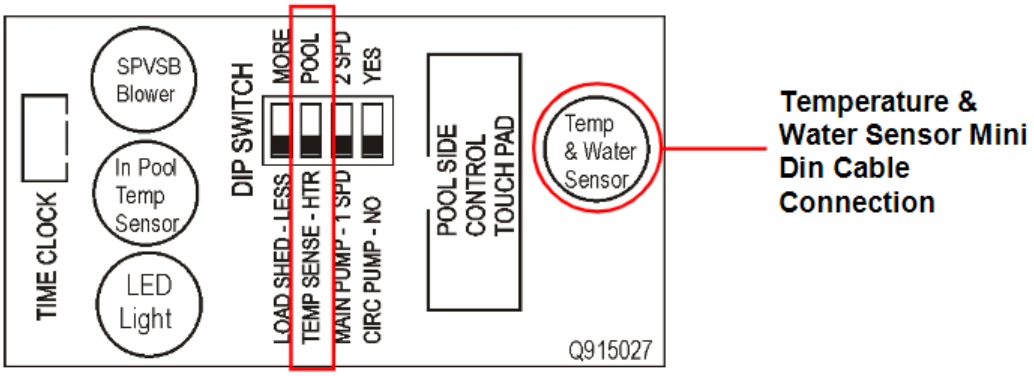
Plumbing

1. The in line heater element should be plumbed so the water flows past it from left to right when horizontally mounted (water sensor at left hand end) and bottom to top when vertically mounted. IMPORTANT: If mounted vertically, the water sensor MUST be at the top.
2. The heater T style element should only be mounted horizontally, mounting vertically could lead to problems from air locks at the element boss.
3. 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.
4. Make sure the controller is mounted securely so that vibration is minimised. Mounting to the spa can be made by either cable ties to frame or screws.
5. It is recommended that the pipework has shut off valves so the heater and pump can be removed for service without loss of water.
6. Pressure test the installation to check for leaks.
7. Support all pipework to prevent sagging and to prevent movement when pumps turn on or off.
8. Insulate all pipework to decrease heat loss.

3.4 Pool Water Heater

The heating element power cable plugs into the AMP connector marked “Heater” on the side of the control box and the sensor cable plugs into the 6 way mini DIN connector labelled as “Temp & Water Sensor” inside the control box. The “TEMP SENSE” DIP Switch must be set to “HTR” when using the in heater temperature sensor.

3.4.1 Heater Tee Water Heater



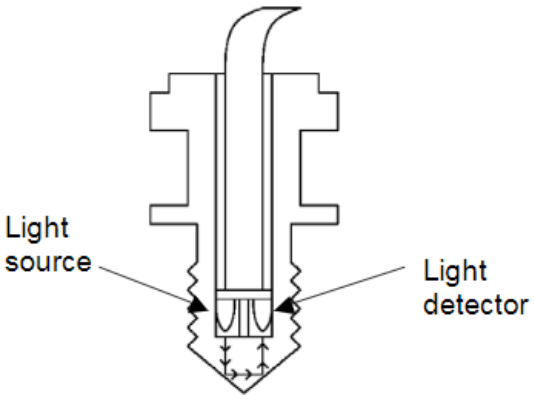
The heater tee mounts on the top (outlet) of the pump and the water heater mounts inside the heater tee. The plumbing should be such that the heater is below the normal level of the pool water and there is not a high point at the heater so that the heater will remain flooded with water and air cannot collect in the plumbing at the heater.

Pump Shown : Maxiflow Booster
Note: A 50mm Heater Tee, to fit the Maxiflow pump, is standard for the SP400P models. A 40mm Heater Tee, to fit the Magnum pump, is also available if required.

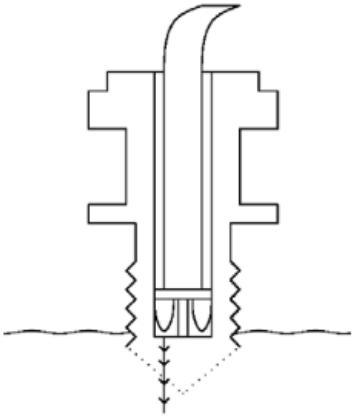
4 SP400P System Components Explained

4.1 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.

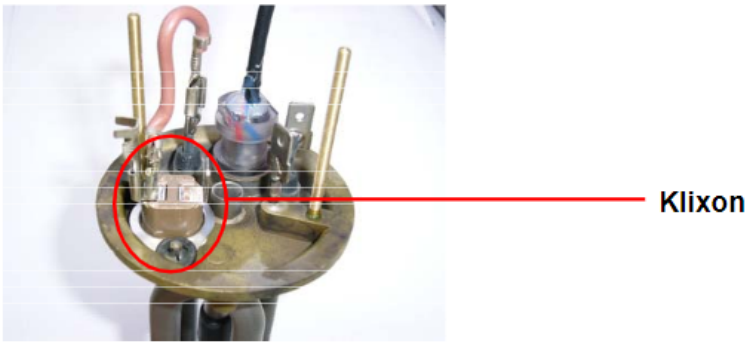


The mirroring effect of the tip is lost once submerged and the detector receives no light.

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 24Hr 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 SP400P PCB. Additional circuitry is included on the PCB to check that the water sensor is connected and is functioning correctly.

4.2 Thermal Cut-out



Each SP400P heater assembly contains a thermal cut-out device (also known as a klixon). It is an electro-mechanical device that acts as a switch. When heated above 50°C (+/-3°C) it switches off, disconnecting the heater element. When it cools below 38°C it switches on and reconnects the element. It is tightly coupled (thermally) to the brass element boss so that the element will be switched off if it 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 cut out has operated this circuit will sense a lack of power at the element and the controller will fault with Error 6. The controller will not attempt to recover from this condition. It will need to be reset by pushing the UP, DOWN & PUMP buttons simultaneously to clear the fault once the thermal cut-out has cooled below 38°C and automatically reset.

4.3 Temperature sensor

The SP400P heater normally 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's water flow. The temperature sensor is sealed into the pocket and connects to the SP400P 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 hysteresis 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 (generally much faster). 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.

'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. Note It is recommended that the in pool temperature sensor be mounted mid way up the spa wall, mounting it in the foot well may cause faster cycling.

7.1 Heater Element Assembly

Removal

Disconnect from the supply. Close the water valves so that the heater unit (in line or heater tee type) can be removed without draining the pool or causing a flood. Loosen the lock rings on the mac-unions and disconnect the in line heater tube from the pipe work or the heater unit from the heater tee (don't lose the O-rings).

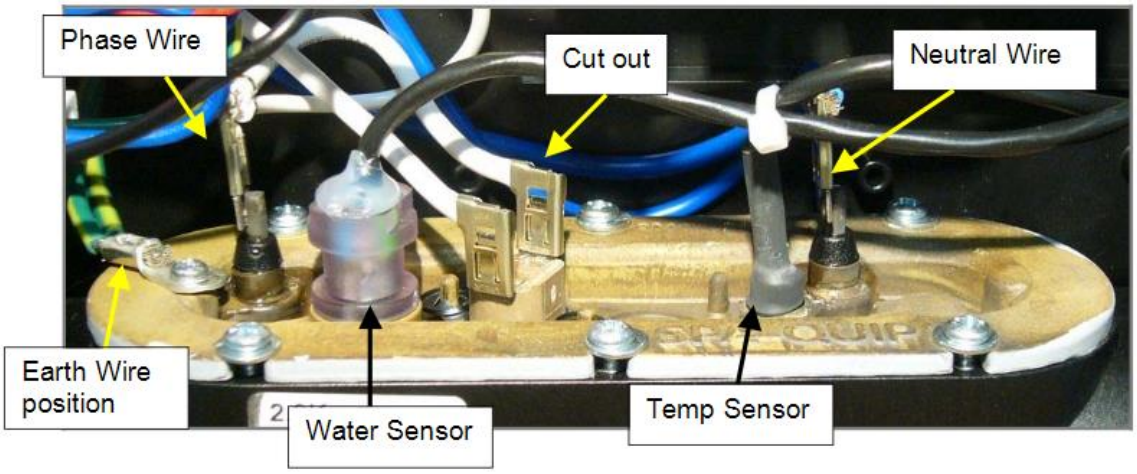
Unplug the heater from the "Heater" AMP plug on the control box. Unplug the sensor cable from the "Temp & Water Sensor" mini DIN socket inside the control box.

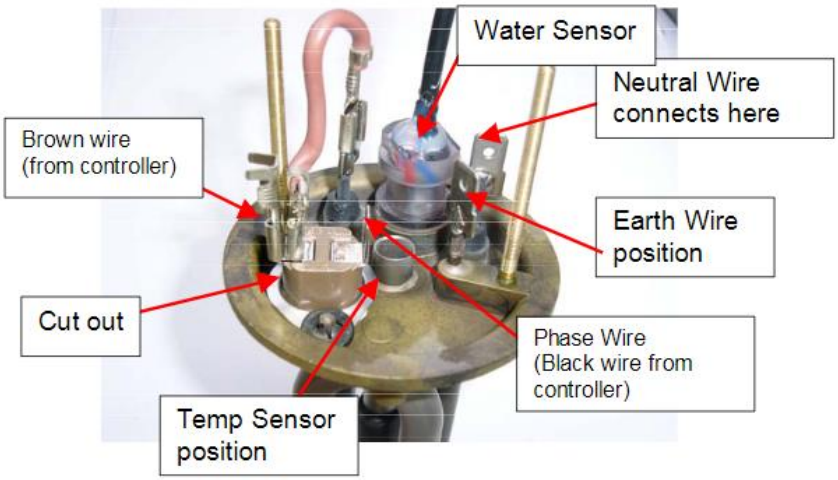
Remove the in line element cover or heater tee element cover by loosening the screws or nuts. Note the connections inside the unit so that they may be disconnected and reconnected later on.

Disconnect the heater element 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. Unplug the water sensor and temperature sensor from the sensor extension cable.

Installation

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.





7.2 Water Sensor

Removal

Disconnect from the supply. Isolate the water supply and drain the heater tube or heater tee so that the water sensor can be removed without draining the pool or causing a flood. Disconnect the plug from the extension cable. Unscrew the sensor from the element boss. Alternatively follow the instructions for the Heater Element Assembly above to gain access to the water sensor.

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 its body is hard up against the element boss it will crack and leak.

Plug the sensor into the extension cable. 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.