



# WE GIVE YOU THE POWER.....

- THE POWER TO SAVE.
- THE POWER TO CONTROL.
- THE POWER OF THE SUN.





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For technical help contact your distributor.

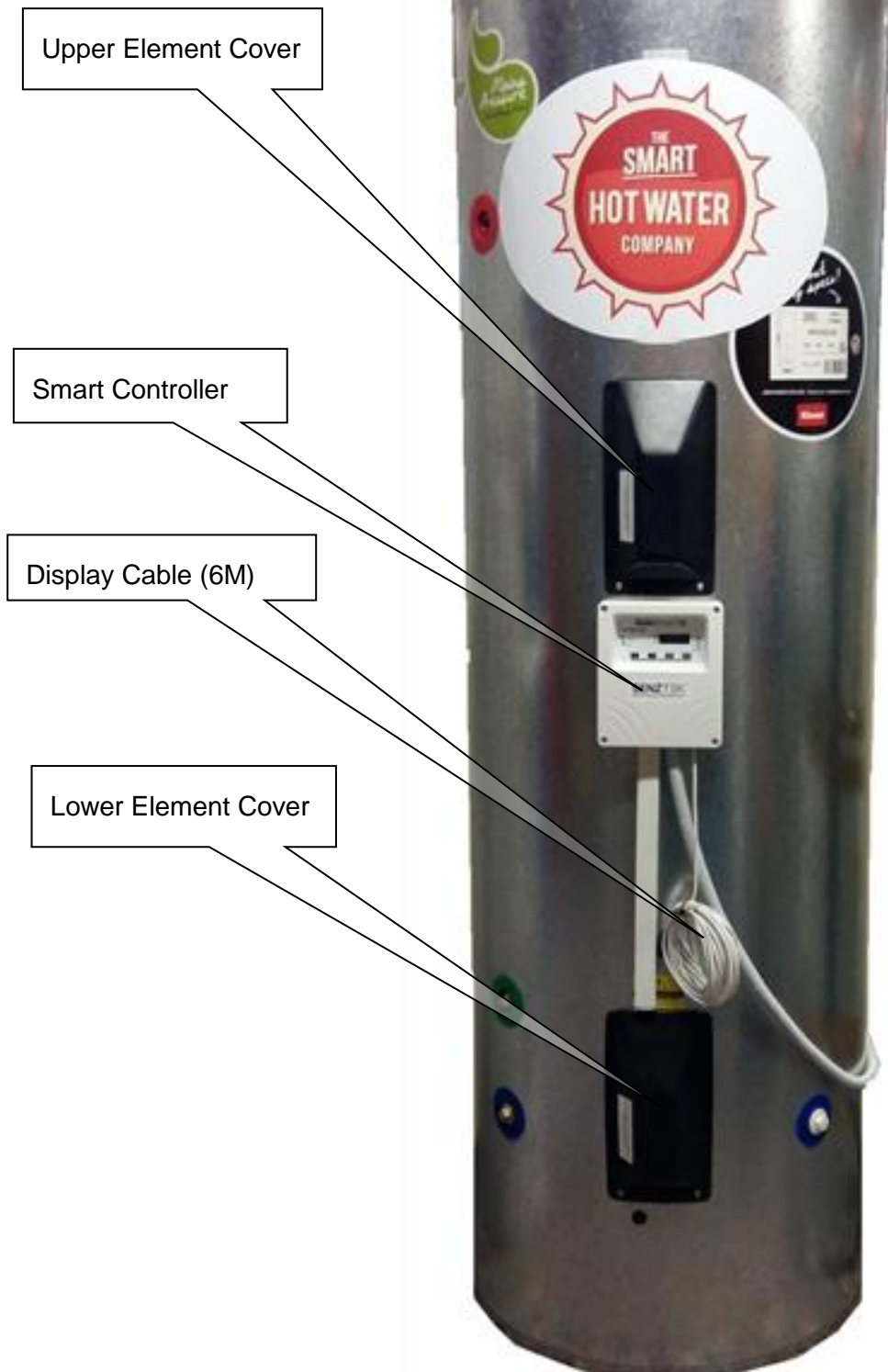
#### **Distributor Details:**

[www.smarthotwater.co.nz](http://www.smarthotwater.co.nz)

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## INTRODUCTION

- The Hot water out port and PTR ports are interchangeable on installation. However, ensure the port selected for the PTR is only used solely for that purpose.
- All Smart Cylinders are mains pressure rated (30 Metres)



## SAFETY

- **No uncontrolled heat sources should be attached to this cylinder such as thermosiphon solar or a woodburner heating coil (also known as wetback heating).** If the cylinder is heated to above 90°C (Stainless Steel) or 70°C (Enamel) the cylinder could fail or rupture with the potential resultant personal injury and property damage. All heat sources should be controlled, usually by a pump and controller.
- The Smart-Cylinder needs to install according to local electrical wiring regulations by qualified personal. It is also vital the cylinder thermostat and over temperature electrical cut-out is fitted, is operational and in contact with the cylinder inner skin. Although the Smart hot water controller takes over control of the cylinder heating the electromechanical thermostat and over temperature cut-out are there as a vital safety back up. **Do not disconnect, bypass or disable**



### CAUTION:

**Dangerous Voltages may be present.**

**The Smart-Cylinder has no user serviceable parts**

**Protective enclosure must only be opened by qualified personnel.**

**Remove ALL power sources before removing protective cover**



- All aspects of the installation must comply with local electrical and plumbing regulations (and any ancillary heating regulations such as solar hot water).
- The 240 litre Cylinder weighs 62 kg (320 litre = 72kg) empty and TSHWC recommends at least 2 persons are involved with any lifting or handling.
- All hot water installations must, at the outlet of all sanitary fixtures, used primarily for personal hygiene purposes, deliver hot water not exceeding 50°C as per AS/NZS3500. In some circumstances a lower temperature of 45°C must be delivered to be safe (Rest homes, children's facilities etc check requirements). This is achieved by installing a **thermostatic mixing valve**
- To protect against dangerous infections by waterborne bacteria, primarily Legionella the Smart-Cylinder controller operates an automatic sterilisation regime according to AS 3498 (and AS/NZS 2712). It is important to always leave the controller on, even while away on holiday as the controller will manage this sterilisation. The controller can be put in holiday mode to greatly minimise energy use while you are away (see user manual)
- It is vital that safe plumbing practices are carried out including the fitting of a PTR (Pressure-Temperature Relief) valve which will prevent the cylinder from violently rupturing in case of excessive water heating (such as by an electrical fault). In some regulatory environments an additional ECV (pressure only relief) valve is also required on the cold inlet. See AS 3498 or applicable local standard.



# REQUIREMENTS

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### Water Quality

Water quality can vary in different locations and affect the performance and safe operation of the hot water system.

If the water supply is not within the acceptable limits as indicated below, the hot water system should not be installed, and will not be covered by warranty from the manufacturer. A suitable solution is to implement a water pre-treatment process to bring the water quality to within acceptable limits to support the installation.

The saturation index (SI) is a measure of the corrosive or scaling properties of the water supply. Corrosive water ( $SI < -1.0$ ) can corrode copper components. In these conditions the warranty will not apply. Scaling water ( $SI > 0.5$ ) can cause build-up of  $CaCO_3$  (Calcium carbonate) which can impact to the correct operation of moving parts within the system, including the temperature and pressure relief valve. In these conditions warranty will not apply. Total Dissolved Solids (TDS) and water hardness can also impact the life of the hot water system, and warranty does not apply outside the following limits:

- TDS exceeding 600 p.p.m
- Electrical conductivity exceeding 850us/cm
- Total hardness exceeding 200 p.p.m
- Chloride exceeding 250 p.p.m
- Magnesium exceeding 10 p.p.m
- Sodium exceeding 150 p.p.m
- Acidity/Alkalinity the limits pH 6.5 - 8.5

**Do not install this cylinder with a bore water supply.**

### PTR valve

Regular testing required. Once every 6 months press lever to allow a small amount of water to escape. There may be some vapour released as well.

### Operation

Never operate the Smart-Cylinder without the cylinder being full of water. If the cylinder is to be drained then ensure power is turned off at the main isolating switch before water is drained and not switched on again until the cylinder has been refilled and any air purged. Failure to follow this precaution can severely damage the cylinder and components.

### Warning

**These products are not designed for use in, and should not be used for, applications which are in conjunction with items that are critical to any person's health (e.g. life support systems).**

**In any critical installation, an independent fail-safe back-up system must always be implemented.**



# INSTALLATION

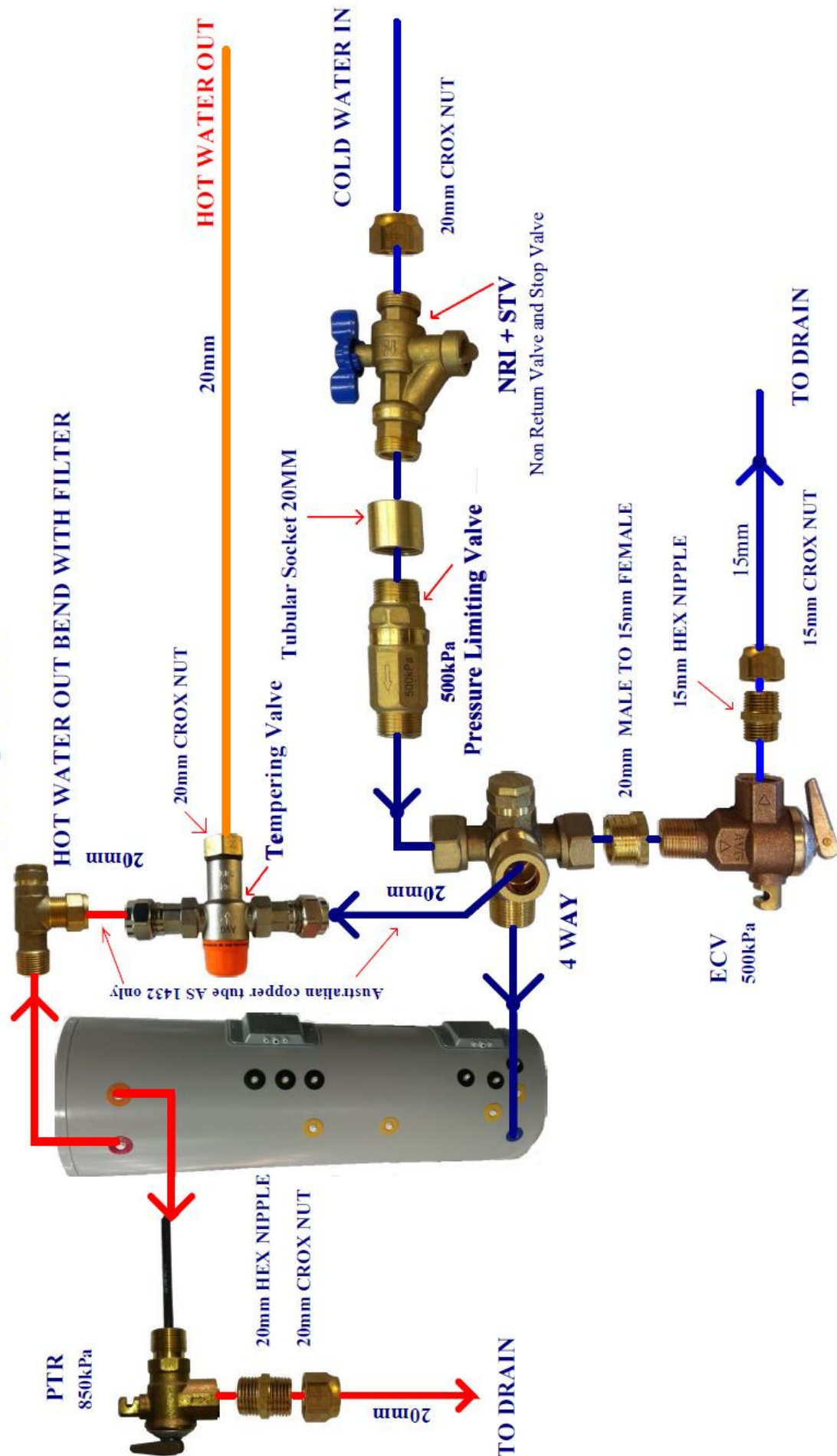
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<b>Clearances</b>	<ol style="list-style-type: none"><li>1. Make sure there is sufficient clearance for the TPR valve removal and Electrical cover removal and working space.</li><li>2. Consider port orientation for ease of access</li></ol>
<b>Level Mount</b>	The Smart-Cylinder must be installed vertical and on a level surface able to support the full weight of the installation. Outdoors this might include a poured concrete slab or paving slab levelled with poured concrete.
<b>Drip Tray</b>	Install a suitable tray under the cylinder with drainage such that any leaks will not damage the building or surrounding area. This is compulsory if installed indoors and highly recommended for outdoors.
<b>Plumbing connections</b>	<p>All plumbing ports on TSHWC cylinder s are 20mm (3/4 inch) AS1432</p> <p>Follow the plumbing schematic (below) for mains pressure installation (for low pressure, less than 120kPa Pressure Limiting Valve is required). The PTR valve is supplied with the cylinder and the other parts are supplied either by TSHWC (as a special order) or by the installer.</p>
<b>Seismic Restraints</b>	The cylinder must be secured against seismic events (mainly earthquakes). Check regulations for requirements but by way of a guide, under AS/NZS 3500.4 the number of restraints is 2 for 180 litre and 3 for 240 litre.
<b>Insulate Valves</b>	All valves, hot water pipes and some unions need to be insulated to avoid high heat loss. All TSHWC supplied valves and most unions have easy to install insulating 'boots'.

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## Smart Cylinder Plumbing pictorial (mains pressure)





### ELECTRICAL

Most installations simply involve connecting Phase / Neutral / Earth wires extending from the supplied flexible conduit to a suitable isolating switch.

The Smart-Cylinders generally come pre-wired for standard installation. In this instance, it is assumed a single 230/240Vac power source is used.

There are other options and configurations, these include;

1. Separate power for the controller and electric elements (such as used for load shedding/ ripple control) where it is desired the controller is always powered. **Note:** The controller must have 24 hr power for the solar upgrade (See appendix 1)
2. Night rate power where the lower element is used by night rate the upper element 24hr power, ensuring the user cannot run out of hot water. This uses advanced control techniques to greatly reduce the chance of the upper element ever needing to come on and as such needs a special controller software setting. (Contact The Smart Hot Water Company for details)



**Note:** If more than one power feed is used then a warning label must be affixed at the Smart- Cylinder and at the switch board stating that there are 2 circuits to isolate to make the Smart- Cylinder safe.

#### Single Phase only

The Smart- Cylinder is configured for **ALL power sources to be on the same phase**. If a second phase is to be used on the installation, then contact TSHWC for special wiring and installation instructions to meet the 400Vac isolation requirements

#### Electrical Covers

The electrical covers must be at earth potential. Test continuity of the outside of the cover to electrical earth after refitting any covers.

**DO NOT over tighten cover screws**

#### Before you connect the power

Ensure the cylinder is fully filled with water and any air released.

**Note:** The mechanical cylinder thermostats for the electric elements are set to maximum by TSHWC and should not be turned down. This is so the HWC Control Mode can operate correctly. (The thermostats are now functional only as a failsafe feature and under normal conditions will not interrupt power)

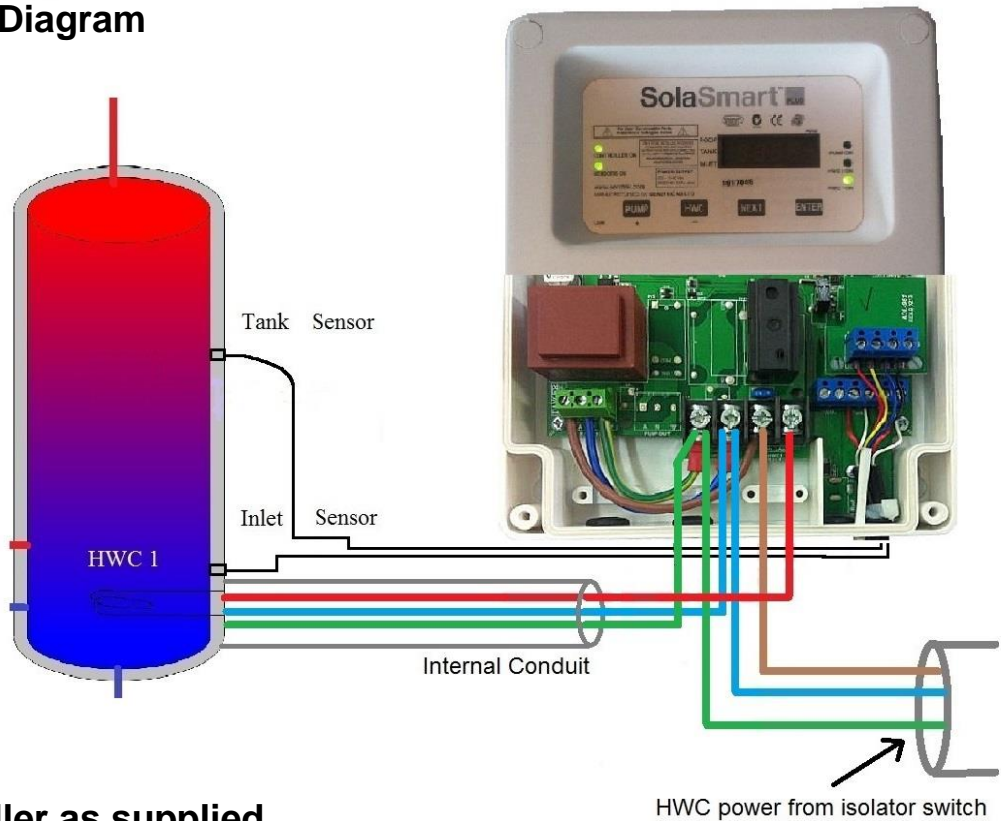


## Standard Wiring (Single Element Single Supply)

(See Appendix 2 for Dual element version)

- The HWC contacts are wired in series with the cylinder thermostat and safety cut-out, **do not bypass**.
- Cylinder mechanical thermostats remain on maximum, or controller will not be able to manage the hot water heating correctly

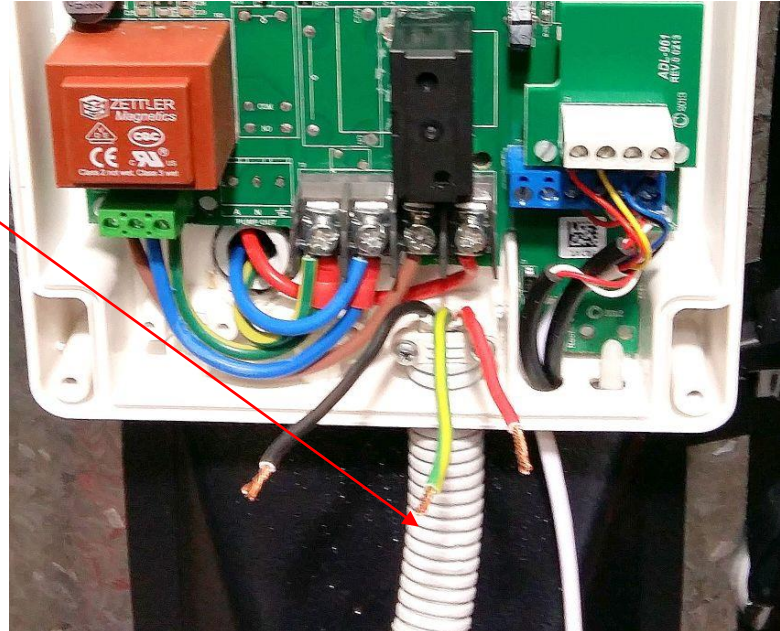
### 1. Wiring Diagram



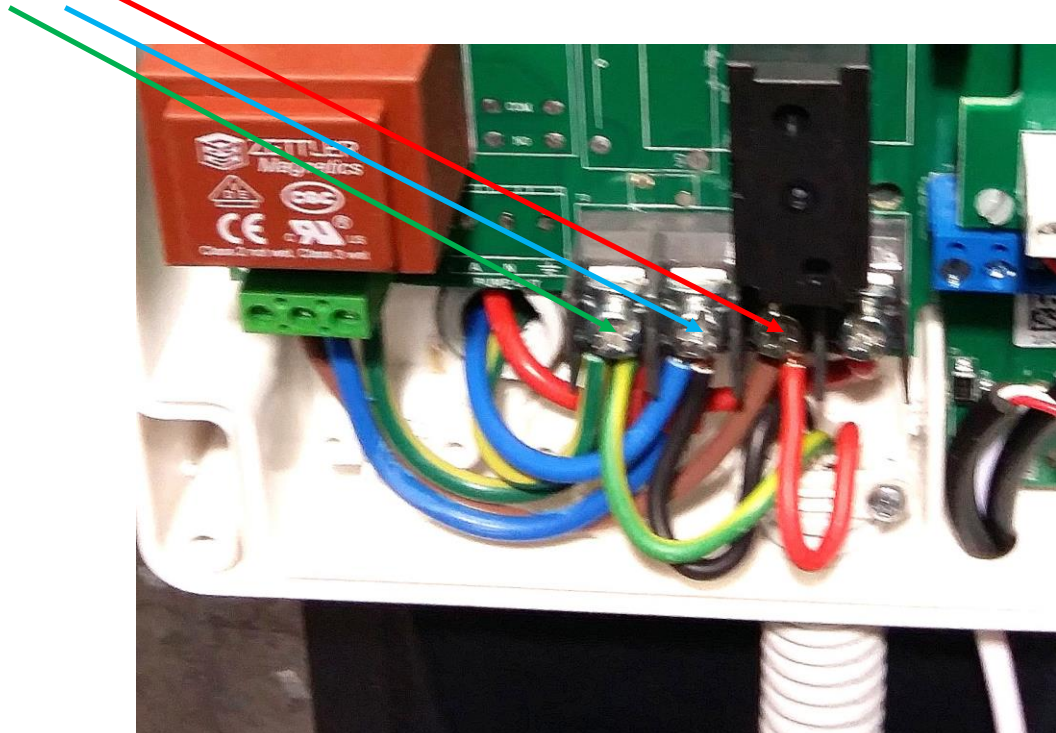
### 2. Controller as supplied



**1. With hot water power conduit  
fitted by electrician**



**3. Wired in  
E N Ph**



## DISPLAY MOUNTING OPTIONS;

### 1. Mount flush on Gib Board (dry wall)

- Use supplied DisplaySmart paper template to cut out area needed to recess the circuitry
- Run comms cable so that it comes out behind this cavity
- Plug in Display with the plug from controller.
- Screw Display onto wall
- Remove protective plastic cover for viewer clarity
- Replace white plastic cover

### 2. Use PDL® electrical surface mount block (PDL 89SP)

- Screw mounting block onto wall
- Run comms cable so that it comes out behind this block
- Plug in Display
- Screw Display onto block
- Remove protective plastic cover for viewer clarity
- Replace white plastic cover

**Mount this way up**



- Remove the protective screen cover after installation for clarity

**Note:** Comms cable is standard at 6 metres but can be extended 20 metres



The DisplaySmart is not isolated and is rated for voltages below 14 Volts DC and therefore must be installed well clear of mains wires and exposed mains terminals of any kind. Do not install in the same cavity or mounting box as light switches or power outlets.




**\*\*\*\*\* Never insert or remove the DisplaySmart interface board (inside the controller) while the controller is on. It might destroy the controller. Ensure the controller is off whenever inserting or removing the controller interface board. This action is normally not required during a standard installation.**

## First display on power up

## Power Up and Test

1. The Controller OK light should be illuminated on the controller
2. The DisplaySmart- Touch should be displaying the home screen (as illustrated)
3. Set the Time and Date



- From the Home screen touch the Clock icon 
- Set the Time and Date by touching the field that you want to update until it starts flashing and then using the Up/down arrow keys to adjust the value.
- Touch the Home icon when finished
- Your new Date and Time will be displayed on the home screen



**Technical Screen-** If you need to set observe system parameters then go into the technical screen

- From the Home screen touch the System icon 



This screen is a more detailed diagnostic display.

4. For more information on setting up profiles and such, see the User Guide

## Note:



**Initial BioSafe-** On first power up the controller will usually initiate a BioSafe heating cycle as it does not know the condition of the hot water (it has no history to determine if it is safe).

The water will heat to a little over 60°C (on both sensors) and then maintain that for an hour and then reset to normal operation.



## The Smart-Cylinder is now fully installed and should be working.

It is best to observe the cylinder heating and check all functions are working correctly before leaving the installation.



## TROUBLE SHOOTING GUIDE

The table below has the correct resistance values of the sensors at different temperatures. The sensor must be removed from the Smart-Cylinder controller to measure these values correctly.

Sensor Resistances

Sensor Resistances		
Temperature	Resistance in k $\Omega$	
0°C	27.25	A 'short' circuit can be caused by the sensor wires being connected together. Check the wires are not partially cut and that moisture is not getting into the sensor causing corrosion.
25°C	10.00	
50°C	4.162	
75°C	1.925	An 'open' circuit can be caused by the sensor wires being broken. Check the wires are not cut and that moisture is not getting into the sensor causing corrosion.
100°C	0.973	
Above 300°C or 'shrt' on display	<.050	
Below -40°C or 'oPn' on display	>200	



Symptom	Possible Cause	Solution
No operation, no lights and no Display	<ul style="list-style-type: none"> <li>⇒ No power</li> <li>⇒ Power is interrupted to controller</li> </ul>	<ul style="list-style-type: none"> <li>⇒ Check mains supply</li> <li>⇒ Check if load control (ripple control) by power co has removed power.</li> <li>⇒ If the controller going off with load shedding is undesirable, then the controller will need a 24hr power supply. It is possible to separately power the elements off a load shedding supply.</li> </ul>
Sensor O.K. light flashing (Sensor fault shows on DisplaySmart Touch home screen)	<ul style="list-style-type: none"> <li>⇒ Inlet or Tank sensor not detected. Broken sensor wire</li> </ul>	<ul style="list-style-type: none"> <li>⇒ Replace sensor in either sensor port until Sensor O.K. light is ON (or reported fault is gone from DisplaySmart-Touch)</li> </ul>
HWC light stays on too long (more than 6 hours)	<ul style="list-style-type: none"> <li>⇒ HWC power not getting to element</li> <li>⇒ Element open circuit (blown)</li> <li>⇒ Faulty thermostat / cutout</li> <li>⇒ Excess water draw off or leak</li> <li>⇒ BioSafe heating (Sterilising) cannot reach above 60°C on <b>BOTH</b> tank sensors for 32 minutes</li> </ul>	<ul style="list-style-type: none"> <li>⇒ Check DisplaySmart-Touch home screen or controller diagnostic screen to determine why tank is heating</li> <li>⇒ Is HWC circuit drawing expected current (typ 10 -16 Amps)? <b>Qualified personnel only</b>. If yes verify excess hot water is not being drawn off</li> <li>⇒ If NO then power is not able to heat the water to the target °C</li> <li>⇒ Read tank temperature at controlling sensor.</li> <li>⇒ If &lt; 50°C issue will be interrupted power or a faulty element. <b>Qualified personnel only</b>; Check for tariff / load control. Check power into the controller HWC contacts. Check power comes out of HWC contacts. Check correct HWC output used. Check wiring is correct. Check element is not blown.</li> <li>⇒ If &gt; 50°C but less than target (e.g. 60°C) issue will be tank thermostat accuracy. Ensure tank thermostat is turned up to max. If this doesn't work then thermostat is too inaccurate.</li> </ul>
	⇒	⇒
Hot water stored drops significantly at night, yet little or no draw off by user	<ul style="list-style-type: none"> <li>⇒ Water leak</li> <li>⇒ Tank is losing heat</li> </ul>	<ul style="list-style-type: none"> <li>⇒ Check for water leak; see if hot water pipe is hot/warm 2 metres from tank.</li> <li>⇒ Install better insulation on hot water tank and fittings</li> </ul>
	⇒	⇒
	⇒	⇒



## Specifications

### Cylinder;

Characteristic	Electric boosted				Gas boosted	
	Mid mount element		Bi- mount element			
	240L	320L	240L	320L	240L	320L
Tank Material (inner vessel)	316AL Stainless Steel (1.6mm)					
Tank Material (Outer Vessel)	0.6mm Galvanised, Bond Coated™ mild steel					
Fittings	316AL Stainless Steel					
Diameter (mm)	540	600	540	600	540	600
Height (mm)	1720	1920	1720	1920	1720	1920
Tank capacity (L)	240L	320L	240L	320L	240L	320L
Net weight (kg)	62kg	72kg	62kg	72kg	62kg	72kg
Weight when full of water (kg)	302kg	392kg	302kg	392kg	302kg	392kg
Element rating (if installed)	2.4kW	2.4kW	2.4kW	2.4kW	n/a	n/a
Thermostat (if fitted)	Thermodisc 59T & 66T manual reset	Thermodisc 59T & 66T manual reset	Thermodisc 59T & 66T manual reset	Thermodisc 59T & 66T manual reset	n/a	n/a

Water Characteristic	Level	
Total dissolved solids	600 mg/litre or ppm	
Total hardness (as CaCO <sub>3</sub> )	200mg/litre or ppm	
Chlorides	300mg/litre or ppm	
Dissolves CO <sub>2</sub>	Gas	Electric
	18 mg/litre or ppm	Not applicable
pH Levels	5.5 – 9.5	
Saturation index (Langelier)	+0.4 to -1.0@65°C	

**Power Supply to elements;** 240 Vac +/- 10% 50 to 60 Hz

#### Safety Compliances:

Electrical	AS/NZ 60335.2.21:2002 Inc A1-3
	AS/NZ 3820:2009
	Ctick
Plumbing	WaterMark AS3498
	AS/NZS 4020:2005
	AS/NZ 2712: 2007



### Controller;

#### Power Supply:

Supply Voltage	240 Vac +/- 10% 50 to 60 Hz
Quiescent power usage	3VA typical

#### Relay Outputs: (element)

2x HWC: 16A max @ 240Vac (3.6kW max) Resistive
1.5 HP/1100W max (240Vac) Motor rating (0.4cos theta)
Minimum Load: 2watts @ 240Vac or -100mA at 60 Vdc
Zero Crossing contact closure / open
Isolated contacts

#### Sensors:

Cylinder Sensors	-20 ~ +120°C tip 5.8mm diameter stainless steel
	-20 ~ +105°C cable, UV resistant
Accuracy	+/-1°C @ 25°C

#### Real Time Clock:

Backup interval (no power)	14 days min (After 4 hour full charge cycle)
Accuracy	Max 30 sec per month drift

#### EMC and Safety Compliances:

Emissions	EN 55022-A, CTick
Immunity	EN 50082-1
Safety Compliance	AS/NZ 60950.1:2003, CTick
	AS/NZ 3820:2009
	AS/NZ 2712: 2007

#### General Specifications: (Unless otherwise stated in other input specifications)

Control Range	-40 ~ +299°C
Operating Temperature	0~60°C
Operating Humidity	5 ~ 85% RH. Non-Condensing
Enclosure Construction	Polycarbonate - Impact Resistant
	UL94 V-2 Non Burning, UV A & B Stabilized
	Water resistant to IP54
Dimensions	L = 167mm
(excluding glands and cables)	W = 142mm
	H = 40mm
Weight	1600grams
(Standard model + cables + sensors + packaging)	

**Note:** Do not exceed these specification limits. Exceeding these limits can result in damage to the unit and voiding of the warrantee.

**Product Liability.** This information describes our products. It does not constitute guaranteed properties and is not intended to affirm the suitability of a product for a particular application. Due to ongoing research and development, designs, specifications, and documentation are subject to change without notification. Regrettably, omissions and exceptions cannot be completely ruled out. No liability will be accepted for errors, omissions or amendments to this specification. Technical data are always specified by their average values and are based on Standard Calibration Units at 25°C, unless otherwise specified. Each product is subject to the 'Conditions of Sale'.

## Appendix 1 – Dual supply variation

### Single Phase only

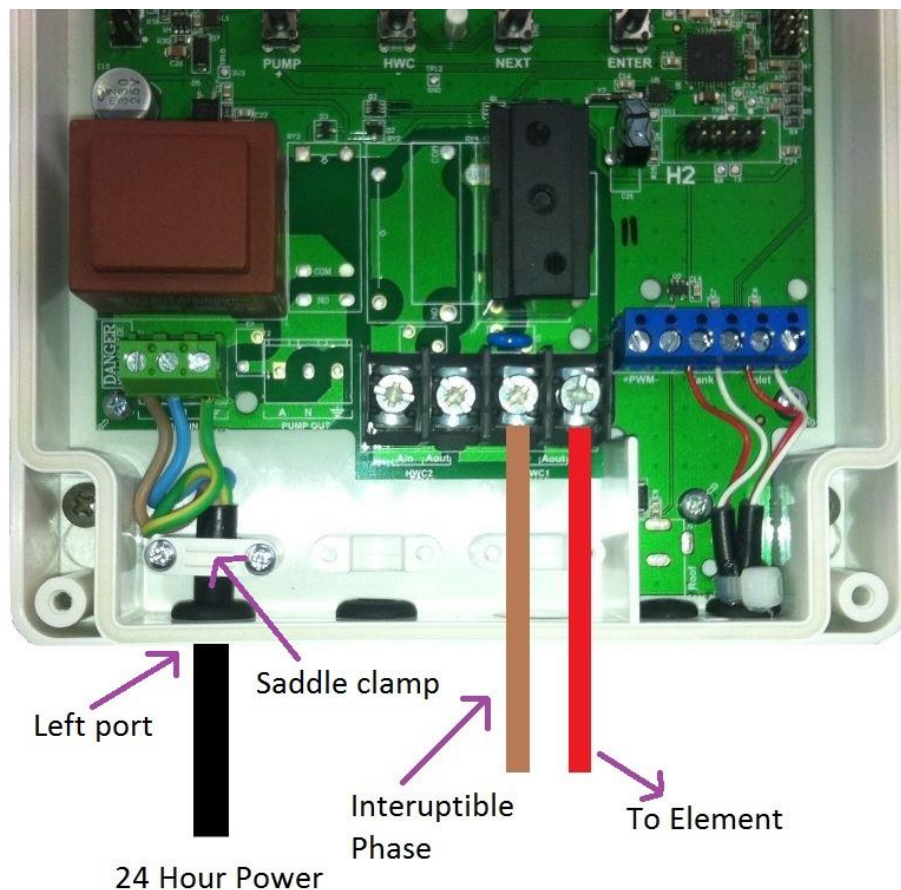


The Smart Cylinder is configured for **ALL power sources to be on the same phase**. If 2 phases are to be used on the installation, then contact The Smart Hot Water Company for special wiring and installation instructions to meet the 400Vac isolation requirements



**Note:** If more than one power feed is used then a warning label must be affixed at the Cylinder and at the switch board stating that there are 2 circuits to isolate to make the Cylinder safe.

- Use in conjunction with wiring diagrams on pages 3 or 4
- 1. Remove the 3 Phase/Neutral/Earth jumper wires from the 'MAINS IN' terminal on the left hand side of the PCBA and the high current terminal block. Interruptible
- 2. Remove bung from left port.
- 3. Insert a round mains cable through the left port. Diameter 6 - 7mm
- 4. Secure strain relief with 2 screws and saddle clamp. Do not over tighten
- 5. Screw in wires to 'MAINS IN' terminal
- 6. Wire in the cylinder high current wires to Ain and Aout (to element) in the HWC1 terminals as shown (and HWC2 on dual element variations)

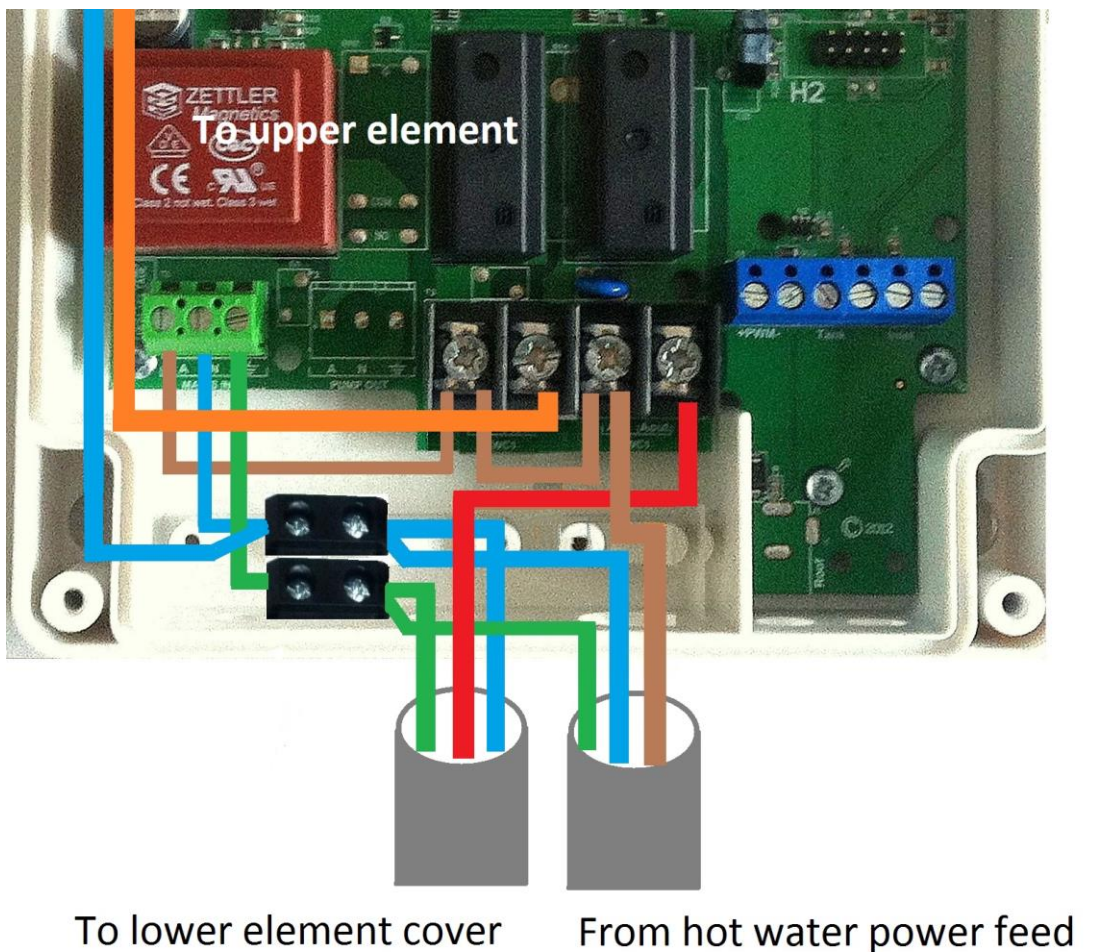


## APPENDIX 2 - DUAL ELEMENT SINGLE SUPPLY

### Wiring

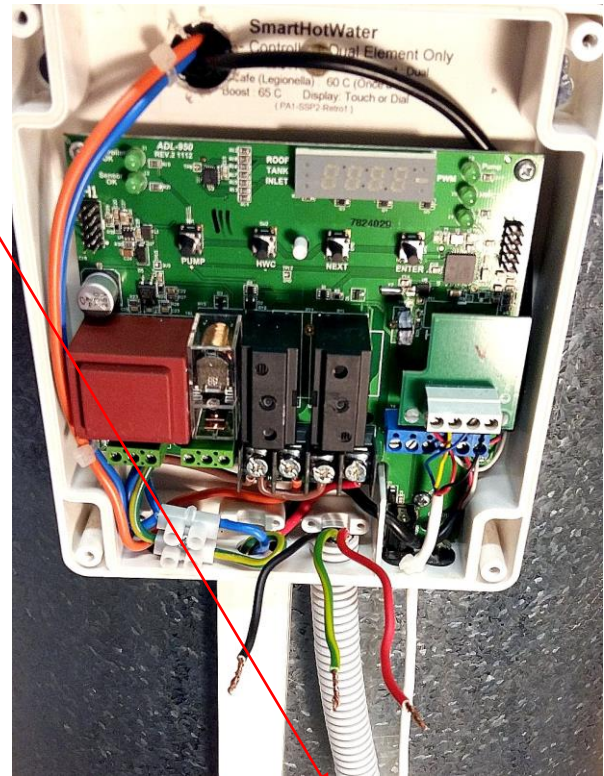
- The HWC contacts are wired in series with the cylinder thermostat and safety cut-out, **do not bypass**.
- Cylinder mechanical thermostats must remain on maximum, or the controller will not be able to manage the hot water heating correctly

#### 1. Wiring Diagram



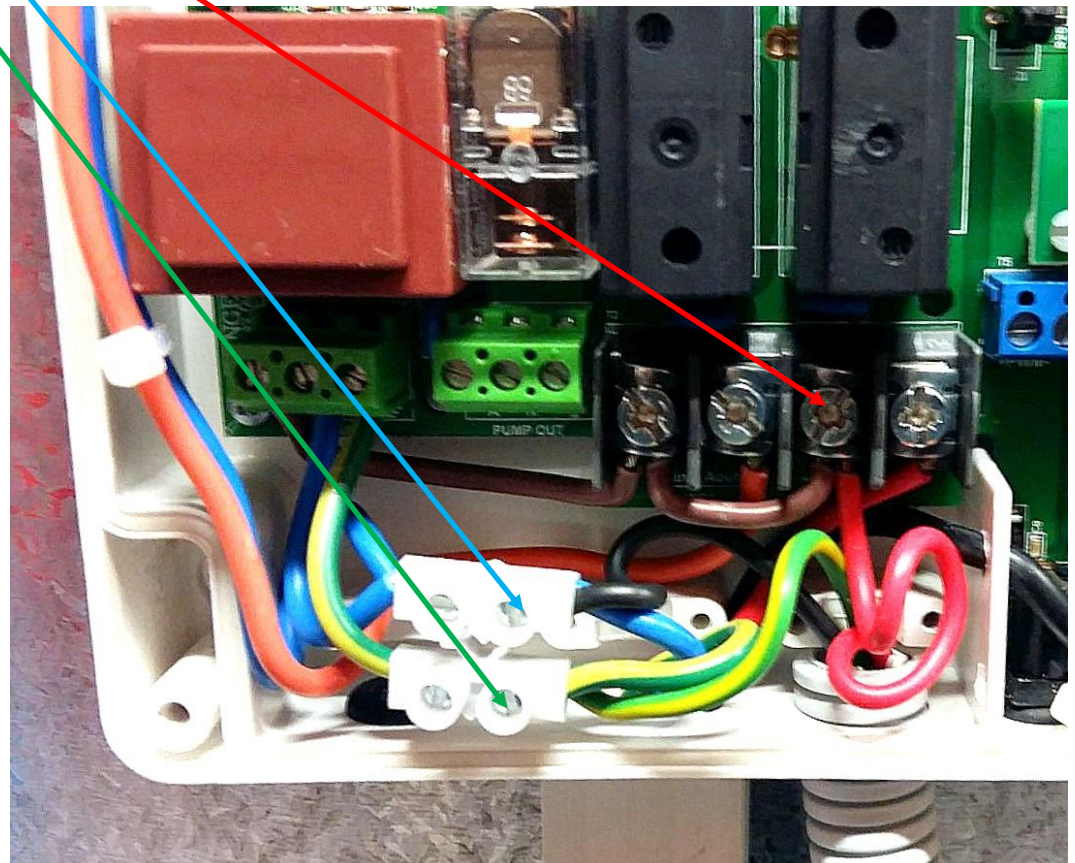


## 2. With hot water power conduit fitted by electrician



## 3. Wired in

E N Ph



## Appendix 3

### PV DIVERTER AND 24 HOUR POWER

1. The Diverter supply cannot power the controller so the following configuration is recommended.
2. Controller set to Single Element Control
3. Wire as illustrated and do not bypass thermostat or safety over temperature cut out.

