair wear and tear, negligence, misuse, incorrect installation, water in the control enclosure or element, chemical or additives in the water, inadequate protection against freezing, rain or other adverse weather conditions, corrosive or abrasive water, lightning or high voltage spikes or through unauthorised persons attempting repairs are not covered by this warranty. The product must only be connected to the voltage shown on the nameplate and with a correctly rated cable.

4 Without limiting the original purchaser's entitlement under the Trade Practices Act (Aust), the Goods and Consumer Protection Legislation of the various Australian states or the Consumers Guarantee Act 1993 (NZ), Spa-Quip shall not be liable for any loss of profits or any consequential, indirect or special loss, damage or injury of any kind whatsoever arising directly or indirectly from the product or defect.

5 Replaceable, wearing items such as pump seals, filter cartridges, light bulbs etc. are not covered by this warranty.

6 Equipment used for working displays or demonstration is not covered by this warranty.

## Identification

Each SP800 has a unique serial number, it is attached next to the circuit board and on the unit's lid label.

The PCB also has a version number, job number and software version number. The job number is hand written and the software version number is found by adding up the crossed out numbers. For example in the picture the job number is 1170 and the number 2 has been crossed out indicating the software version is 2.
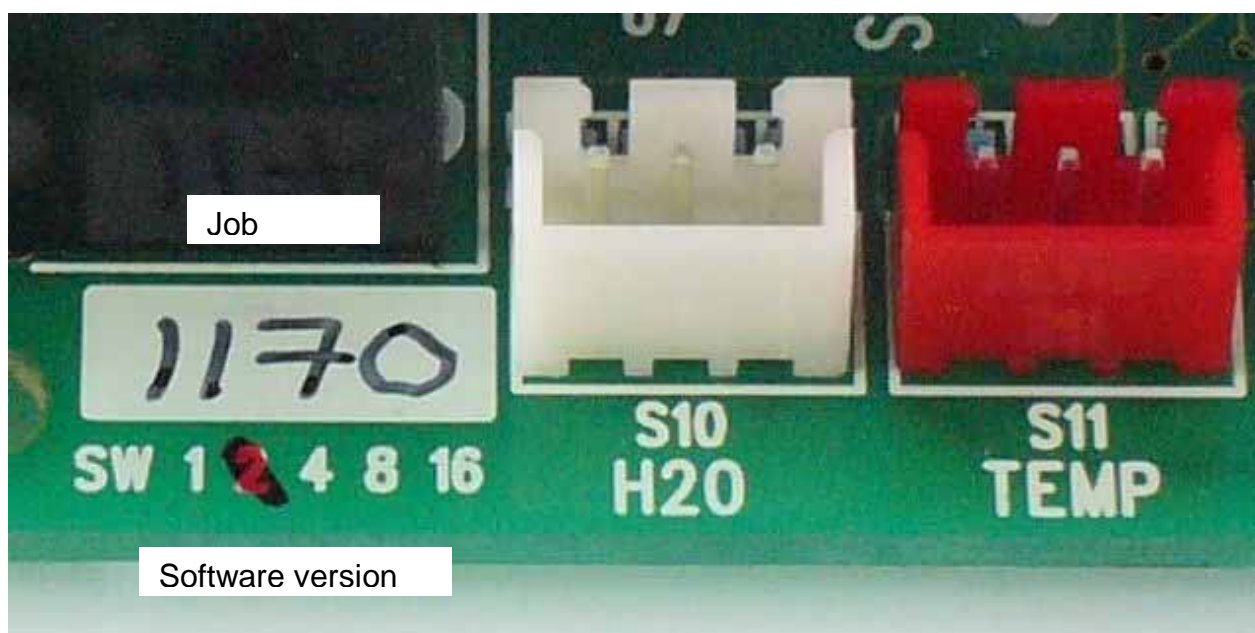


The element power rating is identified by a sticker on the side of the heater tube and is also stamped into the element boss.

## Part Numbers for Spares Ordering

| Description | Part number |
| --- | --- |
| SPVCL | Q3704 |
| SPVSB | Q5602-AMP |
| Heater tube element assembly 2.0kW | Q80062 (Q80062T with tube) |
| Heater tube element assembly 3.0kW | Q80063 (Q80063T with tube) |
| SP800 controller circuit board, all models | Q846606 |
| SP800 switch, all models | Q71069 (rectangular) Q71068 (oval) |
| Water sensor | Q915441A |
| In-Pool temperature sensor | Q915445 |
| In Element temperature sensor | Q915439 |
| Wiring loom | Q927081 |

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