

smart energy management

SolaStat™ -2-3

An Intelligent Technology Solution for Water Heating

INSTALLATION GUIDE

FOR QUALIFIED PERSONNEL ONLY



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For technical help contact your distributor.

Distributor Details:

www.senztek.com

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BEFORE YOU BEGIN INSTALLATION

Assemble the Components You Will Need

The SolaStat™ Controller is supplied with the following components:

- ⇒ Roof sensor
- ⇒ Tank sensor
- ⇒ Inlet sensor
- ⇒ Mains cable
- ⇒ HWC relay socket
- ⇒ Pump cable
- ⇒ Associated screws
- ⇒ Mounting guide
- ⇒ 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 SolaStat™:

- ⇒ Philips1 screwdriver for lid screws.
- ⇒ Pozi 2 screwdriver for mounting screws.

NOTE: These tools are needed to mount the SolaStat™ 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 SolaStat™ 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.
- ⇒ Note that the Sola-2-3at™- ST is factory set to display temperature in degrees Centigrade/ Celsius. The Sola-2-3at™- 2F is factory set to display temperature in degrees Fahrenheit. These settings cannot be changed. Refer to the label on the side of the enclosure and the box.



CAUTION:

Dangerous Voltages may be present. The SolaStat™ 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, overcurrent device and RCD Protection rated to suit the size of the pump plus 5VA must be incorporated in the power supply wiring. The overcurrent 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 SolaStat™ controlled outputs (PUMP and HWC) will be connected to the input power supply wiring and are not isolated from it. Supply voltages will be output through that outlet during activation.
 - ⇒ The HWC Relay Socket is normally used with a SolaStat™- Rly or other external relay. The total current must not exceed 10A maximum.
 - ⇒ 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

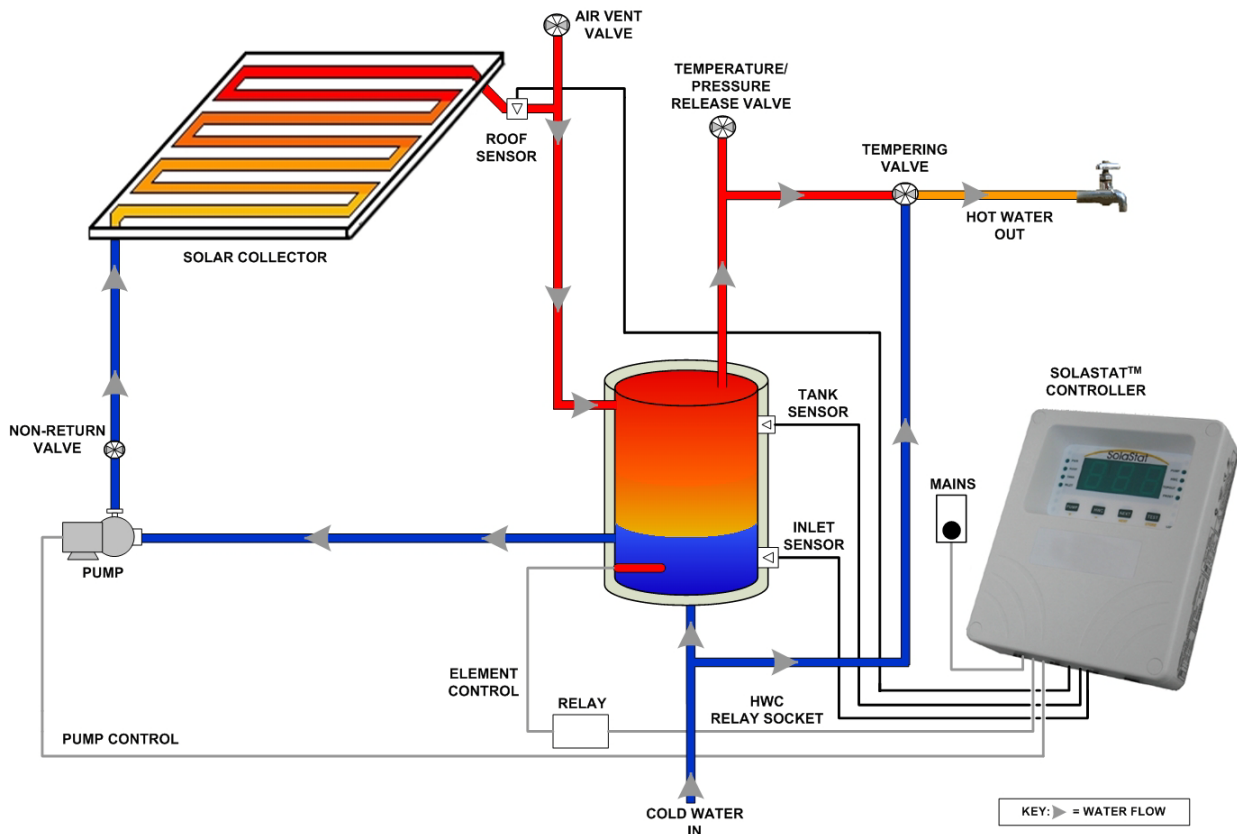
These products are not designed for use in, and should not be used for, applications which are in conjunction with items that are critical to any person's health (e.g. life support systems).

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

INSTALLING THE SOLASTAT™ CONTROLLER

Overview

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



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INSTALLING THE SOLASTAT™ CONTROLLER, CONTINUED

Where to Mount the SolaStat™

The SolaStat™ 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,
 4. The display can be easily read and buttons accessed, and
 5. Allowance is made for cable runs, location of power outlets and lengths of wires.
-

Mounting the SolaStat™

NOTE: In general, you should not need to open the controller unit during installation unless the installation is for a hot water cylinder with two elements.

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 SolaStat™:

- ⇒ Operates correctly and at greatest efficiency;
- ⇒ Protects the system against damage from extreme temperatures, and
- ⇒ Displays hot water readings accurately.

If the **TANK** and/or **INLET** 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.
- ⇒ Hot water readings on the display may be inaccurate.

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 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.

Continued on next page

MOUNTING THE SENSORS AND CONNECTING WIRING, CONTINUED

Positioning the TANK Sensor

The **TANK** Sensor must always be fitted above the Solar Collector return pipe.

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

The **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, or the first possible place below 1/3 of the way down).

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

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 Sensor

The **INLET** 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).

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

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!

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MOUNTING THE SENSORS AND CONNECTING WIRING, CONTINUED

Connect the Wiring

The SolaStat™ is normally supplied pre-wired, hence wiring inside the controller should not be necessary.

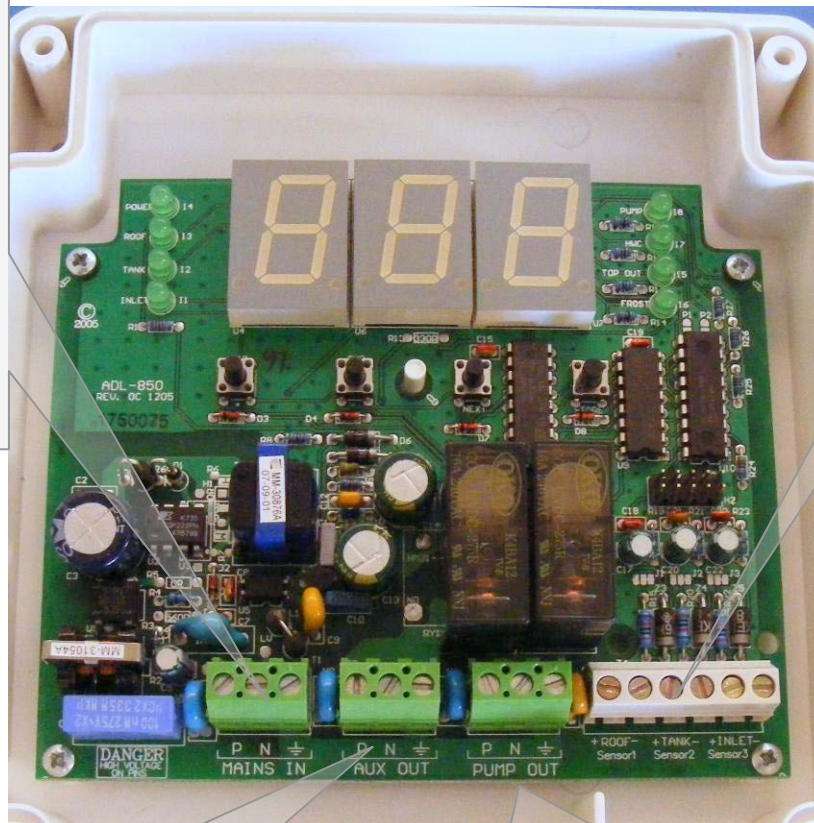
However, if needed, the wiring diagrams below show you how to wire the unit for a single element.

1. Connect the wiring from the SolaStat™ 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 SolaStat™ Controller to the pump.

The unit can also be installed with the wiring entering from behind the unit.

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 **ROOF** sensor, the **TANK** sensor and the **INLET** sensor (as labelled).

3. Connect the wiring from the controller to the hot water cylinder element.

Make sure that the electric element has a fuse that is rated within the stated maximum of the relay driving the element.

4. Connect the pump wiring. Make sure the pump is appropriate for domestic hot water circulation and does not exceed 1 Horsepower rating (750W) as shown on the label on the side of the enclosure.

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

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 SolaStat™ must be installed by a qualified person.
- ⇒ Ensure suitable over-current protection and RCD protection for the SolaStat™ 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 fail safe feature and normally will not operate.)

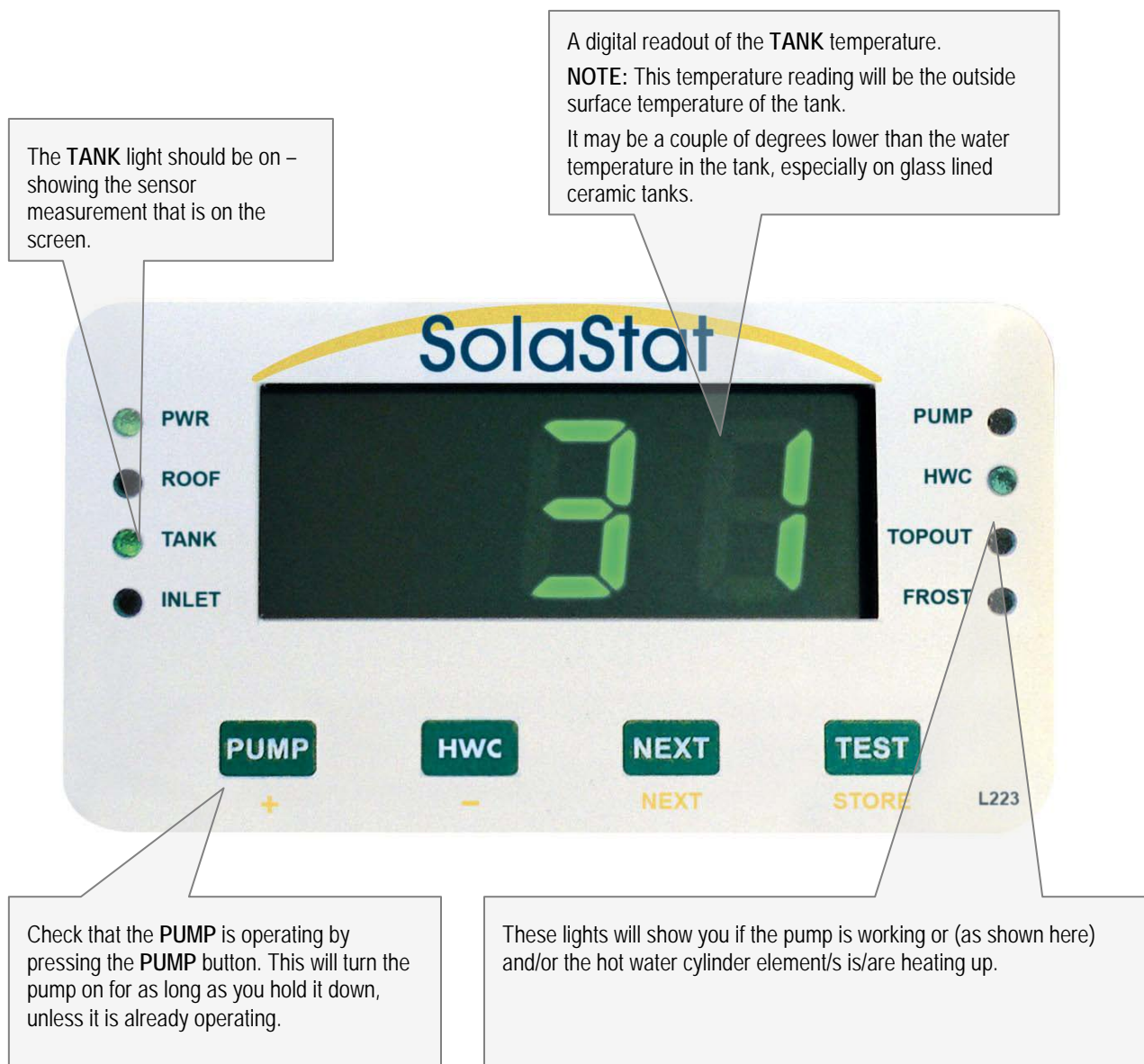
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POWERING UP, CONTINUED

What You Will See

When you power up the unit, it will look like the picture below.

Check that the **PUMP** is operating by pressing the **PUMP** button. This will turn the pump on for as long as you hold it down, unless it is already operating.



POWERING UP, CONTINUED

Note

When the SolaStat™ is turned on for the first time, BioSafe will be turned on for an hour, if both **TANK** and **INLET** temperatures are higher than BioSafe Temperature.

The unit will continue to monitor the hot water tank.

If the **TANK** or **INLET** temperature is below the BioSafe temperature for about 72 hours, BioSafe will be activated again. This will heat the tank to the BioSafe temperature.

The Holdoff timer will start from the next time the pump is activated.

Final Checks

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

These can be adjusted by a certified installer, using the instructions in the '**Programming the SolaStat™**' section on pages 21-31 in this manual.

Note that the Sola-2-3at™- ST is factory set to display temperature in degrees Centigrade/ Celsius. The Sola-2-3at™- 2F is factory set to display temperature in degrees Fahrenheit. These settings cannot be changed. Refer to the label on the side of the enclosure and the box.

See '**Trouble Shooting**' section on page 34 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 SolaStat™ will enable the system to be operated safely 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/212°F (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 Valve

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 needs to be fitted.

The failure of this non-return valve 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.
-

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 Pump Cavitation

If the water pressure drops and/or the temperature of water being pumped rises, cavitation can occur at the pump. This is especially likely to happen in low pressure systems.

Bubbles form when the water is sucked into the pump's impellor; and they collapse again when the water is ejected out of the impellor.

This can make a rumbling/cracking noise (like stones are passing through the pump). It can cause damage to the impellor and other sensitive components; and it also results in less volume of water being moved.

Your SolaStat™ has an automatic timer setting, which can help to minimise cavitation.

The timer is normally factory set to switch off the pump after every 10 minutes operation, for a period of one minute. This helps any accumulated air to escape from the pump.

This feature can also help prevent the pump from running for extended periods in a 'locked up' state.

Continued on next page

PLUMBING TIPS, CONTINUED

Pump Cavitation

To prevent cavitation:

- ⇒ Make sure the pump is appropriate for the installation.
- ⇒ On a variable speed pump, make sure the setting is correct – a slower speed that still has enough head pressure is the best, as it will minimise the pressure difference at the pump.
- ⇒ Mount the pump as low as possible relative to the tank, so the water pressure from the tank feeding in to the pump is maximised.
- ⇒ Lower the resistance to water flow into the pump (use wider - at least ½" - diameter pipes; reduce the number and 'sharpness' of s-bends, etc).

If cavitation at the pump remains a problem, you may need to consider:

- ⇒ Installing a larger pump with a larger impellor to reduce the vacuum at the impellor, or
 - ⇒ Converting the system to the mains pressure.
-

ABOUT THE PUMP SETTINGS

Introduction

The SolaStat™ 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/22°F and PUMP OFF = 6°C/11°F:

- ⇒ When the solar hot water collector (ROOF) water temperature is 12°C/21°F 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/11°F, the pump switches off, allowing the water in the collector to heat up again.
-

About the Setting

For standard domestic hot water systems, the recommended settings are relatively large (e.g. PUMP ON = 12°C/22°F and PUMP OFF = 6°C/11°F).

This causes the pump to transfer hotter water over shorter periods of time.

For lower temperature systems (like swimming pools or under-floor heating), these temperatures settings should be set lower (e.g. PUMP ON = 5°C/9°F and PUMP OFF = 2°C/4°F).

This causes the pump to transfer more water at lower temperatures.

Continued on next page

ABOUT THE PUMP SETTINGS, CONTINUED

Adjusting the Setting

If you increase the PUMP ON value, the solar heater will heat up more before the heat is transferred to your hot water tank.

Hotter water will enter your tank, but it may take longer to heat the water to that level; or on dull days, the temperature difference will not be enough to activate the pump (and the energy in the water within the collector will be lost).

If you increase the PUMP OFF value, then the difference in the temperature of the water coming from the solar collector compared with the tank is greater when the pump turns off (the water entering the tank will be hotter than the water already in the tank).

This will reduce heat losses in pipes, but less energy may be transferred.

HOLDOFF, REHEAT AND BIOSAFE FUNCTIONS

Introduction

The Holdoff, and Reheat Functions operate together to ensure that heating the tank and pump operation are properly coordinated to maximise energy efficiency.

They work together with the BioSafe Function, which ensures that the temperature in your tank is raised to a pre-determined value at least once every 72 hours.

In summary:

- ⇒ The **Holdoff Timer** sets how long the timer will override the element coming on (as long as the tank temperature is above Reheat Lower).
- ⇒ The **Reheat Upper** temperature sets the tank temperature at which the heating element will automatically stop reheating the water in your cylinder.
- ⇒ The **Reheat Lower** temperature sets the tank temperature at which the heating element will automatically start to reheat the water in your cylinder.
- ⇒ The **BioSafe** target temperature is the temperature the tank will heat up to at least once every 72 hours to ensure the water is safe from harmful bacteria.

These different settings are pre-programmed, but can be changed to suit individual user situations and needs. This section gives some examples of settings that can be used, and how the pump and elements will operate in response.

BioSafe Mode

This example shows how the BioSafe function can be used.

If the settings are as follows:

- ⇒ Holdoff Timer = OFF
- ⇒ Reheat Lower = OFF
- ⇒ Reheat Upper = OFF
- ⇒ BioSafe = 60°C/140°F.

Then BioSafe ensures that the Tank reaches 60°C/140°F about every 72 hours - either from Solar Hot Water or the electric element turning ON.

Continued on next page

HOLDOFF, REHEAT AND BIOSAFE FUNCTIONS, CONTINUED

Holdoff, Reheat and BioSafe Mode

This example shows how Holdoff, Reheat and BioSafe Modes can all work together.

If the settings are:

- ⇒ Holdoff Timer = 4 hours
- ⇒ Reheat Lower = 40°C/104°F
- ⇒ Reheat Upper = 55°C/131°F
- ⇒ BioSafe = 60°C/140°F

Then:

- ⇒ BioSafe ensures the tank reaches 60°C/140°F approximately every 72 hours, either from solar hot water, or from the electric element turning ON.
- ⇒ Each time the pump operates, the Holdoff Timer resets to 0 hours and starts counting again, up to four hours.
- ⇒ From the last pump operation, the electric element will be OFF for approximately four hours, unless the tank falls to 40°C/104°F.
- ⇒ If the tank temperature falls to 40°C/104°F, then the electric element turns ON.
- ⇒ When the tank reaches 55°C/131°F the electric element turns OFF.
- ⇒ After four hours has elapsed from the last pump operation, the Reheat Upper acts as a thermostat for the tank:
 - When the tank reaches 55°C/131°F, the electric element turns OFF.
 - When the tank falls to 50°C/122°F, the electric element turns ON.

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HOLDOFF, REHEAT AND BIOSAFE FUNCTIONS, CONTINUED

Reheat and BioSafe Mode

This example shows how Reheat and BioSafe can work together.

If the settings are:

- ⇒ Holdoff Timer = 'OFF'
- ⇒ Reheat Lower = 40°C/104°F
- ⇒ Reheat Upper = 55°C/131°F
- ⇒ BioSafe = 60°C/140°F

Then:

- ⇒ BioSafe ensures the tank reaches 60°C/140°F approximately every 72 hours - either from Solar Hot Water or from the electric element turning ON.
 - ⇒ When the tank falls to 40°C/104°F, the electric element turns ON.
 - ⇒ When the tank reaches 55°C/131°F, the electric element turns OFF.
-

Thermostat and BioSafe Mode

This example shows how you can programme Thermostat Mode to work together with BioSafe.

If the settings are:

- ⇒ Holdoff Timer = 'thr'
- ⇒ Reheat Lower = 'OFF'
- ⇒ Reheat Upper = 55°C/131°F
- ⇒ BioSafe = 60°C/140°F

Then:

- ⇒ BioSafe ensures the tank reaches 60°C/140°F about every 72 hours, either from Solar Hot Water or from the electric element turning ON.
 - ⇒ When the tank reaches 55°C/131°F, the electric element turns OFF.
 - ⇒ When the tank falls to 50°C/122°F, the electric element turns ON.
-

PROGRAMMING THE SOLAStat™

Default Settings

The SolaStat™ settings have been factory set with the pre-set values specified in the Programming Table at the end of this manual. These settings should not require any changes.

Caution: Incorrect settings of these values could damage the system or cause it to run inefficiently, voiding the warranty on the product.

However, the settings can be changed by a qualified installer, using the instructions in this section. Any changes in settings should be entered in the Programming Table at the end of the SolaStat™ User Manual.

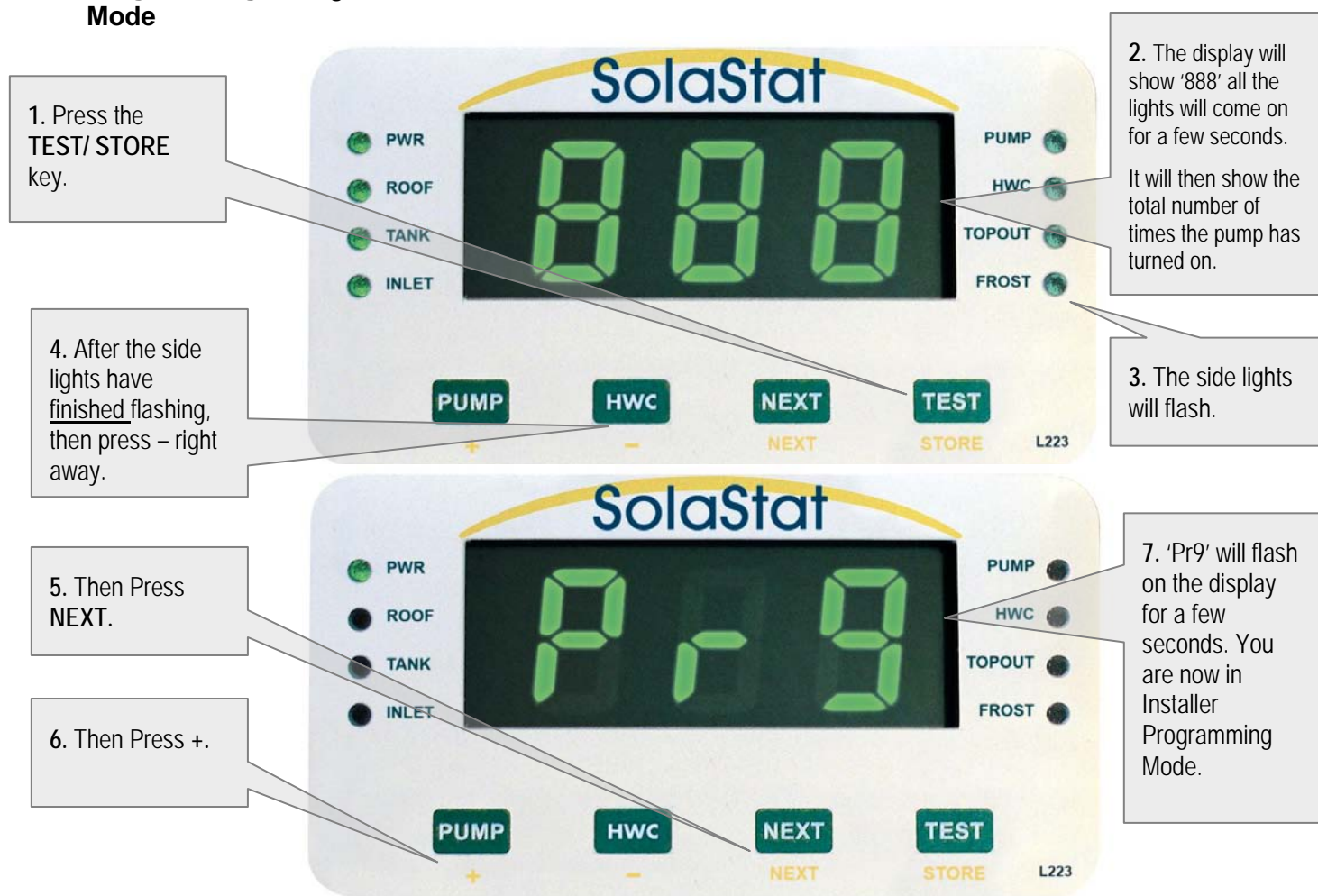
Important Notes

Note that if no keys are pressed for one minute during programming, then the unit will exit from Programming Mode, and you will need to re-enter Programming Mode.

Important: The writing at the bottom of the keys is your programming guide.

Enter Installer Programming Mode

To enter Installer Programming Mode, follow the steps shown in the diagrams below.



Continued on next page

PROGRAMMING THE SOLAStat™, CONTINUED

Enter Adjustable Values

When you have entered the Installer Programming Mode, the **PUMP** light will be flashing. The unit is now ready to accept the '**PUMP OFF**' value entry, and subsequent values.

After each key press, you have one minute to press another key before the unit times out. Remember that while you are in Installer Programming Mode, the screen will flash 'Pr9' every 10 seconds.

The settings are programmed in the following order. Press **NEXT**, when you have adjusted each setting, to move to the next setting. If you wish to go back, keep pressing **NEXT** until you return to that setting.

1. **PUMP OFF** temperature
2. **PUMP ON** temperature
3. **HOLDOFF TIMER**
4. **REHEAT LOWER** temperature
5. **REHEAT UPPER** temperature
6. **BIOSAFE** temperature
7. **TOPOUT** temperature
8. **FROST** temperature

NOTE: While you're in Programming Mode, 'Pr9' will flash on the display screen every 10 seconds.



Use the + and – keys to change the setting value.

Use the **NEXT** button to proceed to the next setting, and repeat until all values are entered.

You can press **STORE** at any time to save all values and exit Programming Mode to automatic operation.

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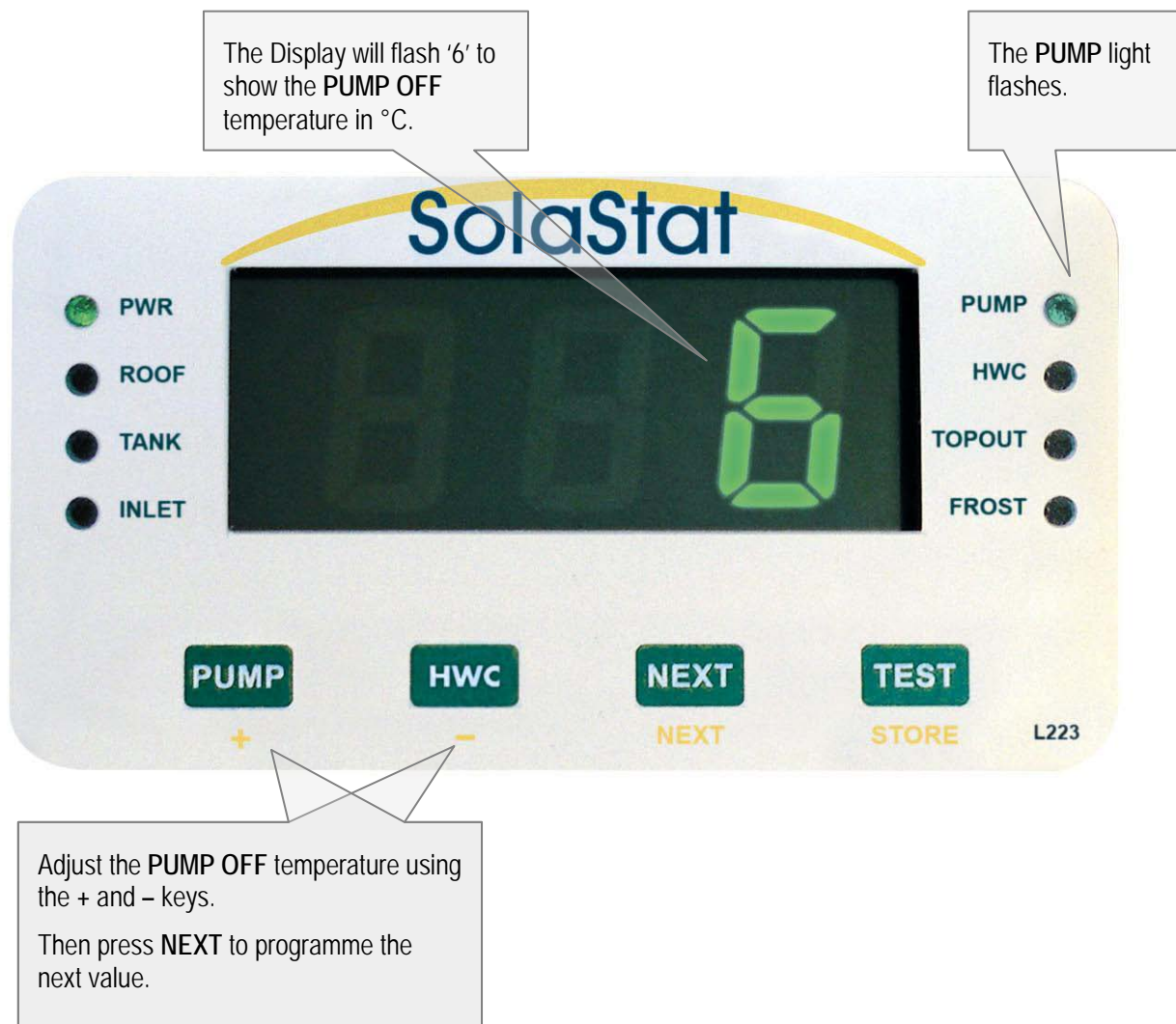
PROGRAMMING THE SOLAStat™, CONTINUED

Adjust the PUMP OFF Temperature

The **PUMP OFF** temperature difference determines when the pump will be turned off, to allow the water in the solar Collector to heat up fully (i.e. make sure that the water in the cylinder is not diluted with colder water).

The Standard Value is 6°C/11°F, and the range is 1-20°C/2-36°F.

NOTE: Further information on PUMP OFF Settings is included on pages 16-17 under **About the Pump Settings**.



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PROGRAMMING THE SOLAStat™, CONTINUED

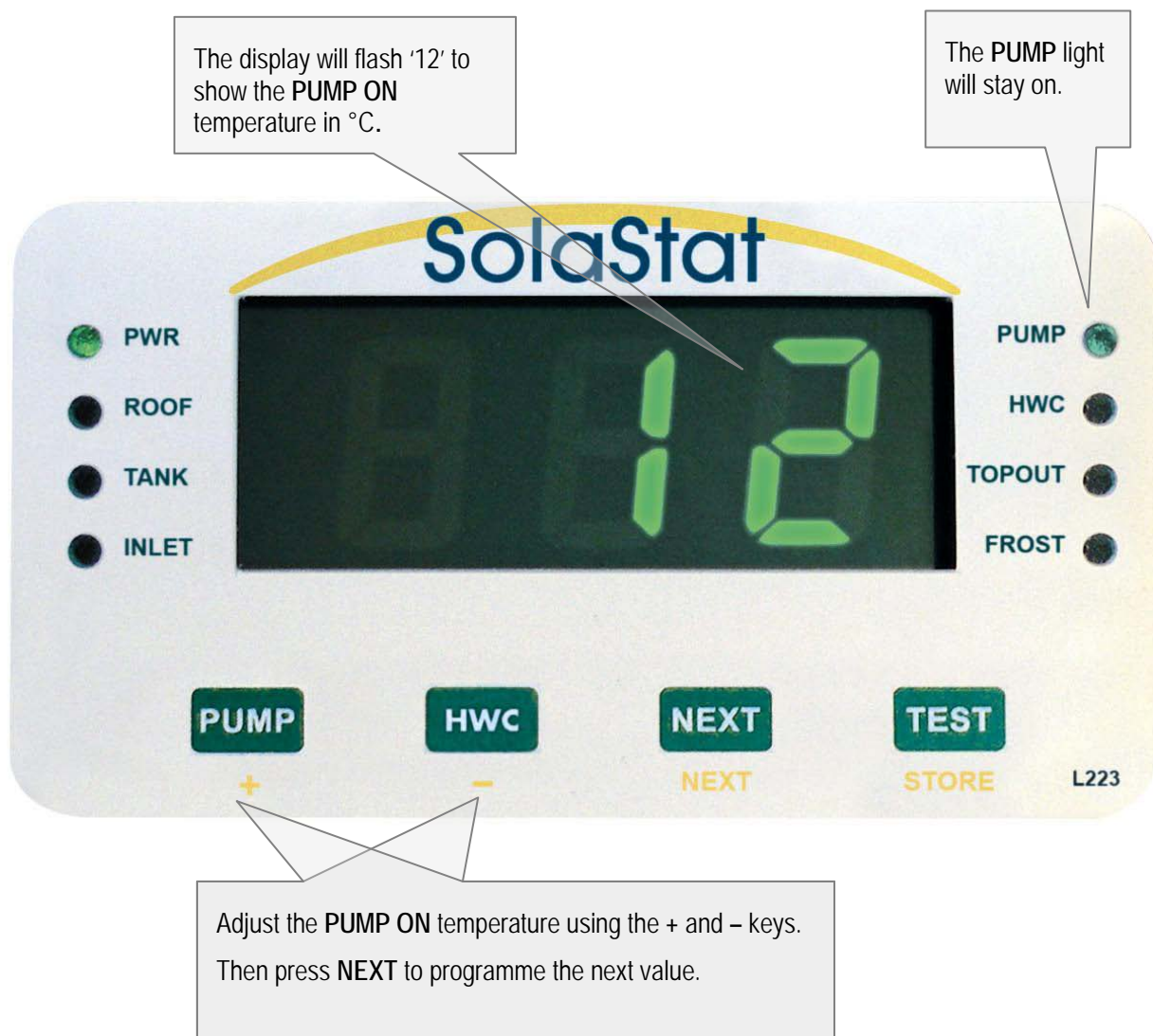
Adjust the PUMP ON Temperature

The **PUMP ON** temperature difference determines when the Controller will activate the pump, to transfer water from the Solar Collector into the hot water cylinder.

The Standard Value is 12°C/22°F, and the range is 2-21°C/4 - 38°F.

It is always set to a higher level than the PUMP Off temperature.

NOTE: Further information on PUMP ON Settings is included on pages 16-17 under **About the Pump Settings**.



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PROGRAMMING THE SOLASTAT™, CONTINUED

Adjusting the HOLDOFF TIMER

The **HOLDOFF TIMER** controls how long after the last pump operation elapses until the electric element can be switched on – unless the temperature fall below the Reheat Lower temperature (see next page).

This stops the hot water cylinder element from coming on when solar heated water is being pumped into the tank during the day.

After the Holdoff time has elapsed since the last pump operation, the Reheat Upper acts as a thermostat for the tank.

The Standard Value is 4 hours, and the range is between 1 and 23 hours.

⇒ To set this to 'OFF', adjust the Holdoff Timer to >23 hours.

⇒ To set this to 'thr' (thermostat), adjust the Holdoff Timer to <1hour.

NOTE: Further information on Holdoff Settings is included on pages 18-20 under **Holdoff, Reheat and BioSafe Functions**.

The display will flash '4' to show the
HOLDOFF TIMER value in hours.

The **HWC** light
will stay on.



Adjust the **HOLDOFF TIMER** value using the
+ and – keys.
Then press **NEXT** to programme the next
value.

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PROGRAMMING THE SOLAStat™, CONTINUED

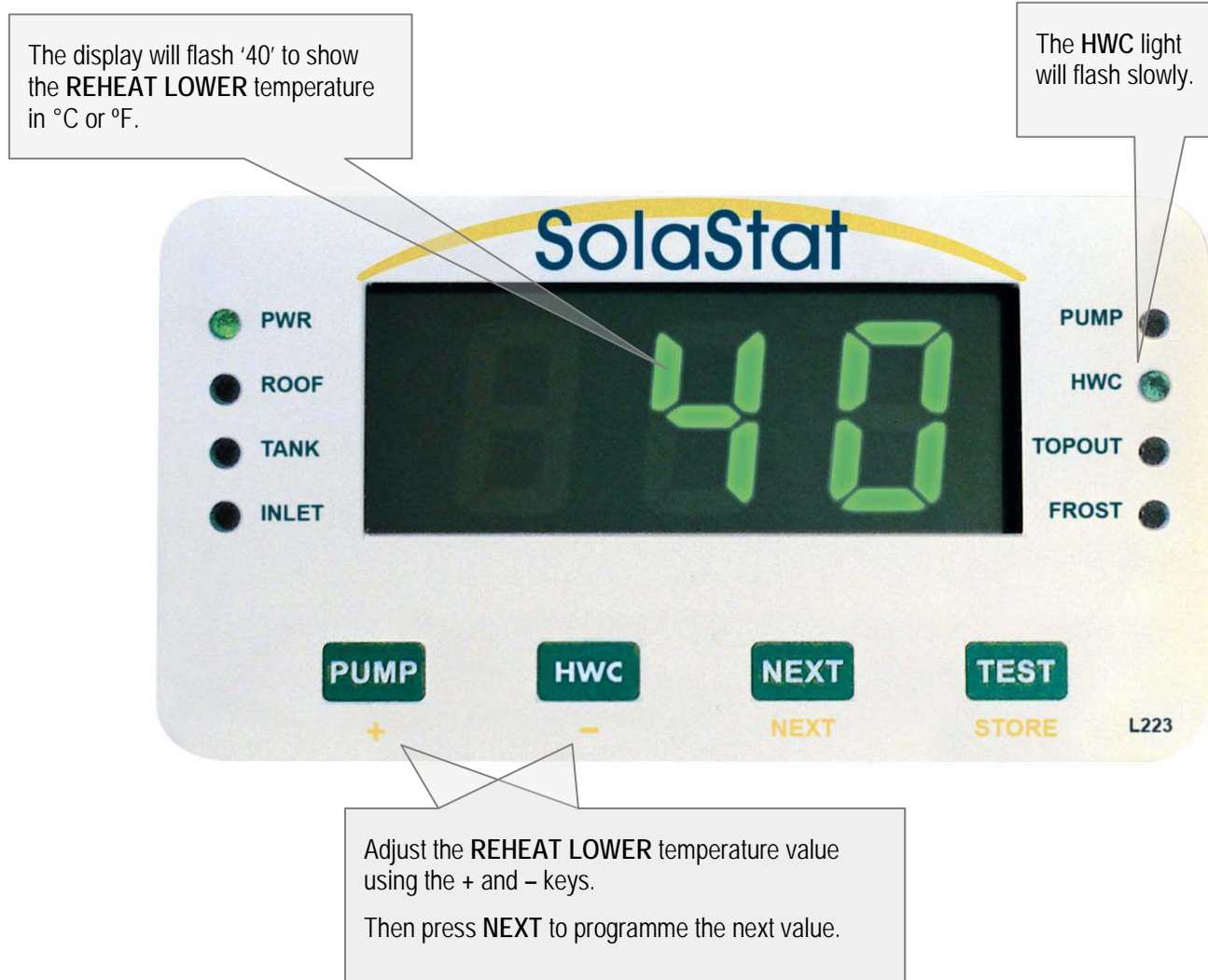
Adjust the REHEAT LOWER Temperature

The **REHEAT LOWER** temperature makes sure that the user will not run out of hot water. It sets the temperature (in the tank) at which the heating element will automatically start to reheat the water in your cylinder.

The standard value is 40°C/104°F, and the range is from 1°C/34°F to 70°C/158°F.

- ⇒ To set it to 'OFF', adjust the Reheat Lower to <1°C/34°F.
- ⇒ Reheat Lower can also automatically be set to OFF if the Holdoff Timer value is adjusted to 'thr'.

Note: Further information on Reheat Lower Settings is included on pages 18-20 under **Holdoff, Reheat and BioSafe Functions**.



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PROGRAMMING THE SOLAStat™, CONTINUED

Adjust the REHEAT UPPER Temperature

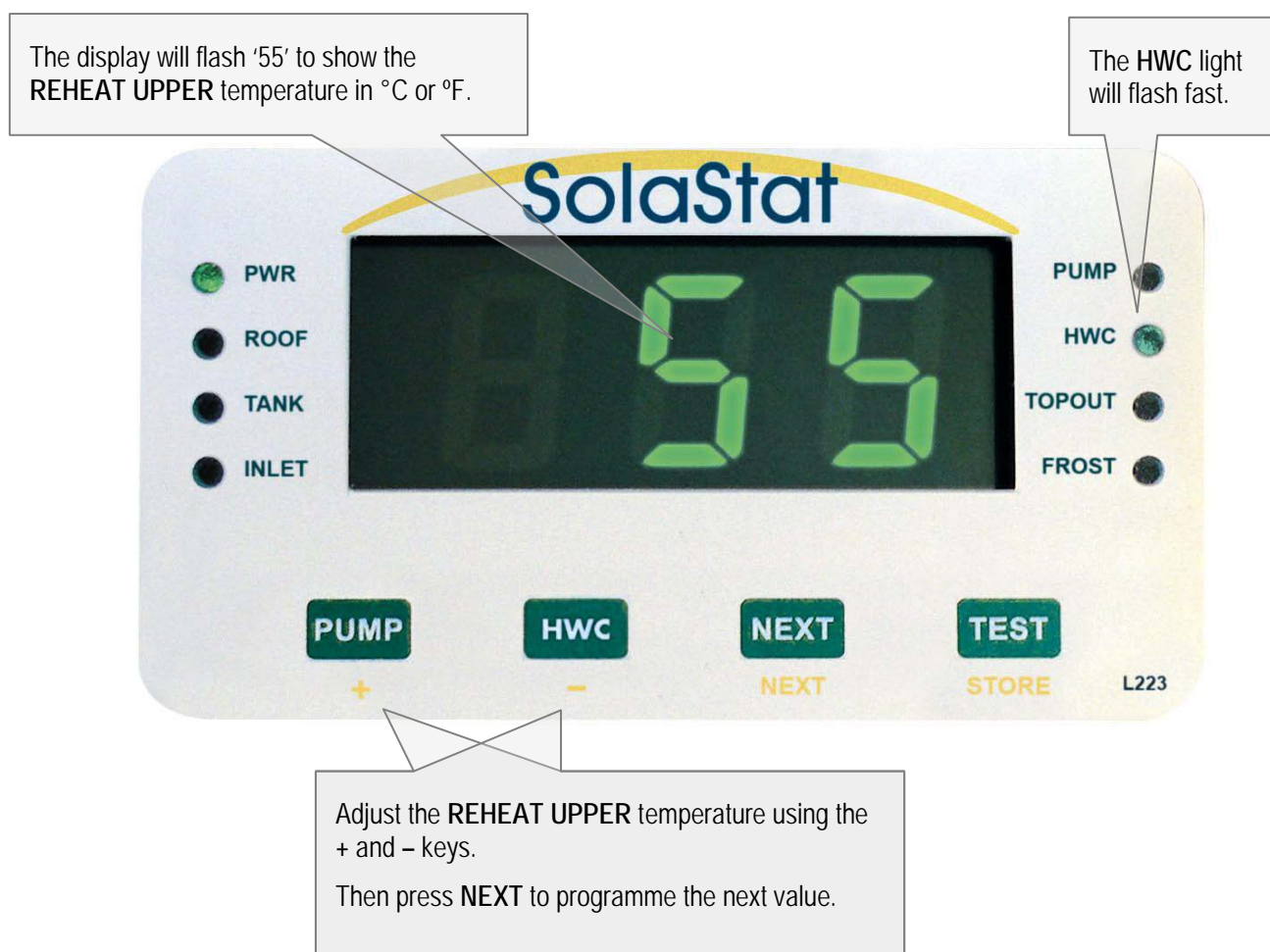
The **REHEAT UPPER** temperature sets the temperature (in the tank) at which the heating element will automatically stop reheating the water in your cylinder, after the Reheat Lower has turned it on.

The Reheat Upper acts as a thermostat for the tank (provided the Holdoff Timer and BioSafe are not active).

The standard value is 55°C/131 °F, and the range is from 2°C/36°F to 90°C/194°F. The Reheat Upper temperature must always be set higher than the Reheat Lower temperature.

- ⇒ To set this to 'OFF', adjust the Reheat Upper to <1°C/34°F.
- ⇒ Reheat Upper can also automatically be set to 'OFF' if the Holdoff Timer value is adjusted to 'OFF'.

NOTE: Further information on Reheat Upper Settings is included on pages 18-20 under **Holdoff, Reheat and BioSafe Functions**.



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PROGRAMMING THE SOLAStat™, CONTINUED

Adjust the BIOSAFE Temperature

The **BIOSAFE** temperature makes sure that tepid water in your cylinder is set at a temperature that does not allow biological contamination to occur.

It does this by ensuring the water in your tank reaches 60°C at least once every 72 hours – either from solar hot water or from the electric element turning on.

If the water does not reach the BioSafe temperature within 72 hours at the Tank sensor, all other functions are overridden. No lights will show, and the electric element turns on to heat the water to a safe level.

The standard value is 60°C/140°F, and the range is 50-70°C/122-158°F.

NOTE: Further information on BioSafe Settings is included on pages 18-20 under **Holdoff, Reheat and BioSafe Functions**.



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PROGRAMMING THE SOLAStat™, CONTINUED

Set the TOPOUT Temperature

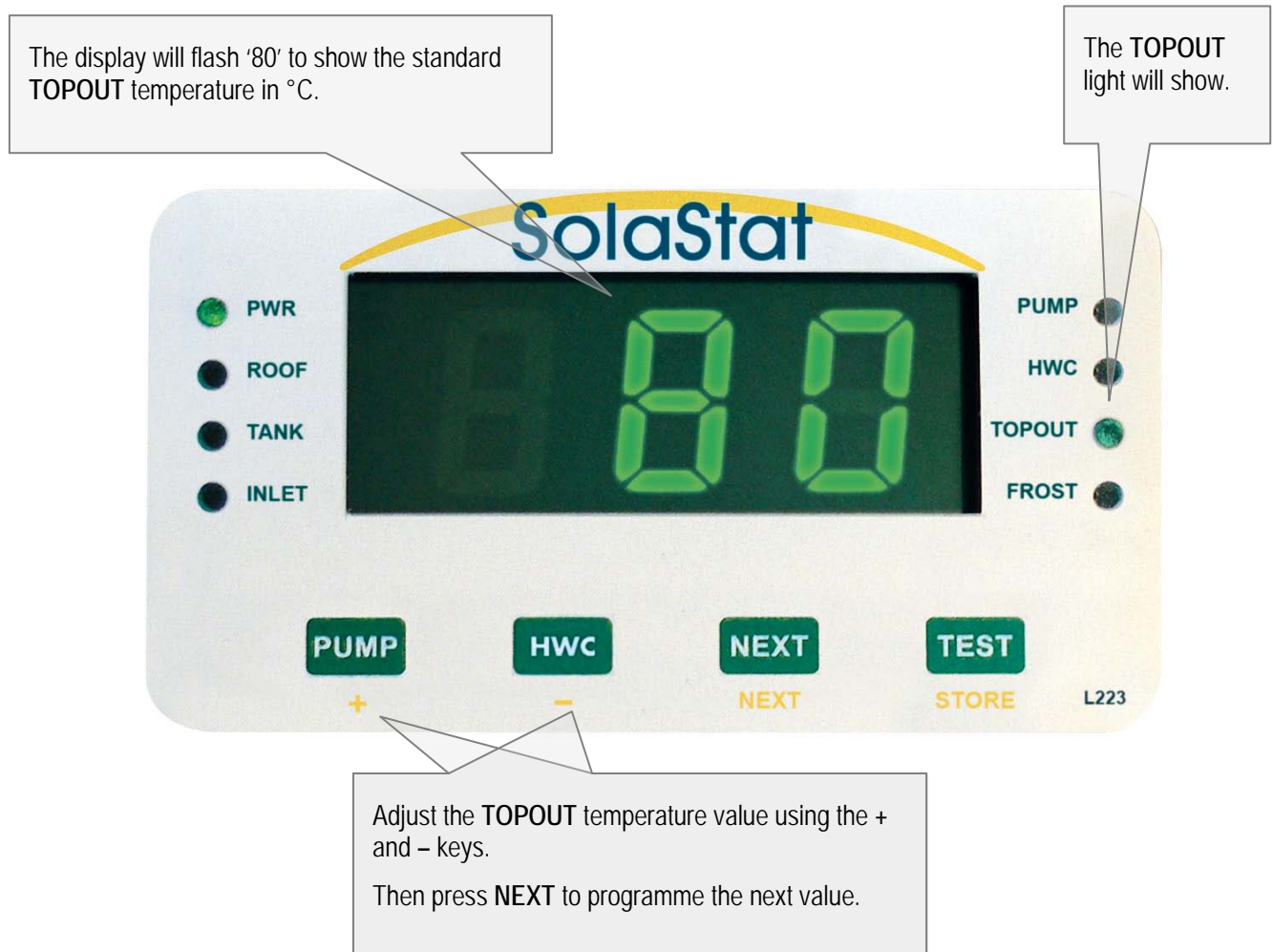
The **TOPOUT** temperature is the maximum temperature that you will allow in the cylinder. Very high temperatures in the cylinder can cause damage (especially for ceramic lined tanks) – both from heat, and from high pressures on plumbing fittings.

This feature 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.

When the maximum tank temperature is reached (Topout Mode), The **TOPOUT** light will come on.

The Topout temperature is usually set at a value somewhat lower than the water tank manufacturer's maximum temperature.

The Standard Topout temperature is 80°C/176°F, and the range is 1-120°C/34-248°F.



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PROGRAMMING THE SOLASTAT™, CONTINUED

Adjust the FROST Temperature

The **FROST** temperature is installed in some (but not all) units.

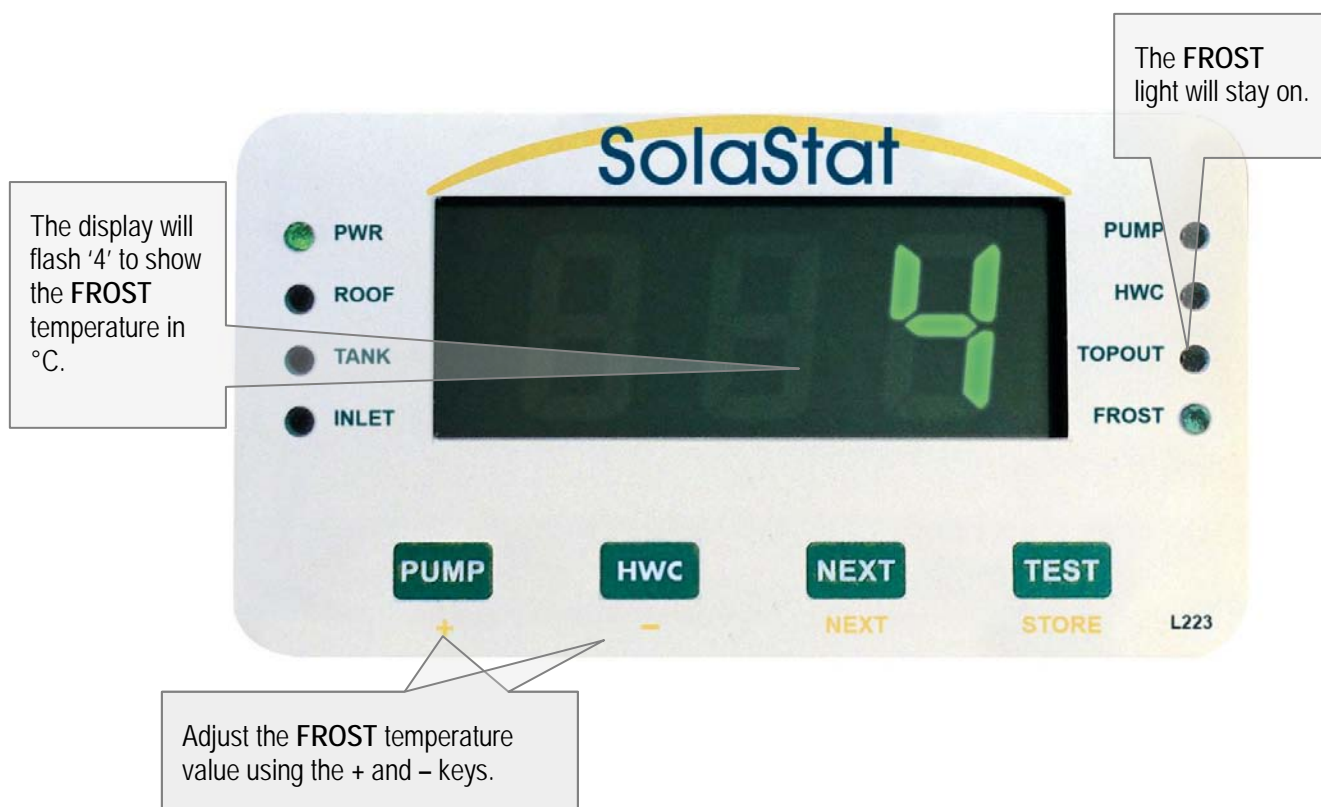
It is designed to protect your collector and hot water system from freezing and bursting. When this temperature is reached, the pump will come on just enough to raise the temperature of water by 2-3°C/4-6°F.

Only a small amount of warm water is needed to protect the collector and plumbing.

When the unit is in Frost Mode, the **FROST** (and **PUMP**) light will come on.

CAUTION: Do not turn the power off when the **FROST** light is on.

The Standard Frost temperature is 4°C/39°F; and the range is 1-10°C/34-50°F.



Continued on next page

PROGRAMMING THE SOLAStat™, CONTINUED

Completing and Storing the Programming

All values are now set. You can check the values simply by continuing to press the **NEXT** key to scroll repeatedly through all the values set.

When you are sure all the values are correct, write these values down in the table within the User Guide.

Now press **STORE**. This will permanently save those values to memory.

The unit will then return to automatic operation.

NOTE: If no key is pressed during programming for a full minute, the unit will save and exit automatically.



Press **NEXT** to scroll through all the values you have set.

Write them down in the programming table in the User Guide.

When you are satisfied with all the programmed values, press **STORE** to save all values and exit Programming Mode to automatic operation.

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 0.5mm² (20 AWG) stranded speaker wire.



CAUTION:

Dangerous Voltages may be present. The SolaStat™ 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 SolaStat™ 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 SolaStat™ 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 (32°F)	27.25	
25°C (77°F)	10.00	
50°C (122°F)	4.162	
75°C (167°F)	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 (212°F)	0.973	
Above 150°C (302°F) or 'short' 'SSd' on display Sensor light on	<0.050	
Below -40°C (-40°F) or 'open' 'SSd' on display Sensor light flashing	>200	

TROUBLE SHOOTING GUIDE

Symptom	Cause	Solution
No operation, no display and no lights (No Power Light).	⇒ No power/fault.	⇒ Check mains outlet. ⇒ Check fuses.
POWER light ON but no display or corrupted display.	⇒ Power brown out (mains power not running at full voltage). ⇒ Unit faulty.	⇒ Switch off power while mains power is in brown out condition. ⇒ Switch off power for 10 minutes, switch on power and see if unit is operating. If not, unit needs repair. Contact your supplier.
Display on, pump not running, but sunny outside. Pump light ON.	⇒ Pump damaged or disconnected. ⇒ Pump timer has turned pump off.	⇒ See if pump has become unplugged. ⇒ Wait one minute for the pump to restart.
Pump is running continuously.	⇒ Pump is cavitating. ⇒ Special Installation. ⇒ Setting is incorrect. ⇒ Airlock in pipe.	⇒ If pump sounds like stones are passing through it, see section under Plumbing Tips. ⇒ Long pump times may be normal for a special installation. ⇒ Check programming for pump ON and Pump Off. ⇒ Check that air relief valves are correctly installed and operating.
Hot water drops significantly at night, yet little or no draw off be user.	⇒ System is reverse thermo-siphoning. ⇒ System is in a high frost area. ⇒ Tank is losing heat.	⇒ The non-return valve is not fitted correctly or is malfunctioning. ⇒ Discuss non-frost sensitive options with your energy provider. ⇒ Install better insulation on hot water tank.
HWC light never comes on.	⇒ Collectors are heating tank to greater than adjustable values.	⇒ Normal operation.
HWC Light flashing slowly (once each second).	⇒ HWC Reheat Upper adjustable value has not been reached. ⇒ Tank Thermostat incorrectly set. ⇒ Sensor malfunction.	⇒ Wait for the tank to heat up to Reheat Upper. ⇒ Check tank thermostat is set higher than Reheat Upper. ⇒ Check sensors are correctly installed.

Symptom	Cause	Solution
HWC Light flashing fast (3 times each second).	<ul style="list-style-type: none"> ⇒ HWC BioSafe value has not been reached. ⇒ Tank Thermostat incorrectly set. ⇒ Sensor malfunction. 	<ul style="list-style-type: none"> ⇒ Wait for the tank to heat up to Biosafe temperature. ⇒ Check tank Thermostat is set higher than BioSafe. ⇒ Check sensors are correctly installed.
Display on, pump not running, but sunny outside. Pump light OFF.	<ul style="list-style-type: none"> ⇒ Roof sensor reads Hi on display. ⇒ Sensor not mounted properly. ⇒ Water not hot enough yet. 	<ul style="list-style-type: none"> ⇒ Normal Operation, pump disabled. ⇒ Check that the ROOF sensor is thermally bonded to the solar panel outlet. ⇒ Check the temperatures of the ROOF and INLET. They need to be greater than the difference programmed for PUMP ON (standard 12°C/22°F). Wait.
Pump runs at night. Frost light on.	<ul style="list-style-type: none"> ⇒ Frost outside. 	<ul style="list-style-type: none"> ⇒ Normal operation.
Pump runs at night. No Frost light on.	<ul style="list-style-type: none"> ⇒ System is reverse thermo-siphoning. 	<ul style="list-style-type: none"> ⇒ The non-return valve is not fitted correctly or is malfunctioning.
Display on, pump will not operate, but sunny outside. Pump light OFF; tp on screen.	<ul style="list-style-type: none"> ⇒ Topout Temperature exceeded. 	<ul style="list-style-type: none"> ⇒ If the tank temperature is greater than the programmed Topout value (standard (80°C/176°F) then the system is working correctly.
‘Lo’ on Display.	<ul style="list-style-type: none"> ⇒ Sensor below -20°C/-4°F. 	<ul style="list-style-type: none"> ⇒ Check outside temperature.
‘Hi’ on Display.	<ul style="list-style-type: none"> ⇒ Sensor above 139°C/284°F. 	<ul style="list-style-type: none"> ⇒ Check Collector has water in it.
‘SSd’ on display. ROOF light flashing.	<ul style="list-style-type: none"> ⇒ Wire to Roof sensor broken. ⇒ Roof Sensor damaged. ⇒ Roof Sensor below -40°C/-40°F. 	<ul style="list-style-type: none"> ⇒ Repair wire. ⇒ Replace Roof Sensor. ⇒ Check Outside temperature.
‘SSd’ on display. ROOF light ON.	<ul style="list-style-type: none"> ⇒ Wire to Roof sensor shorted. ⇒ Roof Sensor damaged. ⇒ Roof Sensor above 142°C/287°F. 	<ul style="list-style-type: none"> ⇒ Repair wire. ⇒ Replace Roof Sensor. ⇒ Check Collector has water in it.
‘SSd’ on display. TANK light flashing.	<ul style="list-style-type: none"> ⇒ Wire to Tank sensor broken. ⇒ Tank Sensor damaged. 	<ul style="list-style-type: none"> ⇒ Repair wire. ⇒ Replace Tank Sensor.
‘SSd’ on display. TANK light is ON.	<ul style="list-style-type: none"> ⇒ Wire to Tank sensor shorted. ⇒ Tank Sensor damaged. 	<ul style="list-style-type: none"> ⇒ Repair wire. ⇒ Replace Tank Sensor.
‘SSd’ on display. INLET light flashing.	<ul style="list-style-type: none"> ⇒ Wire to Inlet sensor broken. ⇒ Inlet Sensor damaged. 	<ul style="list-style-type: none"> ⇒ Repair wire. ⇒ Replace Inlet Sensor.
‘SSd’ on display. INLET light is ON.	<ul style="list-style-type: none"> ⇒ Wire to Inlet sensor shorted. ⇒ Inlet Sensor damaged. 	<ul style="list-style-type: none"> ⇒ Repair wire. ⇒ Replace Inlet Sensor.

Note: When power is removed, the internal timer will keep running for at least 7 days.

PROGRAMMING TABLE

Settings can be changed by a certified installer or maintenance technician.

Caution: Incorrect settings of these values could damage the solar collector and/ or the pump.

Enter the programmed values in the corresponding table at the back of the User Guide.

Adjustable Values	Function	Light Indication	Pre-Set Value	Range
Pump Off	The temperature difference between the Roof and the Tank that will turn the pump off.	PUMP Flash	6°C 11°F	1-20°C 2-36°F
Pump On	The temperature difference between the Roof and the Tank that will turn the pump on.	PUMP on	12°C 22°F	2-21°C 4-38°F
Holdoff Timer	How long the timer will override the element coming on (as long as the tank temperature is above Reheat Lower).	HWC on	4 hours	1-23 hours >23 hours = OFF <1 hour = thr
Reheat Lower	The tank temperature at which the heating element will automatically start to reheat the water in your cylinder.	HWC slow flash	40°C 104°F	1-70°C 34-158°F <1°C = OFF Set Holdoff Timer to thr = OFF
Reheat Upper	The temperature (in the tank) at which the heating element will automatically stop reheating the water in your cylinder.	HWC fast flash	55°C 131°F	2-90°C 36-194°F Set Holdoff Timer to off = OFF
BioSafe	BioSafe target temperature.	No lights (except PWR)	60°C 140°F	50-70°C 122-158°F < 50°C = OFF
Topout	Maximum allowable tank temperature before the pump is de-activated to protect system from overheating.	TOPOUT on	80°C 176°F	1-120°C 34-248°F <1°C = OFF
Frost	Minimum allowable panel temperature before the pump is activated to protect system from freezing damage.	FROST on	4°C 39°F	1-10°C 34-50°F >10°C = OFF

SPECIFICATIONS

Power Supply

Supply Voltage	85–264Vac (high) OR 22–85Vdc (low) (Must be specified at time of ordering)
Max Power Usage	5VA + External loads

Relay Outputs

Pump:	10A (240Vac) Resistive for pre-wired option 16A max (240Vac) Resistive for permanent wired option 1HP (240Vac) Inductive (Motor)
HWC:	10A (240Vac) Resistive for pre-wired option 16A max (240Vac) Resistive for permanent wired option
Note that 3.6kW element under certain conditions will draw over 16A. Hence we recommend using max 3kW element or external relay.	

Sensors

Display Range	-20~+139°C [-4~+282°F]
Control Range	-40~+150°C [-40~+302°F]
PVC Sensor (tank and inlet)	-40~+105°C [-40~+221°F]; 4mm [0.16 inch] Diameter, UV Resistant.
Teflon Sensor (roof)	-40~+250°C [-40~+482°F] peak; 4mm [0.16 inch] Diameter, UV Resistant.
Accuracy	+/-1°C @ 25°C; +/-1.8°F @ 77°F

EMC and Safety Compliances

Emissions	EN 55022-A, CTick
Immunity	EN 50082-1
Safety Compliance	EN 60950, CTick

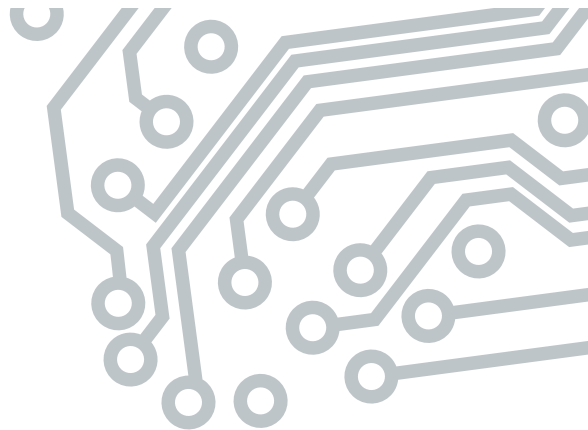
General Specifications (Unless otherwise stated in other input specifications)

Operating Temperature	0~50°C [32~122°F]
Operating Humidity	90% RH Max. Non-Condensing
Enclosure Construction	Polycarbonate - Impact Resistant UL94 V-2 Non Burning, UV Stabilized Water resistant to IP 54 and/or rear entry option available.
Dimensions	L=167mm [6½ inches]
(Excluding glands and cables)	W=142mm [5½ inches] H=40mm [1½ inches]
Weight	=1000 grams [35 oz]
(Standard model + sensors + packaging, without power plug, pump socket and HWC socket)	

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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