SENZTEK

smart energy management

SolaSmart Plus™

INSTALLATION GUIDE

www.senztek.com

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For technical help contact your distributor.

Distributor Details:

www.senztek.com

BEFORE YOU BEGIN INSTALLATION

Assemble the Components You Will Need

The SolaSmart™ Controller is supplied with the following components:

- ⇨ Plug In Roof sensor
- ⇨ Tank sensor
- ⇨ Inlet sensor
- ⇨ Mains cable
- ⇨ Pump cable
- ⇨ Associated screws
- ⇨ Screw covers

Continued on next page

BEFORE YOU BEGIN INSTALLATION, CONTINUED

Assemble the Tools You Will Need

You will need the following tools to install the SolaSmart™:

Philips1 screwdriver for lid screws.

Pozi 2 screwdriver for mounting screws.

NOTE: These tools are needed to mount the SolaSmart™ only, and other tools may be needed for the remainder of the installation including the sensors.

READ THESE SAFETY PRECAUTIONS and LIMIT OF LIABILITY BEFORE YOU BEGIN

The following pages contain instructions for qualified personnel only. They involve potentially hazardous adjustments and high voltage mains wiring information.

General Safety Precautions

The following general safety precautions should be noted:

This installation guide is for the installation of SolaSmart™ Controllers only and is not an installation guide for any other part.

The complete installation should 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 electrical and plumbing regulations (and any special solar hot water regulations).

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BEFORE YOU BEGIN INSTALLATION, CONTINUED

Installation Precautions

Installers need to ensure the following:

The controller must be installed away from water sources such as rain, leaking pipes, or wet floors; and must not be installed in damp areas like bathrooms. The controller must have a waterproof enclosure if it is installed outside.

Make sure the controller is installed away from direct sunlight, flammable liquids or radiant heat sources.

Power leads must face directly down, not sideways or upwards.

Ensure the controller is in a safe environment for users to inspect display panel.

Follow instructions carefully when mounting sensors. Incorrect sensor mounting can lead to a poorly controlled solar hot water system with safety issues (e.g. overheating; over pressure damage to the plumbing; freezing damage to the solar collector).

The unit settings are factory programmed to optimise efficiency and safety. Alteration of the programmed values can lead to dangerous conditions and/or damage to parts of the solar hot water system.

CAUTION:
Dangerous Voltages may be present. The SolaSmart™ has no user serviceable parts.
Protective enclosure must only be opened by qualified personnel.
Remove ALL power sources before removing protective cover.

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BEFORE YOU BEGIN INSTALLATION, CONTINUED

Electrical Precautions

When undertaking electrical installations, please note the following:

All mains voltage electrical work must be carried out by a qualified electrician, especially external power outlet socket installation.

A readily accessible disconnect device, over current device and RCD Protection rated to suit the size of the pump plus 5VA must be incorporated in the power supply wiring. The over current device for a 1500W, 240Vac pump must not exceed 10Amps.

Sensor leads should be kept 300mm (12 inches) away from mains and comms cables.

Do not use mains power extension cords unless approved by the manufacturer. Water resistant plugs and sockets should be used.

The SolaSmart™ controlled output (PUMP) will be connected to the input power supply wiring and is not isolated from it. Supply voltages will be output through that outlet during activation.

The HWC outlets are isolated contacts. A supply wire and an output wire will need to be wired to each HWC outlet.

Always use the unit within specified voltage and load ranges. Never use with damaged leads, plugs or sockets.

Do not allow the sensor cable to come within 10mm of the high voltage connectors or components inside the enclosure.

The electric element should have a fuse that is rated within the stated maximum of the relay driving the element.

Do not connect the mains or the pump to a circuit that could be switched off by your electricity supplier to manage peak loads (ripple control).

Comply with all local and relevant electrical regulations.

Warning

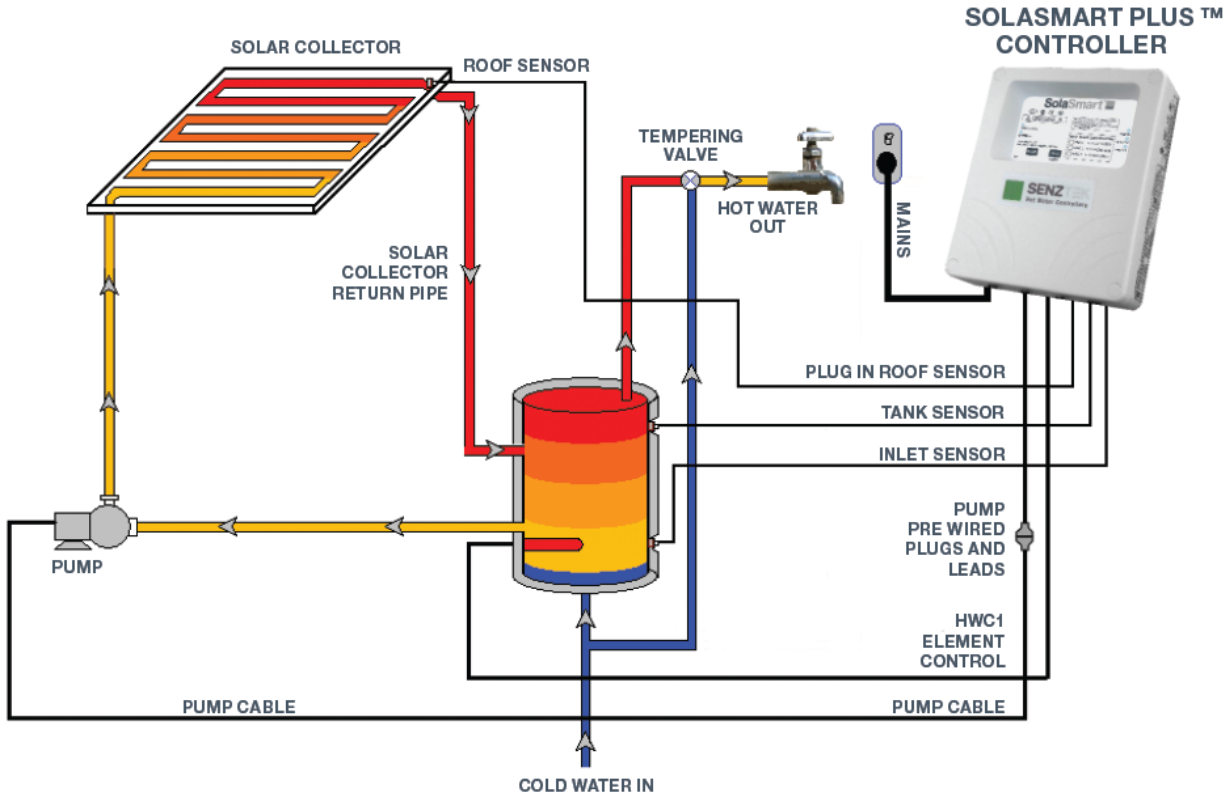
These products are not designed for use in, and should not be used for, applications which are in conjunction with items that are critical to any person's health (e.g. life support systems).

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

INSTALLING THE SOLASMART™ CONTROLLER

Overview

The diagram below shows how the SolaSmart™ is connected to the hot water cylinder (**HWC**), the collector, and the three sensors (**ROOF, TANK** and **INLET**).



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INSTALLING THE SOLASMART™ CONTROLLER, CONTINUED

Where to Mount the SolaSmart™

The SolaSmart™ should be mounted so that:

1. It is against a flat surface with sufficient strength to hold the enclosure and any additional weight from the plugs, sockets and cables,
2. Power Leads face down not sideways or up,
3. It is safe for users to inspect, and
4. Allowance is made for cable runs, location of power outlets and lengths of wires.

Mounting the SolaSmart™

Follow these steps:

1. Allow for the enclosure dropping 5mm (1/5 inch) from screw centres once mounted (keyhole mounting).
2. Place the drill guide template against the wall, checking for level alignment. Four screws are supplied: two chipboard screws and two combination plasterboard/wood screws.

   All four mounting holes should be used with at least two firmly secured into wood.

   The outer plastic plasterboard anchors will self tap into plasterboard and their inner metal screws fix into the centre of the plastic anchors.
3. Mark and drill/screw as appropriate leaving the heads of the screws above the surface by approximately 3mm (1/8 inch).
4. Place the unit over the four screw heads. The unit should slide down 5mm into the ‘key’ slots and become secured to the wall. You will need to adjust the screw height to obtain a secure fit.

MOUNTING THE SENSORS AND CONNECTING WIRING

Introduction

The locations and way that the sensors are mounted is critical to ensure the SolaSmart™:

Operates correctly and at greatest efficiency;

Protects the system against damage from extreme temperatures, and

If the Tank (Upper Tank) and/or Inlet (Lower Tank) sensors are not mounted correctly:

There may be an inaccurate Topout sensing, which could lead to damage to the hot water cylinder or other components.

There may be an inaccurate BioSafe sensing, which could increase the risk of biological contamination.

If the **ROOF** sensor is not correctly mounted:

The unit may not be able to detect **FROST** settings (this can lead to the collector panel bursting).

Please follow the instructions below carefully.

Positioning the ROOF Sensor

The **ROOF** sensor should be fitted into a metal immersion 'pocket' in the hot water outlet pipe.

Apply plenty of heat transfer compound (available from your distributor) between the sensor and the lining of the hot water outlet pipe.

Seal the sensor with neutral cure sealant and install external lagging. The cable should also be insulated from the bare pipe.

Ensure that the sensor cable is **NOT** in contact with the solar collector or any other exposed metallic surface on the roof.

Secure the ROOF sensor cable so it cannot move in strong winds. This is important to stop wire fatigue breakages.

To prevent physical damage to the cable by birds and vermin it is recommended that the cable is run in appropriate electrical conduit that will prevent damage to the sensor cable. The conduit needs to be run from the collector to the controller such that all cable is protected. Make sure the conduit is not in contact with the collector such that heat damage could occur to the conduit.

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MOUNTING THE SENSORS AND CONNECTING WIRING, CONTINUED

Positioning the Tank (Upper Tank) Sensor

The Tank (Upper Tank) Sensor must always be fitted above the Solar Collector return pipe. Labelled 'TANK' on the circuit board.

WARNING: Damage to the Hot Water Cylinder can occur if the Upper Tank sensor is not mounted correctly.

The Upper Tank sensor should be fitted into a metal immersion 'pocket' in the upper region of the hot water cylinder (HWC) (typically 1/3 of the way down from the top of the HWC).

If a 'pocket' is not available, then bond the sensor against the metal wall of the tank (not the outside cladding or insulation). Senztek has an 'S3' mounting option

Apply plenty of heat transfer compound (available from your distributor) between the sensor and the lining of the 'pocket' (or between the tank and the sensor).

If the tank is outdoors then seal where the cable exists the hot water tank with neutral cure silicon.

Positioning the Inlet (Lower Tank) Sensor

The Inlet (Lower Tank) sensor should be fitted into a metal immersion 'pocket' above the HWC electric element near the bottom of the tank (usually just above the element). Labelled 'INLET' on the circuit board.

If a 'pocket' is not available, then bond the sensor against the metal wall of the tank (not the outside cladding or insulation). Senztek has an 'S3' mounting option

Apply plenty of heat transfer compound (available from your distributor) between the sensor and the lining of the 'pocket' (or between the tank and the sensor).

Precautions

Please note:

Removing or cutting the cladding may void the hot water tank warranty.

The sensor must not be immersed in water.

Unless the temperature probe is designed for immersion in water, temperature probe pockets need to be completely dry before you insert the probe; and the pocket must be protected against moisture entry after the probe is fitted.

Sensor leads should be kept 300mm (12 inches) away from the mains and communications cables.

Make sure the right sensors are mounted in the right places!

Continued on next page

MOUNTING THE SENSORS AND CONNECTING WIRING, CONTINUED

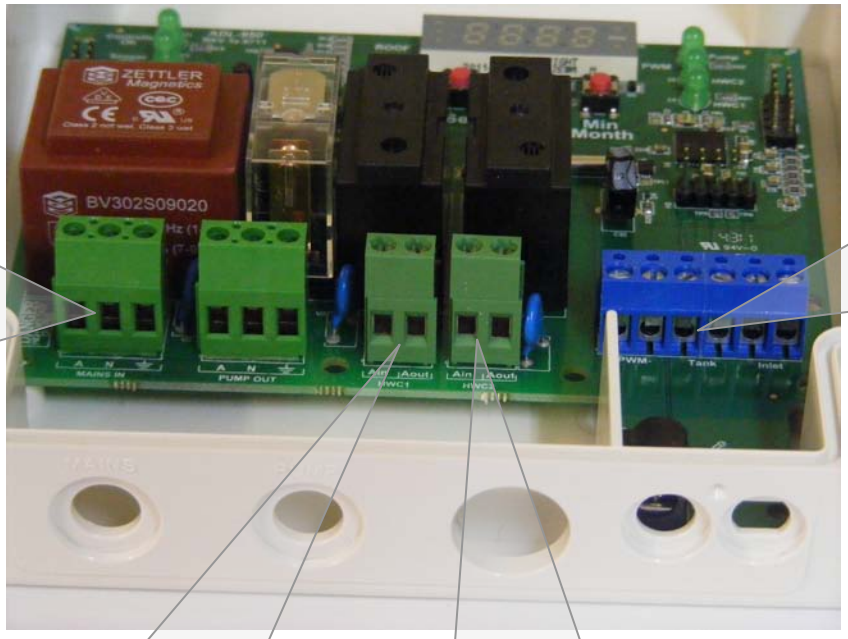
Connect the Wiring

The SolaSmart™ is supplied pre-wired with mains plug and pump socket, tank and inlet sensors.

1. Connect the wiring from the SolaSmart™ Controller to the **ROOF** sensor, the **TANK** sensor and the **INLET** sensor.
2. Connect the mains wiring.
3. Connect the wiring for the hot water cylinder element.
4. Connect the wiring from the SolaSmart™ Controller to the pump.

1. Connect the mains wiring.

   Do NOT connect the mains wiring to a circuit that could be switched off by your electricity supplier to manage peak loads (ripple control)



2. Connect the wiring from the controller to the, the TANK sensor and the INLET sensor (as labelled).
   Plug in the ROOF sensor.

3. Single Element HWC:
   Connect the wiring from the controller to the hot water cylinder element. Lower element or single element

Make sure that the electric element has a fuse that is rated within the stated maximum of the relay driving the element.
This is a simple (clean) set of normally open contacts that interrupt the Active/Phase wire that powers the element.
Do not bypass any thermostats or cut-outs.
Ensure mechanical thermostat is adjusted to maximum so controller can operate HWC.

NOTE: **WIRING OF HWC MUST BE DONE BY A REGISTERED ELECTRICIAN.**

4. Dual Element HWC:
   Connect the wiring from the controller to the hot water cylinder element. Upper element in a dual element tank

Make sure that the electric element has a fuse that is rated within the stated maximum of the relay driving the element.
This is a simple (clean) set of normally open contacts that interrupt the Active/Phase wire that powers the element.
Do not bypass any thermostats or cut-outs.
Ensure mechanical thermostat is adjusted to maximum so controller can operate HWC.

NOTE: **WIRING OF HWC MUST BE DONE BY A REGISTERED ELECTRICIAN.**

POWERING UP

Before you Connect the Power

Before you power up, make sure you have:

Read the safety instructions, warnings and liability statements.

Completed installation.

Securely mounted the unit in place before you connect power to the unit.

Checked that no water, metal shavings or other electrical hazards are anywhere near the plug, socket and/or surrounding environment.

NOTE:

The power outlet socket must be installed by a registered electrician.

The SolaSmart™ must be installed by a qualified person.

Ensure suitable over-current protection and RCD protection for the SolaSmart™ is in place.

The mechanical hot water thermostat for the electric element should be set to the maximum for the HWC Control Mode to operate correctly. (The hot water thermostat is only used as a failsafe feature and normally will not operate.)

Continued on next page

POWERING UP, CONTINUED

What you will see

Before you power up, make sure you have:

Read the safety instructions, warnings and liability statements.

Completed installation.

Securely mounted the unit in place before you connect power to the unit.

Checked that no water, metal shavings or other electrical hazards are anywhere near the plug, socket and/or surrounding environment.

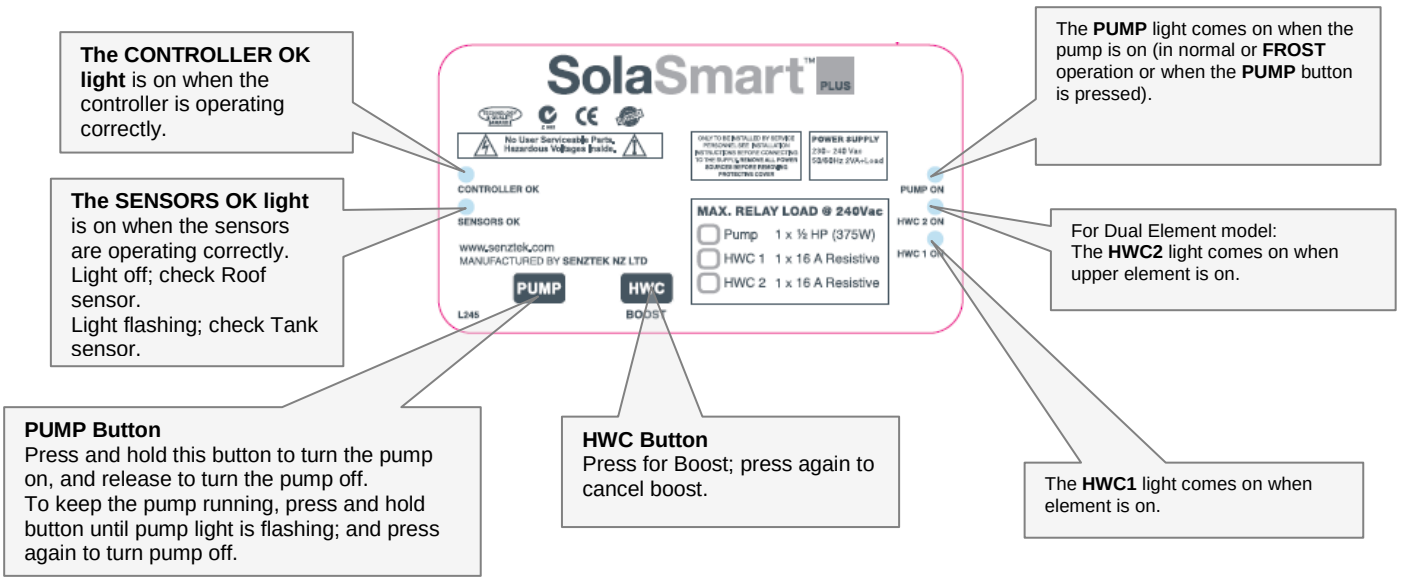
NOTE:

The power outlet socket must be installed by a registered electrician.

The SolaSmart™ must be installed by a qualified person.

Ensure suitable over-current protection and RCD protection for the SolaSmart™ is in place.

The mechanical hot water thermostat for the electric element should be set to the maximum for the HWC Control Mode to operate correctly. (The hot water thermostat is only used as a failsafe feature and normally will not operate.)



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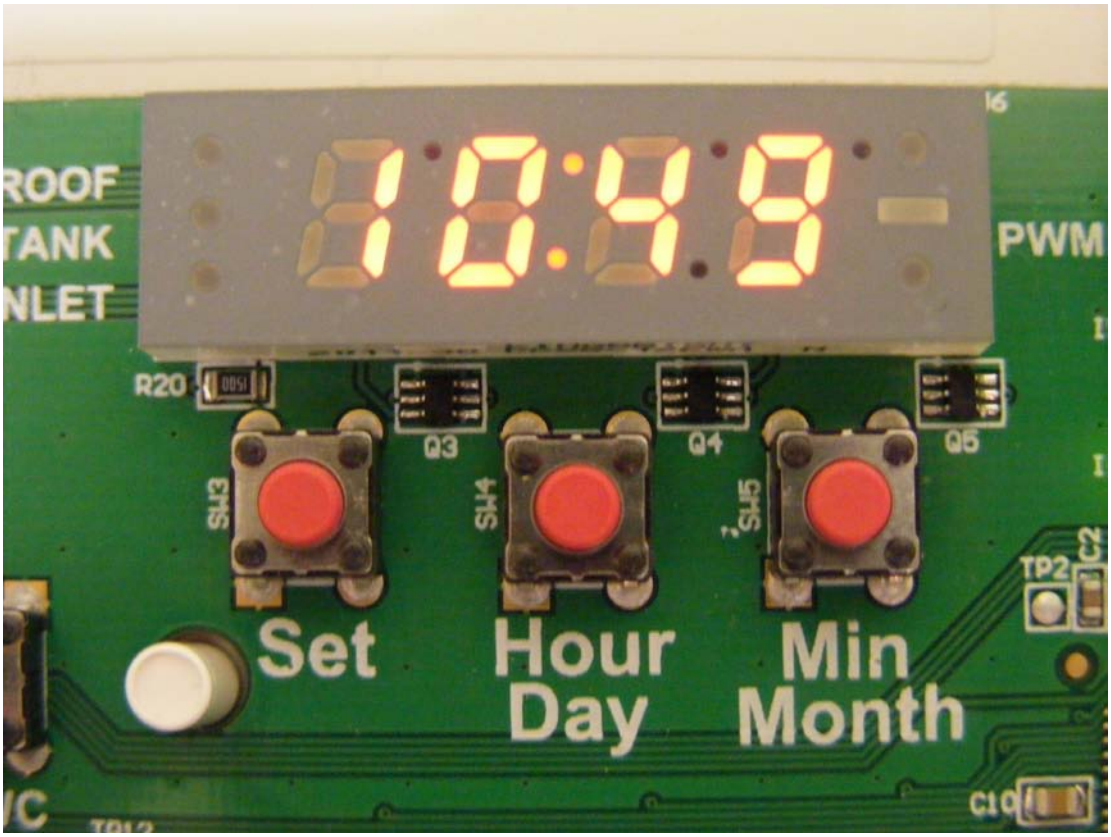
POWERING UP, CONTINUED, CONTINUED

Setting the Time and Date

The display is accessed by taking the top cover off the unit. Care must be taken in these conditions as there are dangerous voltages present around the high voltage section of the PCB. There is a plastic sheath fitted around this area under normal conditions. The Setting Time and Date procedure is also printed on the plastic sheath.



Procedure:

1. Press the Set Button.
2. Press the Hour and Min buttons to adjust time.
3. Press the Set Button.
4. Press the Day and Month buttons to adjust date. Year not set.
5. Press the Set Button.

Continued on next page

POWERING UP, CONTINUED, CONTINUED

Final Checks

The SolaSmart™ is now fully installed and should be working.

It is best to observe some solar hot water pump cycles, but this will depend on the sun shining.

Check all functions are working correctly before leaving the installation.

The SolaSmart™ settings have been factory set to the standard settings for your area and requirements.

See **'Trouble Shooting'** section on pages 27-28 of this guide if the system is not working correctly.

PLUMBING TIPS

Overview

This section will help you to ensure the plumbing associated with the SolaSmart™ will enable the system to be operated safety and to maximum efficiency.

All plumbing installations should be carried out by registered and qualified plumbers and all regulatory and local standards must be applied. Best plumbing standards must be used for all plumbing work associated with installation and maintenance.

All parts including the pump must be rated for the elevated temperatures found in solar hot water systems.

The information provided here provides feedback from experienced solar hot water professionals, but does not represent a complete guide to plumbing a system.

Tempering Valve

Water from solar hot water collectors frequently reaches very high temperatures. It may exceed 100°C (under pressure).

A tempering (or mixing) valve must be installed if required by local regulations.

It is used to ensure the supply from the tank does not burn end users. The tempering valve must be appropriately rated to handle extreme temperatures.

Installation must be to best plumbing practice and the manufacturer's specifications.

Non Return System

Hot water rises and cold water falls. If the solar collector is colder than the tank (e.g. at night) the hot water from the tank can thermo-siphon up to the collector. The collector then radiates the heat to the cool night air and the cooler water descends back to the tank.

To stop this loss of hot water at night or during cloudy skies, a 'one way' or non-return valve or other non return solution needs to be fitted.

The failure of a non-return valve or heat loop is a common problem with solar hot water systems. Some key points are:

It is critical to make sure that the orientation of the valve is as per the manufacturer's directions.

Make sure there are no debris caught in the valve as that could cause the valve not to close.

The heat loop/trap is long enough.

Continued on next page

PLUMBING TIPS, CONTINUED

Pressure Relief Valves

Solar hot water systems can run much hotter than standard domestic hot water systems. Hotter water expands more, and needs high quality pressure relief valves to ensure the tank or other components do not burst under pressure.

A qualified plumber can recommend the best practice solution for each installation for pressure relief valves, including the number and placement of them.

Air Relief Valves

Air locks can occur within the piping system (as well as the pump). These can increase the pressure that the pump is working against, to the point where the pump can no longer circulate the water.

To avoid this, an air relief valve should be fitted (especially in low pressure systems).

Your registered plumber should install the air relief valve to the highest point of the return from the solar water collector.

ABOUT THE PUMP SETTINGS

Introduction

The SolaSmart™ works by turning the pump on when the difference between the temperature at the solar hot water collector (ROOF) and the INLET is at a high level (i.e. the temperature at the solar hot water Collector is significantly higher than the temperature at the bottom of the tank (INLET).

The pump turns off again when the difference is lower (i.e. the water in the tank has been heated up).

For example, using the standard settings:

PUMP ON = 12°C and PUMP OFF = 6°C:

When the solar hot water collector (ROOF) water temperature is 12°C higher than the INLET, the pump turns on. This transfers hot water from the collector to the tank, and transfers cooler water from the bottom of the tank to the collector.

This makes the temperature in the Tank heat up; and the temperature in the collector on the ROOF cool down.

When the difference in the two temperatures reduces to 6°C, the pump switches off, allowing the water in the collector to heat up again.

FROST Function

The **FROST** function is designed to protect your collector and hot water system from freezing and bursting. When this temperature is reached, the pump will come on just enough to raise the temperature of water by 2-3°C Only a small amount of warm water is needed to protect the collector and plumbing.

When the unit is in Frost Mode, the **PUMP** light will come on.

PWM Pump Function

The PWM output is a signal that can communicate with an intelligent variable speed pump such as the Grundfos Solar PM 15-85. This is a signal only and not a power source.

A PWM pump uses less electricity to pump the same amount of water as a standard induction pump and will harvest solar energy more efficiently with the SolaSmart controller using a control method that self adjusts to maximum energy transfer.

Continued on next page

ABOUT THE PUMP SETTINGS, CONTINUED

Advanced TopOut Function

The Topout temperature is the maximum temperature that you will allow in the cylinder. Very high temperatures in the cylinder can cause damage (especially for ceramic lined tanks) – both from heat, and from high pressures on plumbing fittings.

This function is designed to stop hotter water from the collector entering the cylinder if the temperature is already high – until the water in the cylinder has cooled down to a safe level.

Senztek has also developed an advanced Topout method that delays the onset of collector stagnation and facilitates early recovery if stagnation has occurred.

This is achieved by using a three stage Topout where the tank is protected at all times and the solar pumping control method is altered progressively.

If stagnation has occurred and the hot water tank is no longer at maximum then recovery is achieved by pulsing water through the collector, dissipating heat in the pipes such that steam should not be present when the water re-enters the tank and thus avoiding steam implosions (loud banging noises in tank).

BIOSAFE, REHEAT, AND BOOST FUNCTIONS

Collector BioSafe

During BioSafe the pump is run for two minutes once the tank is above the target temperature.

BioSafe Mode

BioSafe runs periodically according to the settings. Only Inlet (Lower Tank) Sensor is used and Lower Element will be turned on when the controller is in the BioSafe Mode.

For installations where the Inlet (lower tank) sensor is below the electric element, BioSafe must use the Tank (upper tank) sensor for control and should be set to run every 24 hours to comply with AS 3498 Clause 7.1 (j)

BioSafe uses the Real Time Clock to determine when it should run and is therefore immune to power outages less than 14 days.

⇨ **BioSafe Target**

The controller ensures that the whole tank is above this temperature during BioSafe Mode.

⇨ **BioSafe Holdup**

The time BioSafe Target Temperature will maintain before exiting BioSafe Mode. If Lower Tank Temperature drops below BioSafe Target Temperature, the holdup timer is reset for the full BioSafe Holdup.

⇨ **BioSafe Band**

BioSafe can be specified to run at the start of any of the four Tariff band.

(Refer to "**Tariff Table**" on page 21)

⇨ **BioSafe Period**

It is the interval that BioSafe takes to repeat its operation, nominally every 7 days.

Continued on next page

BIOSAFE, REHEAT, AND BOOST FUNCTIONS, CONTINUED

Reheat Mode

Either the Tank (Upper Tank) or Inlet (Lower Tank) Sensor and either the Upper or Lower Element will be used in Reheat Mode. The Tariff Table on page 5 specifies which sensor will be used for control and which element will be used heating the tank. This enables the user to control the amount of hot water stored in his tank based on electricity price fluctuations during the day.

⇨ **Reheat Upper**

Reheat Upper is the temperature that the element will stop heating the tank in the Reheat Mode.

⇨ **Reheat Lower**

Reheat Lower is the temperature that the element will start heating the tank in the Reheat Mode.

Boost

Pressing the HWC button should heat from the lower element until the Inlet (Lower Tank) sensor reaches Reheat Max setting; for mid element tanks; this will use upper sensor (as for all heating control with mid elements).

To stop Boost, press the HWC switch again.

Boost will only come on if the temperature is below Reheat Max and the controller is not in BioSafe Mode.

OPERATIONAL SETTINGS

Introduction

All settings are factory set and not editable from the controller. Default values shown below.

It is recommended for solar installations to set the Tank Max value to as high as safely possible.

SETTINGS		
SOLAR Settings		
Setting names	**Value**	**Units**
Differential Pump On	10	ºC
Differential Pump Off	5	ºC
Frost On	4	ºC
Tank Max – Topout	80	ºC
HWC Settings		
Settings	**Value**	**Units**
BioSafe Target	60	ºC
BioSafe Holdup	32	Min
BioSafe Band	4	N/A
BioSafe Period	7	Days
Reheat Max	65	ºC

<Table 1> Controller Operational Settings

TARIFF TABLE

Introduction

The Tariff Table allows the controller to be setup in such a way as to minimise the home owners electricity cost. It comprises time bands in a 24 hour period and for each time band specifies various parameters as detailed below.

Table 1 shows all the variables in Tariff Table. The values in the table are indicated as an example only.

TARIFF TABLE				
Description	**Band 1**	**Band 2**	**Band 3**	**Band 4**
Band Start Time	7:00	15:00	20:00	23:00
Band Stop Time	14:59	19:59	22:59	06:59
Band Comfort %	20	50	70	100
Band Element	Upper	Upper	Upper	Lower
Band Sensor	Upper	Upper	Upper	Lower

Table 1

Calculated values of reheat Upper and lower based on Comfort % for each band.

Comfort %	**20**	**50**	**70**	**100**
Reheat Upper ºC	53	57	60	65 (Reheat Max)
Reheat Lower ºC	45	52	57	64

Table 2

Band Comfort %

The comfort level is the inverse of efficiency. Having a high comfort level minimises the chance of running out of hot water at the expense of greater electricity usage. Holiday mode is achieved by setting the comfort level to 0%, in which case only BioSafe will turn the element on.

Band Element & Band Sensor

These are the element and the sensor that will be used in Reheat Mode. Only one element and one sensor will be active.

DISPLAY AND DIAGNOSTICS

Introduction

The display is accessed by taking the top cover off the unit. **Care must be taken in these conditions as there are dangerous voltages present around the high voltage section of the PCB. There should be a plastic sheath fitted around this area under normal conditions.**

The Display is normally a scrolling display of six screens. Every 5 seconds the display scrolls to the next screen.

To force the screen to advance, press the hour button.

To hold the current screen, press and hold the min button.

Screen 1: Roof Temperature

The dot next to the “ROOF” will be lit up when the Roof Temperature is on the display.

If the sensor is faulty, “Opn” or “Shrt” will be displayed depending on the fault condition.

Screen 2: Tank (Upper Tank) Temperature

The dot next to the “TANK” will be lit up when the Upper Tank Temperature is on the display.

If the sensor is faulty, “Opn” or “Shrt” will be displayed depending on the fault condition.

Screen 3: Inlet (Lower Tank) Temperature

The dot next to the “INLET” will be lit up when the Inlet (Lower Tank) Temperature is on the display.

If the sensor is faulty, “Opn” or “Shrt” will be displayed depending on the fault condition.

Note: To see screens 4-6, press the hour button. This will activate advanced diagnostics mode for 10 minutes, after which time it will revert to the temperatures only.

Screen 4: PWM Duty Cycle %

Shows the speed of your variable speed pump (0 to 100%). Only applies when using a PWM pump.

Screen 5: Time

Time is shown in HH:MM format.

Continued on next page

DISPLAY AND DIAGNOSTICS, CONTINUED

Screen 6: Diagnostics

SEG 1:

Solar Rule that is currently active

- \- = IDLE
- F = Frost
- d = Differential
- t = TopOut (D1 Stage 1, D2 Stage 2 , D1 & D2 Stage 3)
- b = Collector BioSafe
- E = Error

SEG 2:

HWC Rule that is currently active

- \- = IDLE
- r = Reheat
- b = Collector BioSafe
- 0 = Boost
- E = Error

SEG 3:

Active Element: L = Lower, U = Upper

SEG 4:

Active Tariff Band: 1 to 4

Continued on next page

DISPLAY AND DIAGNOSTICS, CONTINUED

LEDs

LEDs diagnose the operation of the controller. The LEDs indicates the following information

L1. **Controller OK:**

On – Controller is running successfully

Off – Controller failed power up Built in Test

L2. **Sensor OK:**

On – All sensors ok

Flashing – Lower or Upper Tank Sensor faulty

Off – Collector Sensor faulty

L3. **Pump:**

On / Flashing– Pump is running

Off – Pump is not running

Flashing – Pump switch was held down for 10 seconds, pump will run for 1 hour unless cancelled by another press

L4. **Upper Element:**

On – Upper Element is on

Off – Upper Element is off

L5. **Lower Element LED:**

On – Lower Element is on

Off – Lower Element is off

SENSOR MAINTENANCE

Lengthening Sensor Wire

The sensor wire can be lengthened within certain guidelines:

The absolute maximum cable length is 100m (328 feet).

Over 20m (66 feet), care must be taken to avoid electrical interference being picked up.

In noisier electrical environments, screened cable may be required.

Firmly attach wires to each other by either soldering (heatshrink over each joint) or by quality screw terminals. Joints must be kept dry.

Wire normally used for lengthening is twin 0.5mm^2 (20 AWG) stranded speaker wire.

CAUTION:
Dangerous Voltages may be present. The SolaSmart™ has no user serviceable parts.
Protective enclosure must only be opened by qualified personnel.
Remove ALL power sources before removing protective cover.

Replacing a Sensor

If a damaged sensor needs to be replaced then the cover of the enclosure will need to be opened unless the choice is made to join the wires externally (see Lengthening Sensor Wire section above).

Remove the mains power supply. Make sure no other power source is feeding back through other connections.

1. Remove the four screw covers on each corner of the lid of the enclosure. This will require a fine tipped tool such as a screw driver. Be careful not to damage the lid. Always press the tool away from you to avoid injury if you slip.
2. Remove the four screws that hold the lid on.
3. Unscrew the damaged sensor from the terminal block.
4. Loosen the cable clamp for the sensor leads.
5. Carefully pull the wire back through the opening in the bottom case.
6. Thread the new sensor wire back through where the old one came from.

Continued on next page

SENSOR MAINTENANCE, CONTINUED

Replacing a Sensor, continued

7. Place the wires of the new sensor into the terminal block where the old sensor came from and retighten the screws.
8. Do not allow the sensor cable to come within 10mm of the high voltage connectors or components inside the enclosure. Tighten the screws on the cable clamp.
9. Replace the lid, replace the four screws and tighten.
10. Push in four new screw covers available from your distributor or Senztek NZ Ltd. **NOTE:** There are locating lugs to ensure correct orientation.
11. Reconnect the SolaSmart™ and turn on the power.
12. Check that the sensor is reading correctly.

Sensor Resistances

The table below has the correct resistance values of the sensor at different temperatures. The sensor must be removed from the SolaSmart™ to measure these values correctly.

Follow the above procedure to remove a sensor.

Sensor Resistances		
Temperature	**Resistance in kΩ**	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.
0°C	27.25	
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	⇨ No power/fault	⇨ Check mains outlet. ⇨ Press pump button. If pump light comes on controller is o.k.
Sensor O.K. light OFF	⇨ Roof sensor not detected	⇨ Check sensor is plugged in ⇨ Plug a spare Roof sensor in to test ⇨ If test sensor O.K then replace Roof sensor
Sensor O.K. light flashing	⇨ Inlet or Tank sensor not detected	⇨ Replace sensor in either sensor port until Sensor O.K. light is ON
Pump not running, while sunny outside. Pump light ON	⇨ Pump damaged or disconnected. ⇨ Pump timer has turned pump off ⇨ Controller fault	⇨ See if pump has become unplugged ⇨ Wait one minute for the pump to restart. ⇨ Test controller pump outlet if power is present. If power present replace the pump. If no power replace controller
Pump not running, while sunny outside. Pump light OFF	⇨ System in Topout ⇨ Sensor mounting problem	⇨ Check display if in Topout. If so then this is normal. ⇨ Check sensor readings. If readings do not match real water/plumbing temperatures check sensor is making good contact with pocket/ surface. Thermal paste required to make good thermal conductivity.
Pump is running continuously	⇨ Pump is cavitating ⇨ Special Installation ⇨ Airlock in pipe ⇨ Setting does not match plumbing used	⇨ If pump sounds like stones are passing through it, the pump may be cavitating. ⇨ Long pump times may be normal for a variable speed pump or a special installation ⇨ Unplug pump for 1 minute. If system behaves normally after plugging back in then an airlock was present. ⇨ If return pipe temperature losses are greater than 'pump off' value system may lock on for extended periods of time. Insulate return pipe better or change pump off value.
Pump only comes ON when Roof sensor is above 100ºC	⇨ Advanced Topout method	⇨ Normal operation for Advanced Topout.
Pump only comes ON for few seconds every few minutes	⇨ T2 Advanced Topout and recovery method in action	⇨ Normal operation for Advanced Topout and Recovery. This prevents banging in tank (steam implosions)

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TROUBLE SHOOTING GUIDE, CONTINUED

Symptom	Possible Cause	Solution
Hot water stored drops significantly at night, yet little or no draw off by user	⇨ System is reverse thermo-siphoning ⇨ System is in a high frost area ⇨ Tank is losing heat	⇨ The non-return method is not effective or is malfunctioning. May be associated with night time pump activities. Check roof sensor reading at night to verify. ⇨ Discuss non-frost sensitive options with your energy provider ⇨ Install better insulation on hot water tank
HWC light stays on too long (more than 6 hours)	⇨ Excess water draw off or leak ⇨ HWC power not getting to controller ⇨ HWC power not getting to element ⇨ Element open circuit (blown)	⇨ Is HWC circuit drawing expected current (typ 16 Amps)? **Qualified personnel only**. If yes verify excess hot water is not being drawn off ⇨ If NO then power is not able to heat the water to the target ºC ⇨ Read tank temperature at controlling sensor. ⇨ If < 50ºC issue will be interrupted power or a faulty element. **Qualified personnel only**; 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. ⇨ If > 50ºC issue will be tank thermostat. Ensure thermostat is turned up to max. If this doesn't work then thermostat is too inaccurate for this application. ⇨

SPECIFICATIONS

Power Supply:

Supply Voltage	240 Vac +/- 10% 50 to 60 Hz
Quiescent power usage	2VA typical

Relay Outputs:

Pump: 10A (240Vac) Resistive (element)
½ HP/375W (240Vac) Motor rating (0.4cos theta)
Zero Crossing contact closure / open
Voltage from input switched through this output

2x HWC: 16A (240Vac) Resistive (element)
1.5 HP/1100W (240Vac) Motor rating (0.4cos theta)
Zero Crossing contact closure / open
Isolated contacts only provided

PWM Output: (Only for connection to an intelligent variable speed pump e.g. Grundfos Solar PM 15-85)

1kHz +/- 10% pulse repetition rate
Max drive 5mA avg at 9-14 volts. Peak 1.5Amps
Max 5 meter cable to pump

Sensors:

PVC Sensors	-20 ~ +120°C tip 5.8mm diameter stainless steel
	-20 ~ +105°C cable, UV resistant
Silicone Sensor	-20 ~ +250°C peak tip, 5.8mm diameter stainless steel
	-20 ~ +180°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

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SPECIFICATIONS, CONTINUED

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 (excluding glands and cables)	L = 167mm 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’.

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