



For technical help contact your distributor.

### Distributor Details:

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

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## INTRODUCTION AND SAFETY

### Scope

Covers **Smart Hot Water Controller Retrofit Variations-**

- Retrofit Single Element – Dial Display
- Retrofit Dual Element – Dial Display
- Retrofit Single Element –Touch Display

Note: This manual does not cover Smart Hot Water Controller Single Element – Touch Display. That unit uses different wiring techniques.

### General Safety Precautions

Installation to be checked at least annually for damage or malfunction  
All servicing must be carried out by an authorised service agent only.  
All aspects of the installation must comply with local regulations

### Hot Water Safety

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**

### BioSafe®

To protect against dangerous infections by waterborne bacteria, primarily Legionella the Smart-Hot Water 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)

### Electrical Safety

The Smart-Hot Water Controller needs to be installed according to local electrical wiring regulations by qualified personal. It is also vital the cylinder thermostat and over temperature electrical cut-out is still functional. Although the Senztek Smart controller takes over control of the cylinder heating the electromechanical thermostat and over temperature cut-out are there as vital safety features. **Do not disconnect, bypass or disable the cylinder thermostat or over temperature cut-out**



#### CAUTION:

Dangerous Voltages may be present. The Smart-Controller has no user serviceable parts.

Protective enclosure must only be opened by qualified personnel.  
Remove ALL power sources before removing protective cover

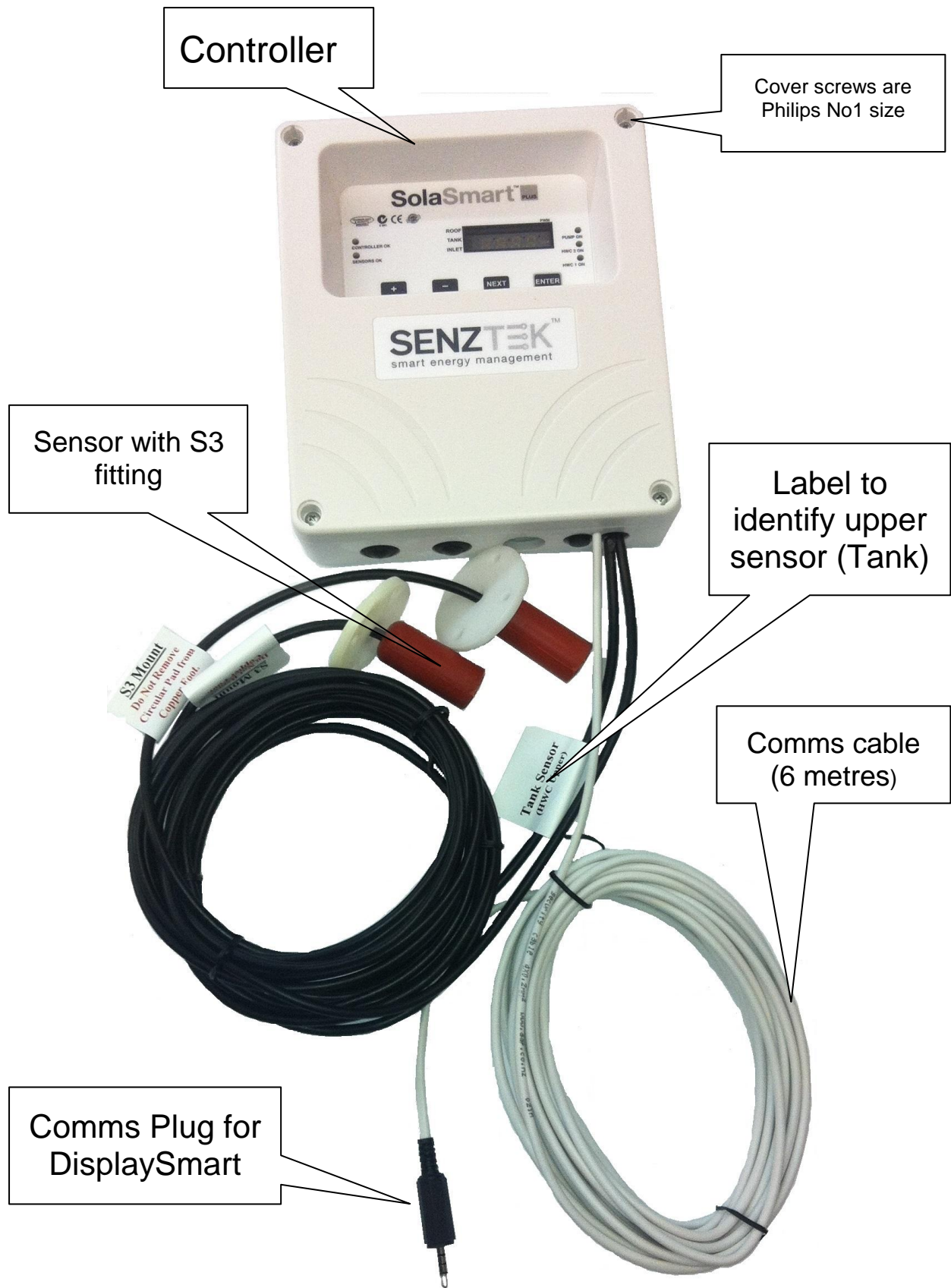


### Warning

**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.**

## SMART HOT WATER CONTROLLER – RETROFIT PACKAGE



## INSTALLATION

### Overview

The installation sequence will be;

1. Mount the controller
2. Electrically connect the controller to the cylinder and power source
3. Mount the S3™ sensors on the cylinder
4. Mount the DisplaySmart
5. Power up and test
6. Set correct time + date and program (if necessary)

### Controller Mounting

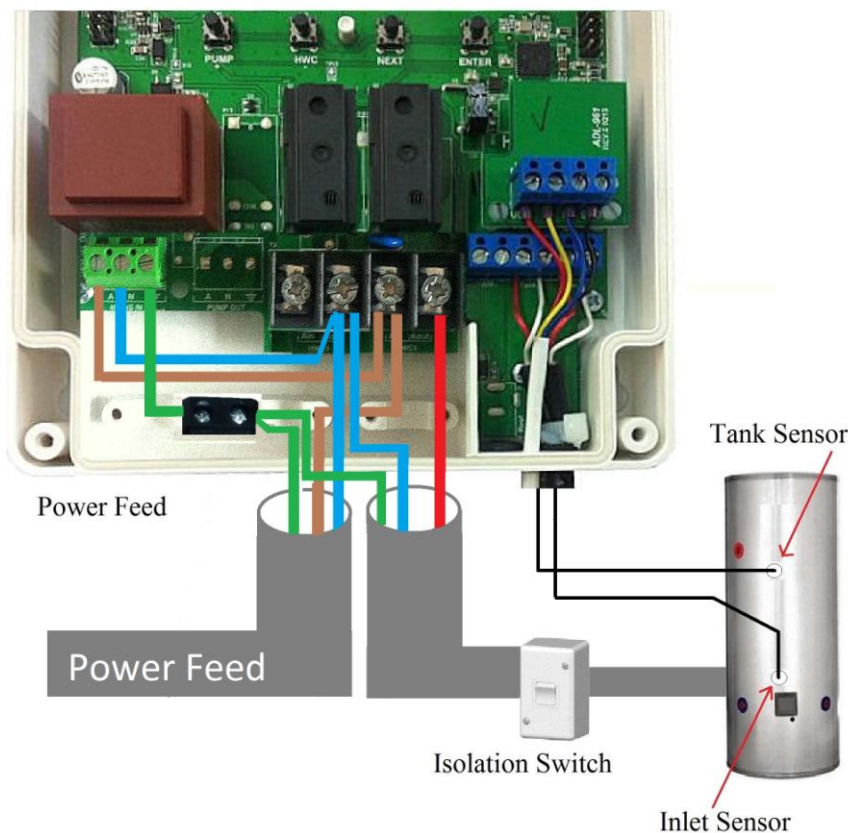
The controller comes with 4 mounting screws and a paper mounting template. Mount the controller vertically with the wires facing **down**. The controller enclosure and sensor entry points are water resistant to IP54 however if the glands and conduit used are not IP54 then the unit is no longer IP54. If the unit is mounted outdoors the power / conduit connections need to be IP54 and suitable for outdoor use.

### Electrical Connections

Most installations simply involve connecting Phase / Neutral / Earth wires from the power feed and then another set of Phase / Neutral / Earth wires to the Cylinder (Red phase wire to cylinder used in diagram just for clarity).

## Retrofit - Single Element

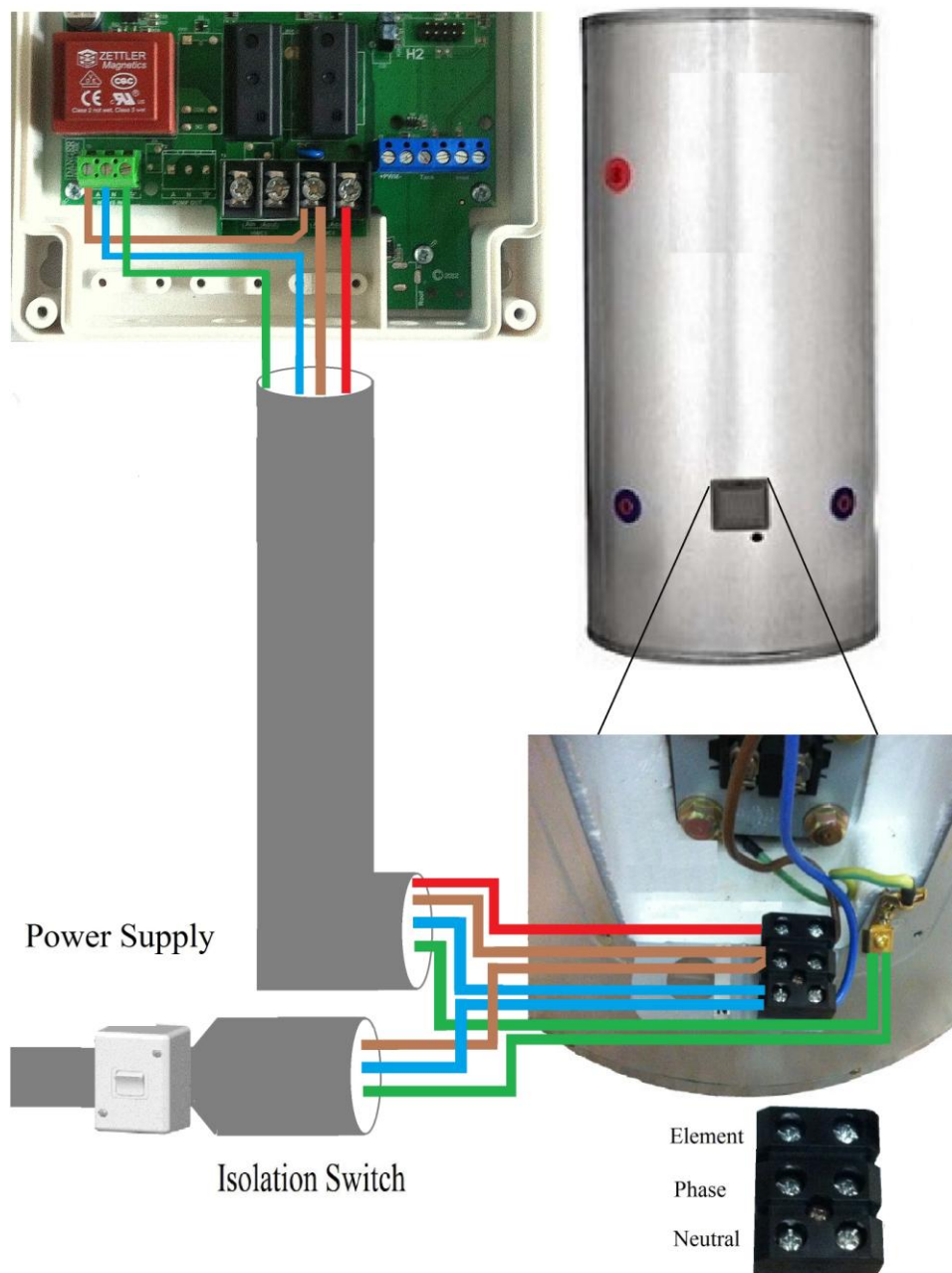
### Option 1



'A2 out' can be used for a 'spare' connection as it is fully isolated from other terminals (as illustrated above for Neutral connections). Do not use 'A2 in' as another spare as it is possible 'A2 in' and 'A2 out' can short together if the software is set up for dual element operation.



## Option 2



**Note:** For Dual element wiring see appendix 1

### Ripple Control

**Note:** The controller will not operate while the power is removed by the power utility for load shedding (ripple control). However the controller will permanently retain all settings and maintain the time and date for at least 14 days in an unpowered state. Also it will automatically restart and resume operation without intervention upon power being restored.

If this is unacceptable then either arrange for the hot water circuit to be permanently powered or use the alternative wiring option, illustrated in **Appendix 1**

**\*See separate single page wiring diagram for Colour of wires**

### S3™ Sensor mounting

1. Locate the best sensor position on the tank. We recommend the upper sensor is  $\frac{1}{3}$  from the top and the lower sensor is just **above** the element and thermostat (approx  $\frac{1}{3}$  from bottom)
2. Drill an 18mm hole\* through the outer cladding being careful not to contact the inner tank wall.
3. Remove the insulation material within that hole
4. **Ensure that no residual insulation material remains in front of the exposed inner tank wall** (this is critical to the success of the installation)
5. Place the sensor assembly in the hole. Add spacers until a millimetre or so of the last ring is protruding beyond the outer cladding. Spacers can be added by gently opening the split in the ring and pushing them over the sensor cable. **Note:** Tank sensor (labelled Tank) must always be above the Inlet sensor
6. Remove assembly and apply a liberal amount of heat transfer compound to the foot of the S3™ assembly.
7. Re-insert the sensor assembly
8. Fix in place by securing the flange to the outer cladding with the 4 screws provided.



**\*WARNING; Use only a hole saw with a short drill protruding from the saw. This will make it far less likely to damage the inner tank by coming in contact with the drill.**

**Note:** Ensure the attached thermal pad remains in place on the foot of the S3™ sensor. This is to electrically isolate the copper foot from dissimilar metals and avoid corrosion.

The S3™ sensor is patented by Senztek NZ Ltd.

## There are two DisplaySmart mounting options;

### DisplaySmart Dial

#### 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
- Remove knob and aluminium cover. Knob needs a 1.5mm size Allen Key to loosen
- Plug in DisplaySmart-Dial to plug from controller.



- Screw DisplaySmart-Dial onto wall
- Replace aluminium cover and secure Dial with Allen Key – be careful to align dial indicator to correct position

#### 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
- Remove Dial and aluminium cover
- Plug in DisplaySmart-Dial (as illustrated above)
- Screw DisplaySmart-Dial onto block
- Replace aluminium cover and secure Dial with Allen Key – be careful to align dial indicator to correct position

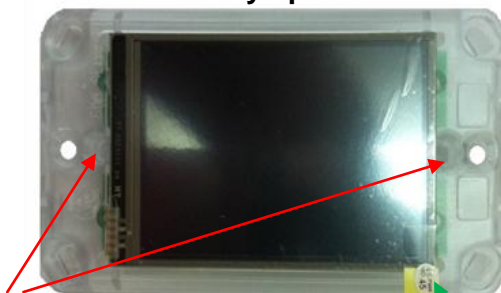


### DisplaySmart Touch

Similar to DisplaySmart-Dial installation but with the following variations

Some models of DisplaySmart Touch **cannot** be screwed on using the **inner holes on the plate** because the display will be destroyed.

**Mount this way up**



- Do not screw into these **inner holes** (use outer holes only)
- Remove the protective screen cover after installation for clarity

### CAUTION:

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



The DisplaySmart is not isolated and 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 DisplaySmart interface PCB while controller is on. It might destroy the controller.**





## Power Up and Test

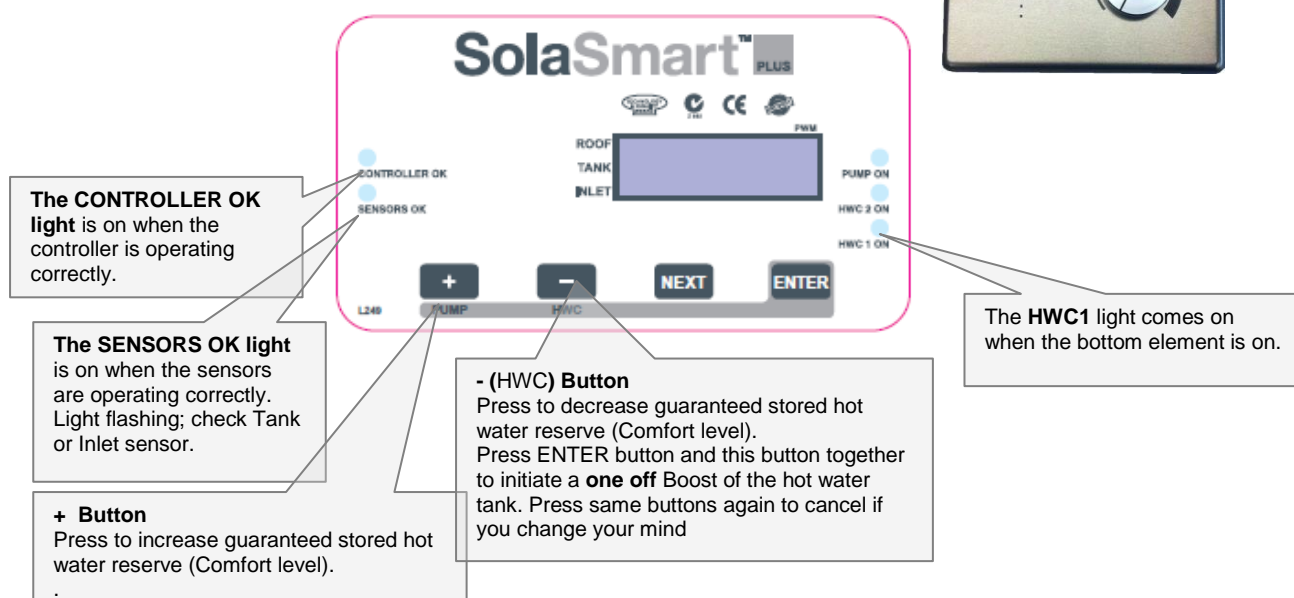
There are 2 optional user interfaces

1. **DisplaySmart- Touch** See **Appendix 4** on setting up the system with this interface.

**Note:** There will be no 7 segment display on the controller visible with this interface installed



3. **DisplaySmart – Dial** The controller 4x7 segment display will be present as for the below 'controller only' option. The DisplaySmart-Dial will also display available hot water as a 'fuel gauge' and allow easy adjustment of the Comfort percentage by turning the dial (see DisplaySmart-Dial manual)



**First display on power up**

**On power up the display will;**

1. Show all LED segments lit for 5 seconds (:88:88%)
2. Then the **software version number** for 5 seconds (4460)
3. After which the 2 sensor temperatures will cycle through Tank – Inlet. Indicated by the single dot next to label on the display.

**Note:** Roof is for the Solar option and will not display on this controller

On the 'controller only' option Comfort % and 'One Off Boost' are handled on the controller display and buttons.

**Comfort %**

Pressing + or the – button will adjust the comfort level and also display what the comfort percentage is for 10 seconds after the last button press.

100% = maximum settings as per the Tariff Table

0% = Holiday mode. The cylinder will not heat except for BioSafe®

**One-off Boost**

This a 'one –off' operation that will heat the cylinder to maximum and automatically reset when the Boost target temperature is attained

Press and hold **ENTER** and press **-** to initiate the one off boost (same again to cancel)

**Tariff Tables** The minimum reserved hot water **profile** is called a 'Tariff Table'  
It might be necessary to change the default Tariff Table

Only **entire tables** can be selected on Controller Only and DisplaySmart-Dial  
Note: (The DisplaySmart- Touch can generate a custom profile from the touch interface, this is stored as Tariff Table 6 (H6))

The Tariff Tables minimise the home owners electricity cost by matching hot water use and expectations to 4 different time bands each day. Thus not heating too much hot water. There are 5 to choice from to best suit the user.

Because the user can only 'turn down' the profile with the comfort control feature (the tables here = 100% user comfort setting) the table must represent the likely **maximum** expected stored reserved hot water.

The options are;

1. MAX – 100% and non over-rideable by user comfort control
2. High
3. Med
4. Low
5. Minimal

**Note:** These Tariff Tables are used on software version 4460 (not 4360). See page 8

H1 (Default) - Most popular profile				
	Band 1	Band 2	Band 3	Band 4
Band Start Time	5:00	9:00	15:00	23:00
Hot Water Level	High	Low	Med	Low

H2 (Constant) - Use if unsure or changing circumstances				
Band Start Time	7:00	9:00	20:00	23:00
Hot Water Level	High	High	High	High

H3 (Night Rate) - Suited to off peak heating				
Band Start Time	6:00	9:00	20:00	23:00
Hot Water Level	High	High	High	Max

H4 (Night Low)- Low expected night usage				
Band Start Time	5:00	9:00	15:00	20:00
Hot Water Level	High	High	High	Low

H5 (Solar Electric) – For using Solar Electric power for hot water heating				
Band Start Time	4:00	11:00	14:00	18:00
Hot Water Level	Med	Max	High	Low

## Setting Time/Date and Tariff Table

### Procedure

It will be necessary to set the correct time as well as the profile (for installations with DisplaySmart-Touch this is entered on the touch screen)

1. Press and hold **ENTER** for 10 seconds
2. The 'Hours' digits flash
3. Adjust with **+** and **-**
4. Press **NEXT**
5. Now the 'Minutes' digits flash
6. Adjust with **+** and **-**
7. Press **NEXT**
8. The selected Hot Water Tariff number will flash e.g. *H3*
9. Adjust with **+** and **-**
10. Press **NEXT**
11. Press **ENTER** to save and exit

It should not be necessary to adjust the other system parameters except in non standard situations. Contact TSHWC for more details.

The Comfort Level is an adjustable user control that allows the efficiency vs guaranteed hot water storage (backup) of the system to be managed


- Set higher for more guaranteed hot water
- Set lower for more savings

The Comfort Level percentage is not a direct temperature control; rather it uses advanced computer logic to determine the best temperatures and which sensors or elements in conjunction with the selected HWC profile (Tariff Table) to optimise the system for the user's expectations of stored hot water. The control can be easily altered at anytime to suit changing circumstances such as weather or guests in the house.

**Note:** The last Comfort setting is written to permanent memory 5 minutes after the last adjustment. If power is removed before the 5 minutes has elapsed the setting will revert to the previous stored value.

## CONTROLLER DISPLAY AND DIAGNOSTICS

- Introduction** The Controller Display will scroll screens 1 then 2 and repeat every 5 seconds. (Does not appear if a DisplaySmart-Touch is installed)
- Screen 1:  
Tank °C** The dot next to the "TANK" will be lit up when the Upper Tank Temperature is on the display.
- Screen 2:  
Inlet °C** The dot next to the "INLET" will be lit up when the Inlet (Lower Tank) Temperature is on the display.

**Note:** To view screens 3-5, press  This will activate advanced diagnostics mode for 10 minutes, after which time it will revert to the temperatures only.

- Screen 3:** Pump speed (not active on this controller)
- Screen 4:  
Time** Time is shown in HH:MM format.
- Screen 5:  
Tariff Table** The table that is selected for the hot water profile e.g. H I

- Screen 6:  
Diagnostics** Segment 1:  
Solar Rule that is currently active (not active for this option)


- = IDLE

Segment 2:  
HWC Rule that is currently active

- = IDLE  
r = Reheat  
b = BioSafe  
□ = Boost  
E = Error

Segment 3:  
Active Element: L = Lower, U = Upper

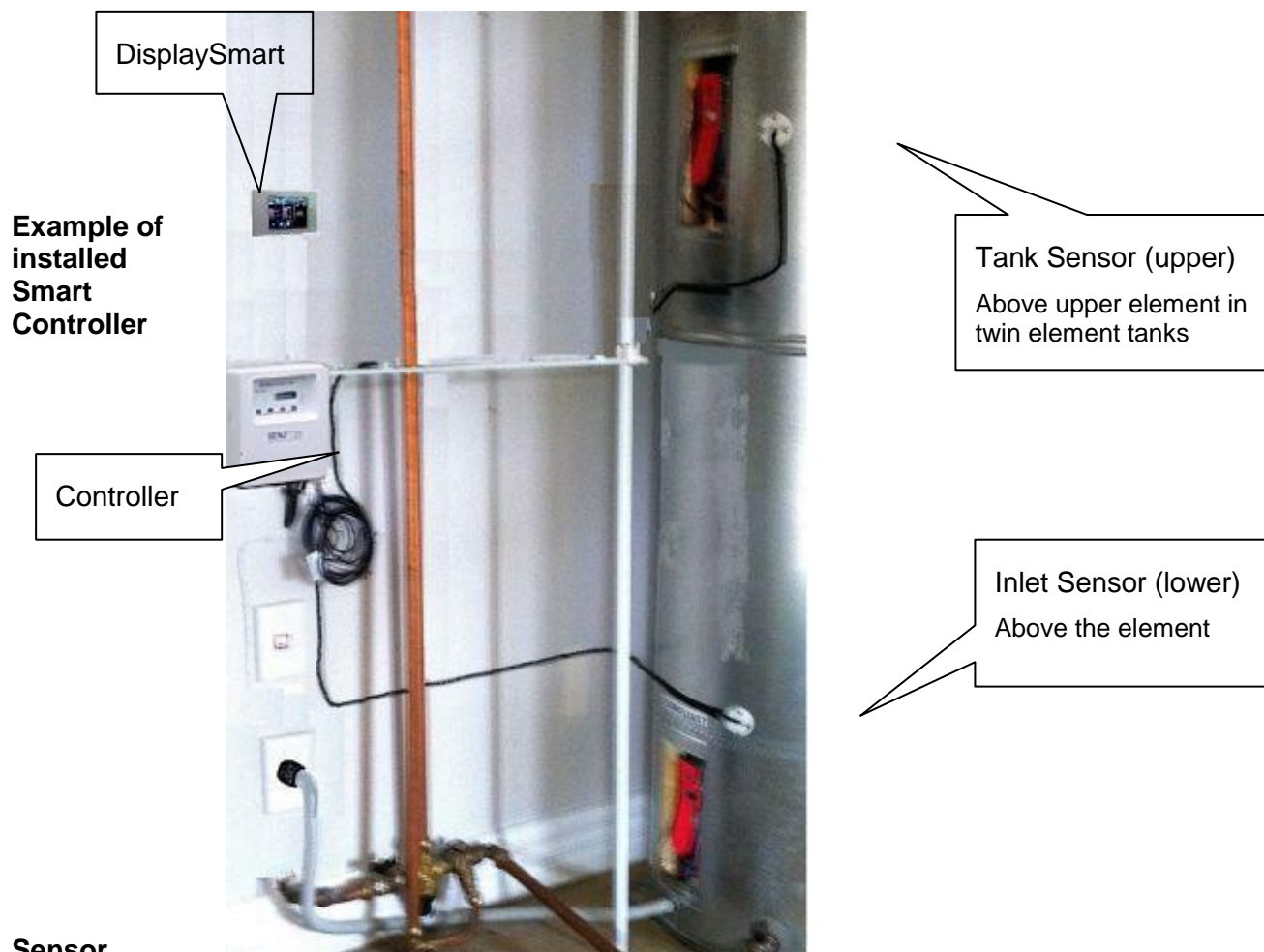
Segment 4:  
Active Tariff Time Band: 1 to 4

 = The solar pump is off, the tank is using an element to heat the tank (reheat) and that element is the lower It is time period 2.

**The Smart-Controller 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.





## Sensor Resistances

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

This table is a reference for checking sensors

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 Sensor light Off	<.050	
Below -40°C or 'oPn' on display Sensor light Flashing	>200	

## TROUBLE SHOOTING GUIDE

Symptom	Possible Cause	Solution
No operation, no lights on controller (and blank DisplaySmart). Power on in rest of house	⇒ Power is interrupted to controller	⇒ Check mains supply circuit breaker ⇒ Check if load control (ripple control) by power co has removed power. ⇒ If the controller going off with <b>Ripple Control</b> is undesirable then the controller will need a 24 hr power supply. See Appendix 1(Page 15)
Sensor O.K. light flashing (Sensor fault shows on DisplaySmart Touch)	⇒ Inlet or Tank sensor not detected. Broken sensor wire	⇒ Replace sensor in either sensor port until Sensor O.K. light is ON (or reported fault is gone from DisplaySmart-Touch)
HWC light stays on too long (more than 6 hours)	⇒ HWC power not getting to element ⇒ Element open circuit (blown) ⇒ Faulty thermostat / cutout ⇒ Excess water draw off or leak ⇒ BioSafe heating (Sterilising) cannot reach above 60°C on <b>BOTH</b> tank sensors for 32 minutes ⇒ <b>NOTE:</b> If tank is not <b>very</b> hot (or boiling) then power is not being consumed even though HWC light has been on for a long time	⇒ Check DisplaySmart-Touch home screen or Controller diagnostic screen to determine <b>why</b> tank is heating ⇒ 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. ⇒ If <b>NO</b> then power is not able to heat the water to the target °C ⇒ Read temperature at controlling sensor. ⇒ If < 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 wiring is correct. Check element is not blown. ⇒ If > 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.
Running out of hot water HWC light on	⇒ Similar problem to above ⇒	⇒ See above solutions but also consider profile values and times. E.G. a high heating period might need to come on at an earlier time
Running out of hot water HWC light off	⇒ Profile and/or Comfort (Savings) control set too low ⇒	⇒ If a rare event then use one off Boost ⇒ If a regular event alter the comfort setting to a higher setting (decrease saving control) or adjust tariff / profile
Hot water stored drops significantly at night, yet little or no draw off by user	⇒ Water leak ⇒ Tank is losing heat	⇒ Check for water leak; see if hot water pipe is hot/warm 2 metres from tank. ⇒ Install better insulation on hot water tank and fittings
Touch control not working on DisplaySmart	⇒ DisplaySmart needs re-calibration	⇒ Press touch screen while power to controller turned off / then on. Follow instructions on screen

## Specifications

### Power Supply:

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

### Relay Output: (element)

1x 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 below 60 Vdc
Zero Crossing contact closure

### Sensors:

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:

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	1200grams
(Standard model + cables + sensors + packaging)	

**Note:** Do not exceed these specification limits, result will be unit damage and void warrantee

**Product Liability.** This information 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, 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 is 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 Element wiring

### Most Dual Element Cylinders need wiring altered

It might be required to wire both the controller and the cylinder to accommodate dual element operation.

Unless a cylinder is specifically wired for dual independent element operation then it most likely is wired to heat with the upper element first and then switch over to the lower element once at target temperature. This operation will interfere with the Smart Hot Water controller and so must be altered.

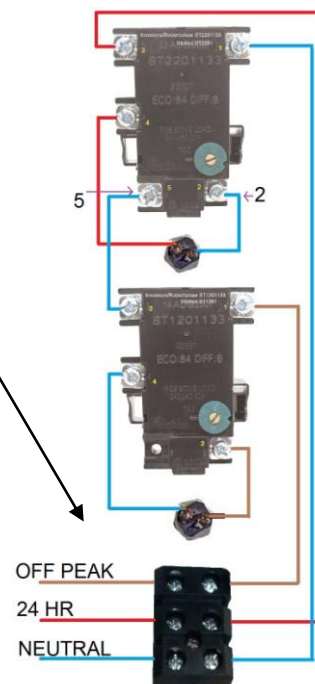
### Typical Cylinder wiring

Switch over of the Neutral occurs between terminals 2 and 5 on the upper thermostat. Once the upper thermostat switches the element off it provides Neutral so the lower element can be energized. This is an example using Robert Shaw Thermostats. Off Peak and 24Hr are usually linked

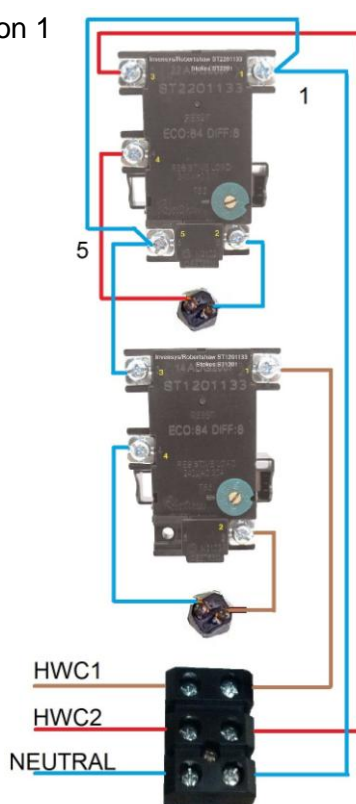
### Solutions

**First** option is to link the Neutral feed wire to the change over terminal on the upper thermostat. Link terminals 1 and 5 (as illustrated below).

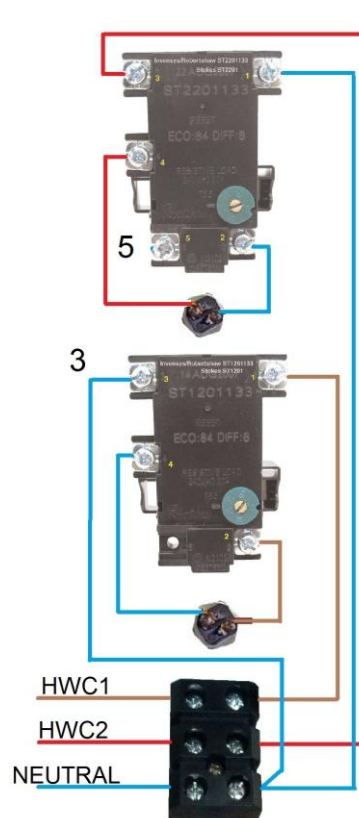
**Second** option is to disconnect the Neutral feed wire off terminal 5 on the upper thermostat and pull it through (or attach another). Then wire it to the neutral feed terminal block. Terminal 3 now has a permanent Neutral and is independent.



Option 1



Option 2



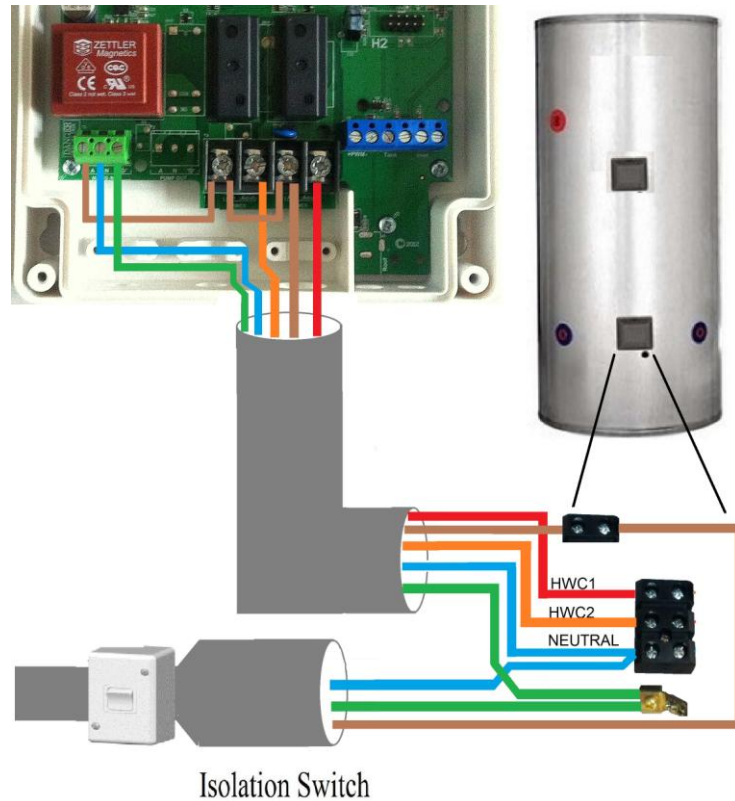


### Controller Wiring

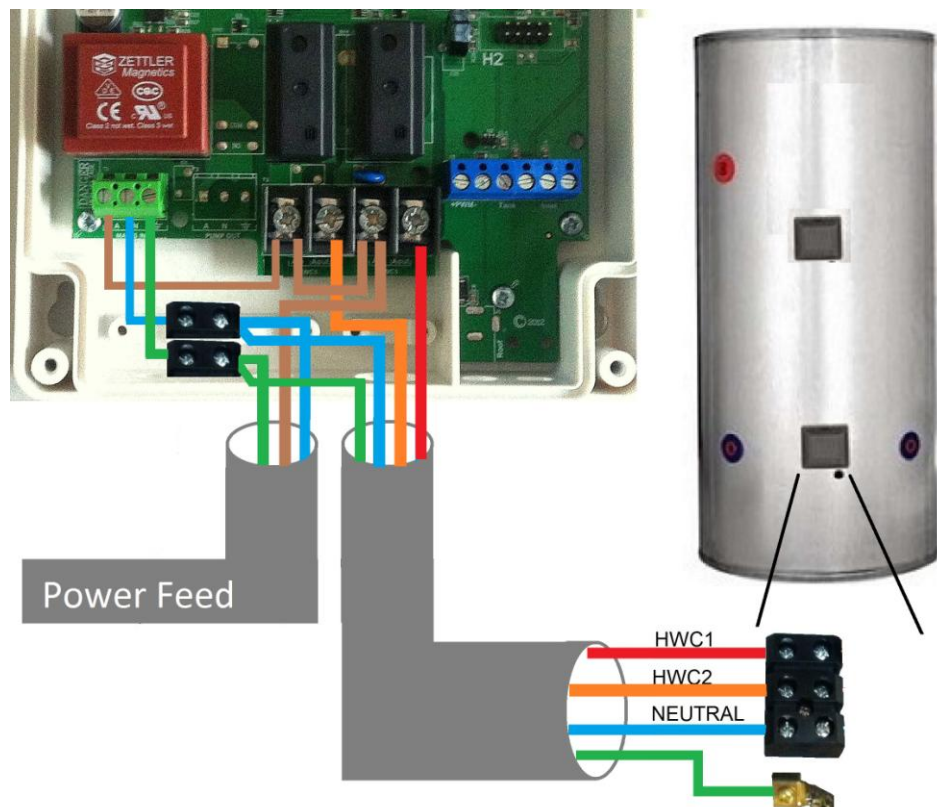
Here are two possible controller wiring solutions

Option 1; junction in Hot Water Cylinder

Note: the controller only draws around 2 watts of power so in this example the wires going to the controller power terminals (3 way terminal on the left) do not have to be substantial.



Option 2; Junction in controller.



## Appendix 2 – Dual supply variation

Single Phase  
only

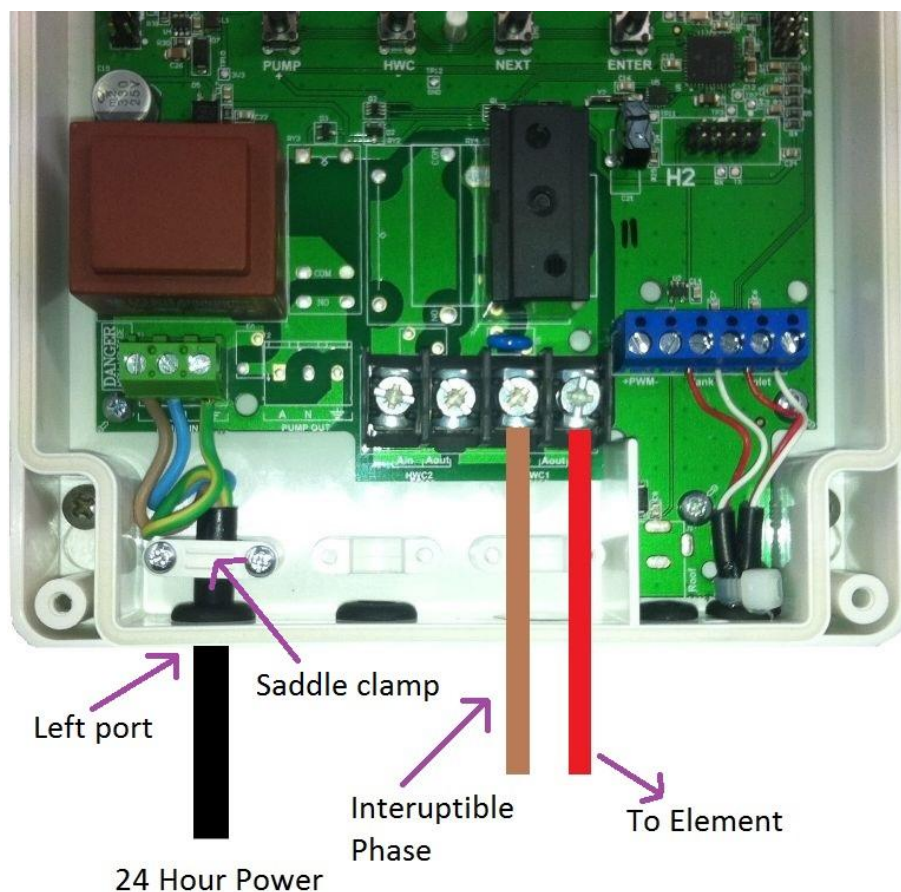


The Smart- Hot Water Controller is configured for **ALL power sources to be on the same phase**. If 2 phases are to be used on the installation then contact TSHWC for special wiring and installation instructions to meet the 400Vac isolation requirements



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

- Use in conjunction with wiring diagrams (single element example below)
  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 plug from left port.
  3. Insert a round mains cable through the left port. Must be 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 according to appropriate wiring diagram. There must be no common connection of Neutrals between power supplies



## Appendix 3 – Ripple Control information

Ripple control is a form of load shedding used mainly in New Zealand and in a handful of other countries around the world, where power is removed periodically from the hot water cylinder electric circuit by the power utility to help reduce peak loading of the power grid.

This differs from Night Rate where power is always removed at exactly the same time every day, usually from 7:00 am to 11:00pm.

Ripple control in New Zealand is usually mainly used in winter and for only a few hours at a time at most. However in times of power shortage this might be longer and /or more frequent

If your ripple control has removed power for an extended time, especially for 12hours or even 24 hours then it is possible the ripple has failed to re-energize (a known issue). Contact your power provider to enquire if ripple control is still active.

**Solutions:** It is possible to have the Smart Controller wired so the controller uses non-interruptible power while the hot water element uses ripple controlled power. See **Appendix 1** for wiring details

Another option is to have the ripple control removed; however this might increase your power costs. Your power utility will be able to help with information on this option.

## Appendix 4 – Setup with DisplaySmart –

### Power Up and Test

#### First display on power up

4. The Controller OK light should be illuminated on the controller
5. The DisplaySmart- Touch should be displaying the home screen (as illustrated)
6. 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



**Installers Screen-** If you need to set system parameters then go into the setup screen (not normally required)

- From the Home screen touch the System icon



This screen is a more detailed diagnostic display.



- Press the setup icon
- The access code is 1236 then 'enter'
- From here you can navigate all the system parameters.



### System Parameters

Once in the installer set up area the following parameters can be adjusted  
There are simple word explanations on screen

1. Solar enable/ disable
  - Do not enable. On a hot water only system the unit will malfunction if enabled.
2. Tank configuration
  - The controller must operate in 1 of 3 modes
  - Single element, Dual element or Night Rate
  - This controller version can only operate as a 'Single element'
3. RMax
  - Maximum temperature the electric heating can reach
4. Mid Element
  - If the Inlet (lower cylinder) sensor is BELOW the element then the unit must operate in Mid Element mode.
5. BioSafe
  - Legionella protection function
  - Normally if the entire cylinder has not been 60°C for 32 minutes sometime over the last 7 days then heating is initiated to achieve this 'acceptable solution'. Will display as Sterilising on the home scree.
  - Options for 60°C (normal)
  - 55°C -If the cylinder thermostat cannot be adjusted above 60°C (a common problem where the controller stays in Sterilisation mode). The cylinder thermostats are meant to be legally compliant with heating to at least 60°C so this is an adjustment to work with them
  - Off – For systems not required to meet Legionella regulations.

To save any changes press the disk icon

**The Smart-Controller 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.