

SENZTEK

SolaStat™-Plus-ET



Installation Guide

FOR QUALIFIED PERSONNEL ONLY

Version1.2 July 2011

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For technical help contact your distributor.

Distributor Details:

Contact:

Phone:

Address:

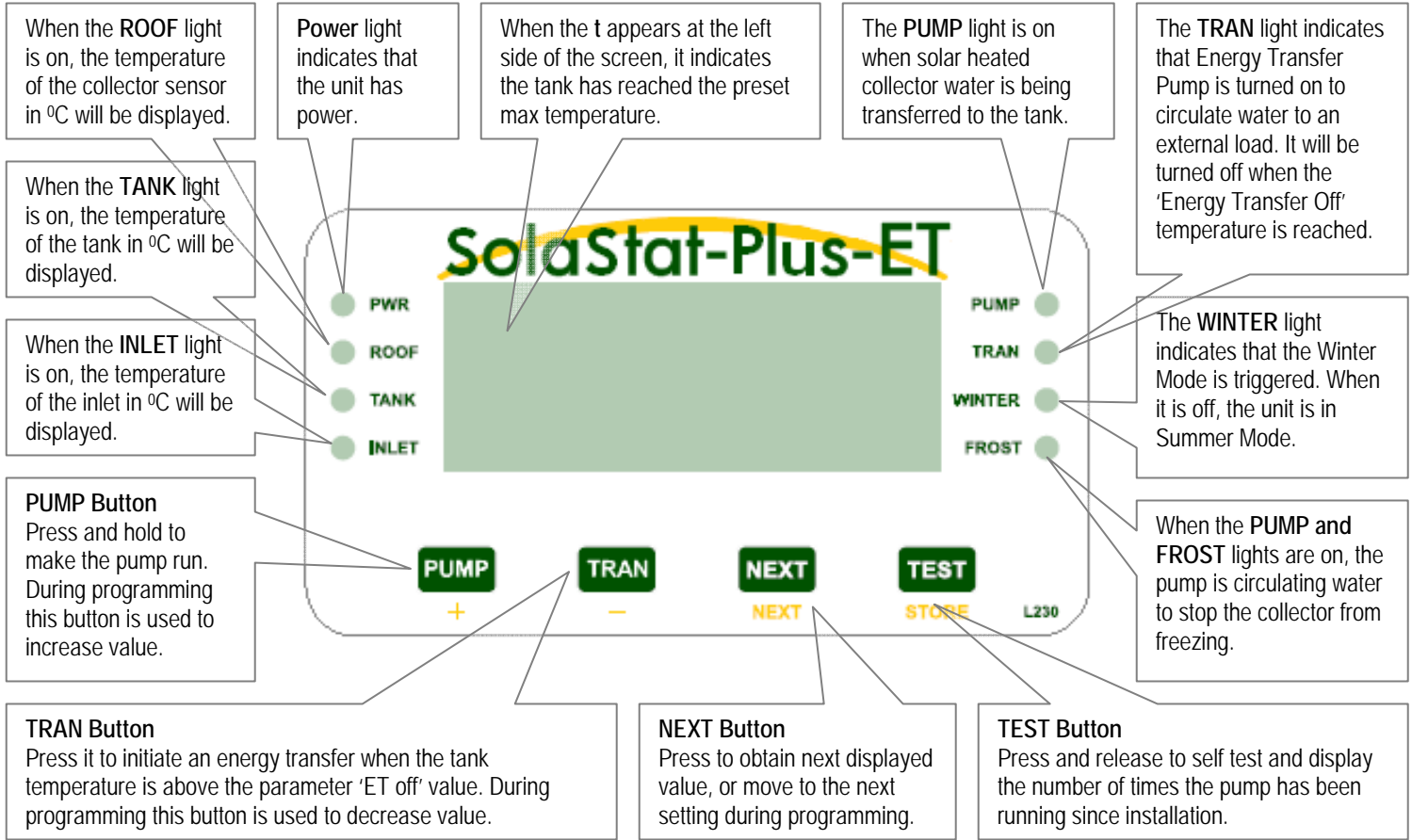
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THE DISPLAY PANEL



FUNCTIONS

It's Smart!

The SolaStat™-Plus-ET is a solar hot water controller that efficiently manages your hot water system. It measures water temperatures at three different places in the system and turns on a water pump at the optimum time. The pump moves hot water from the solar collector into the hot water tank. This controller also allows intelligent control heat transfer of excess stored hot water.

The SolaStat™ –Plus-ET has advanced features that protect the system from damage, run self diagnostics, self correction of some problems. It will also keep you informed of the measurement and the decisions it is making.

Principle of Operation

There are three key things to remember:

1. The solar collector sensor is called ROOF.
2. The upper hot water tank sensor is called TANK.
3. The lower hot water tank sensor is called INLET.

The controller measures the temperature at the ROOF and compares that to the INLET temperature. If the difference is too great, then, during normal operation, the pump turns on and transfers heated water from the solar collector to the tank and replaces this with cooler water from the bottom of the tank. When the heat difference is reduced to acceptable levels the pump turns off.

This cycle repeats continuously to heat up the tank.

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FUNCTIONS CONTINUED

Smart Functions

There are a number of built in functions that enable the SolaStat™-Plus-ET to manage temperature and power usage efficiently:

- **ENERGY TRANSFER function** allows excess hot water to be transferred to an external load when the tank reaches to an adjustable preset temperature. An external load can be swimming pool, under floor heating, spa pool, etc.
 - **FROST function** will protect the solar collector from freezing in mild frost areas. This will turn on the pump to move a small amount of water through the collector.
 - **PUMP TIMER function** is to assist in pump cavitation recovery. After the pump has run continuously for approximately ten minutes, it will turn off for one minute. The one minute turn off period helps any accumulated air to escape from the pump and has been effective as a backup in exceptional conditions. This feature can help prevent the pump running for hours in a 'locked up' state, increasing the installation reliability. This will not affect normal operation in a standard hot water collector and cylinder installation. Also refer 'Plumbing Issues, Cavitation'.
 - **SMART SHUTDOWN function** will shut the system down in the case of a shorted sensor or wire, or where the temperature at either sensor is outside the specified temperature range of -40°C to 150°C.
 - **TOPOUT function** will protect the hot water tank from over heating which can lead to pressure problems.
 - **WINTER MODE function** allows different external load to be set up.
 - **20°C LOCKOUT function** is activated if the collector is equivalent or less than 20°C since the collector will not contribute any useful heat, even to cold water. The controller will not turn the pump on under differential conditions unless FROST condition is detected. Hysteresis applies.
 - Low Voltage Option makes it possible to safely run the unit near the water but still have a remote mains powered pump.
-

USING YOUR SOLAStat™-PLUS-ET

Reading the Display

There are 3 parameters that can be displayed individually:

- ROOF Temperature
- TANK Temperature
- INLET Temperature

To read each reading, follow the steps below.

1. When switching on the power, the TANK light will be on, and the tank temperature will be displayed, in this case 65°C.

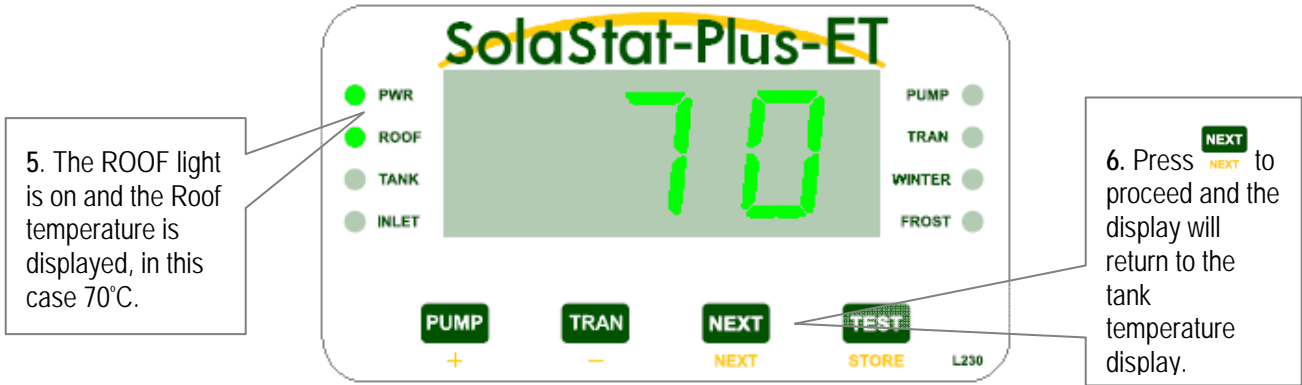
2. Press **NEXT** to proceed to the next reading.

3. The INLET light is on and the inlet temperature will be displayed, in this case 60°C

4. Press **NEXT** to proceed to the next reading.

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USING YOUR SOLASTAT™-PLUS-ET, CONTINUED

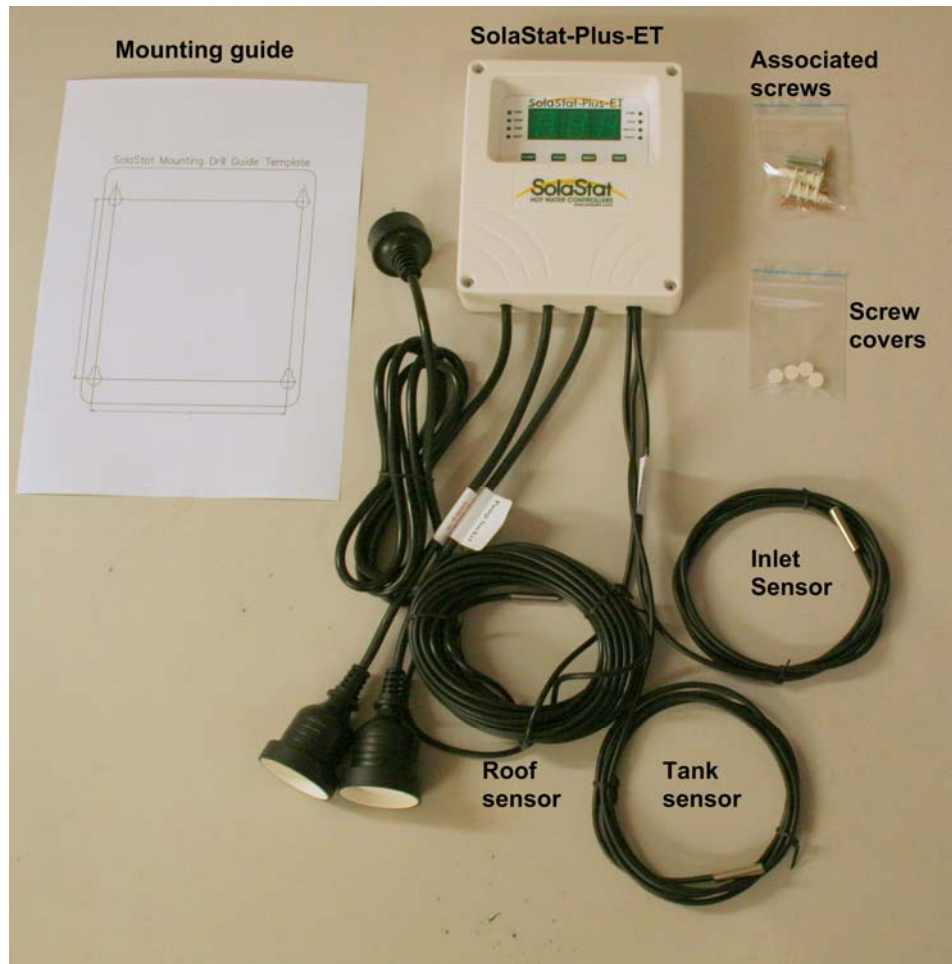


BEFORE INSTALLATION

Assemble the components you will need

The SolaStat™-Plus-ET solar hot water controller includes the following components:

- Roof sensor
- TANK sensor
- INLET sensor
- SolaStat™-Plus -ET Controller
- Associated screws
- Mounting guide
- Screw covers



Continued on next page

BEFORE INSTALLATION, CONTINUED

Assemble the tools you will need

You will need the following tools to install the SolaStat™-Plus-ET:

- Philips1 screwdriver for lid screws
- Pozi2 screwdriver for mounting screws

Note: These tools are needed to mount the SolaStat™- Plus-ET 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 INSTALLATION

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

General Safety Precautions



1. This installation guide is for the installation of SolaStat™-Plus-ET solar hot water controllers only and is not an installation guide for any other part.
2. The complete installation should be checked at least annually for damage or malfunction.
3. All servicing to be carried out by an authorised service agent only.
4. All aspects of the installation must comply with local electrical and plumbing regulations (and any special solar hot water regulations).

Installation Precautions

1. 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.
2. Must be installed away from direct sunlight, flammable liquids or radiant heat sources.
3. Power leads must be facing directly down, not sideways or upwards.
4. Must be in a safe environment for users to inspect display panel.
5. Failure to mount sensors correctly can lead to a poorly controlled solar water system with safety issues such as:
 - overheating and over pressure damage to the plumbing and the tank
 - freezing damage to the solar collector.
6. Alteration of installer level program values outside those recommended values recommended by SolaStat™ / Senztek™ and other parts suppliers (especially hot water tank manufacturer’s maximum recommended temperature) can lead to dangerous conditions and/ or damage to parts of the solar hot water system.

Continued on next page

BEFORE INSTALLATION, CONTINUED

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

1. All mains voltage electrical work to be carried out by a qualified electrician, especially external power outlet socket installation.
2. 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.
3. It is recommended that sensor leads be kept 300mm away from mains and comms cables.
4. Do not use mains power extension cords unless approved by the manufacturer. Water resistant plugs and sockets should be used.
5. The SolaStat™-Plus-ET controlled output (PUMP and TRANSFER) is connected to the input power supply wiring and is not isolated from it. Supply voltages will be output through that outlet during activation.
6. Always use within specified voltage and load ranges. Never use with damaged leads, plugs or sockets.
7. Do not allow the sensor cable to come within 10mm of the high voltage connectors or components inside the enclosure.
8. Comply with local special electrical regulations for hot water tank.

Warning

These products are not designed for use in, and should not be used for, patient connected applications. In any critical installation an independent fail-safe back-up system must always be implemented.

MOUNTING THE SOLASTAT™-PLUS-ET

Where to mount the SolaStat™-Plus-ET

The SolaStat™-Plus-ET must 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 are facing directly down, not sideways or up,
 3. it is not in direct rain or sunlight,
 4. it is safe for users to inspect,
 5. the display can be easily read and buttons accessed, and
 6. allowance is made for cable runs, location of power outlets and lengths of wires.
-

Mounting the SolaStat™-Plus-ET

Note that there is no need to open the enclosure during a standard installation. For a standard installation follow these steps:

1. Allow for the enclosure dropping 5mm from screw centres once mounted (keyhole mounting).
 2. Place drill guide template against wall, checking for level alignment. 4 screws are supplied, 2 are chipboard screws and 2 are combination plasterboard/wood screws. It is recommended that all mounting holes are used with at least 2 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.
 4. Place unit over the 4 screw heads, unit should slide down 5mm into the 'key' slots and become secured to the wall. You will need to adjust screw height to obtain a secure fit.
-

MOUNTING THE SENSORS

Where to mount the Sensors

Correct mounting is critical to the success of the installation.

The sensors are the only way the SolaStat™-Plus-ET can efficiently control and protect the system. Please note:

1. The 10m Roof Sensor (Labelled 'ROOF SENSOR' - connects to solar collector) is best fitted into a metal immersion 'pocket' just inside the solar collector in the hot water outlet pipe. Liberally apply heat transfer compound between the sensor and the lining of the 'pocket'. Sensor should be sealed with neutral cure sealant and externally lagged. Also, the cable should be insulated from the bare pipe. Heat transfer compound is available from your distributor or Senztek Ltd.

BEWARE: Some collectors can exceed the 120°C rating of a standard sensor. In this case ensure a high temperature sensor is used.

2. The 2m Tank Sensor (Labelled 'TANK SENSOR'- connects to the top of the hot water tank) is best fitted into a metal immersion 'pocket' in the upper region of the hot water tank. Senztek also offer mounting solution called an S3. For the SolaStat™-Plus-ET, the position of the tank sensor will establish the control point the energy transfer function works from. Of course hot water rises so as this position cools any water hotter from below this point will rise to take its place. If TOPOUT is required, caution should be exercised to allow for stratification of hot water in the tank. For Topout Adjustable Value in Installer Programming Mode, we recommend a conservative value somewhat lower than the hot water tank manufacturer's maximum temperature. Liberally apply heat transfer compound between the sensor and the lining of the 'pocket' or in the case of the S3, against the copper foot.
3. The 2m Inlet Sensor (Labelled 'INLET SENSOR'- connects to the bottom of the hot water tank) is best fitted into a metal immersion 'pocket' in the lower region of the hot water tank..

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MOUNTING THE SENSORS, CONTINUED

Warning

When mounting the sensors please note the following points carefully:

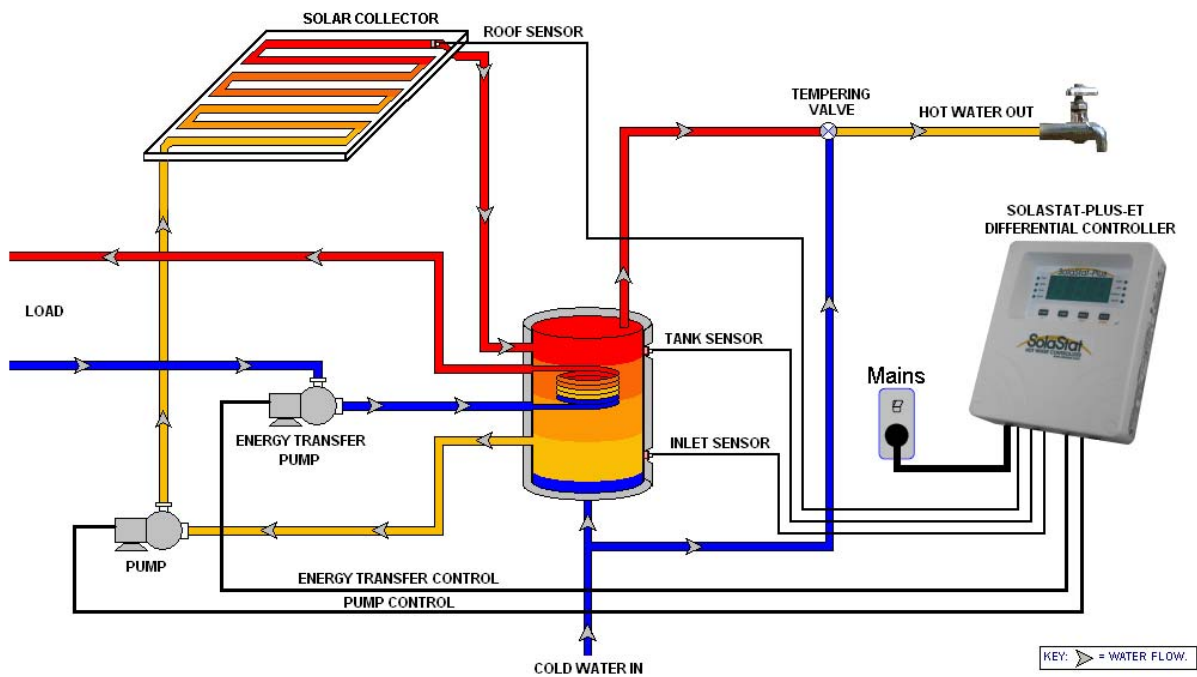
1. Removing or cutting the cladding may void hot water tank warranty.
 2. Sensors must not be immersed in water
 3. It is recommended that sensor leads be kept 300mm away from mains and comms cables.
 4. Ensure the correct sensors are mounted in the correct place.
 5. Failure to properly mount the Tank and Inlet Sensor as prescribed in the method above can result in:
 - i. The system not operating at greatest efficiency.
 - ii. Inaccurate tank and inlet temperature readings on the display.
 - iii. Inaccurate TOPOUT sensing and causing damage of components.
 6. Failure to correctly mount the Roof Sensor as prescribed in the method above can result in:
 - i. The system not operating at greatest efficiency.
 - ii. Failure to detect Frost conditions. Collector can burst.
 - iii. Misleading hot water readings on the display.
 - iv. The pump running on too long.
 7. Do not mount sensors in direct rain or sunlight.
-

INSTALLATION AND WIRING

Connect the Pump Plug in the pump to the PUMP socket on the SolaStat™-Plus-ET. This should not exceed the 2hp load rating as specified on the label on the side of the enclosure.

Connect the ET Pump Plug in the pump to the TRAN socket on the SolaStat™-Plus-ET. This should not exceed the 2hp load rating as specified on the label on the side of the enclosure.

Installation A possible way to install the SolaStat™-Plus-ET is shown below. This diagram is only to be used as a general guide and not all the required components are shown. Each installation needs to be customised to suit its situation. Always use best plumbing and electrical practices, and comply with any regulatory requirements.



The roof, tank and inlet sensor will be wired to the collector, upper tank and lower tank respectively. The power plug will connect to mains. After collector and inlet temperature are measured, SolaStat™-Plus-ET then decides if turning on the pump to circulate the water is necessary to heat up the tank. It also decides to turn on the energy transfer pump to circulate the stored water to an external load when the tank reaches to the energy transfer temperature. The arrow indicates the direction of the water flow.

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POWERING UP

Before you Connect the Power

Make sure you have read the safety instructions, warnings and limit of liability and that you have completed installation, and securely mounted the unit in place before you connect power to the unit.

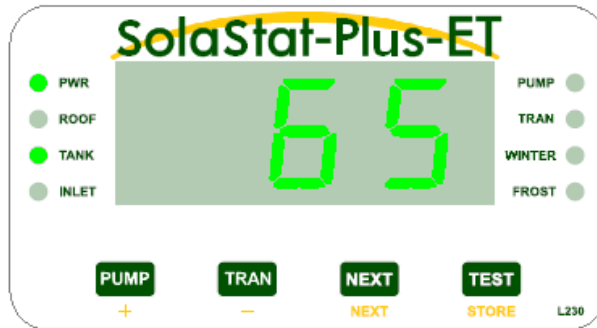
Ensure suitable over-current protection and RCD Protection for the SolaStat™-Plus-ET is in place. Check that there is no water, metal shavings or other electrical hazards to contaminate the plug, socket, wiring or surrounding environment.

Only when all of the above has been done, should you plug in the unit and turn it on.

What you will see

When you power up the unit you will see:

- A digital readout of the TANK temperature in °C.
- The PWR light and the TANK light should be on.
- Right lights will be on indicating how the system is operating.



Testing

The collector pump operation can be tested by pressing the ‘PUMP’ button. This will turn the pump on as long as the button is held down, unless of course the pump is already on in normal operation.

The ET pump can be tested by pressing the ‘TRAN’ button. If the tank temperature is higher than “Energy Transfer Off” value, the ET pump can be manually turned on or off. If it is lower, the ET light will flash.

The SolaStat™-Plus-ET is now installed and should be working. It would be best to observe some solar hot water pump cycles but this will rely on the sun shining. Check all functions are working correctly before leaving the installation.

Note 1. See “The Display Panel” section for display explanation.

Note 2. See “Trouble shooting” section if system not working correctly.

INSTALLER PROGRAMMING

Adjustable Values - Overview

There are eight parameters that can be adjusted.

This programming is to be performed by qualified installers only. Incorrect values can cause deficiencies in the system, or cause damage to the system voiding the warranty. In addition, these values **directly affect safety** and must be programmed correctly to avoid injury, illness or worse.

The parameters are:

1. Pump Off
2. Pump On
3. Energy Transfer Off in Summer
4. Energy Transfer On in Summer
5. Energy Transfer Off in Winter
6. Energy Transfer On in Winter
7. Frost
8. Topout

These are explained in more detail below.

Heating Mode

Heating Mode triggers heating of the tank and involves two values:

- **Pump Off** – the ROOF sensor temperature minus the INLET sensor temperature, at which the pump turns off.
- **Pump On** – the ROOF sensor temperature minus the INLET sensor temperature, at which the pump turns on.

Note: The Pump On value must always be higher than the Pump Off value.

Example: Pump On = 12°C and Pump Off = 6°C. When the solar collector temperature has risen to 12°C hotter than the inlet temperature, the pump turns on to move the hot water from the collector into the tank. When the temperature difference between the collector and the inlet has dropped to only 6°C the pump will turn off.

Continued on next page

INSTALLER PROGRAMMING, CONTINUED

Energy Transfer Mode

Energy Transfer Mode Triggers the Energy Transfer Pump to circulate the isolated heated water stored in the tank to an external load such as swimming pool, under floor heating or spa pool, etc. It triggers at different temperatures in summer and winter to allow choosing different loads. There are four values involved:

- **Energy Transfer On in Summer** – The temperature to turn on the energy transfer pump in summer.
- **Energy Transfer Off in Summer** – The temperature to turn off the energy transfer pump in summer.
- **Energy Transfer On in Winter** – The temperature to turn on the energy transfer pump in winter.
- **Energy Transfer Off in Winter** – The temperature to turn off the energy transfer pump in winter.

To enter Winter Mode, press PUMP and TRAN buttons at the same time for at least 3 second. WINTER led will be on to indicate the Winter Mode is activated. Repeat this to go back to Summer Mode.

Example: Energy Transfer Off in Summer = 60°C, Energy Transfer On in Summer = 70°C. When the tank temperature has reached to 70°C, the energy transfer pump turns on to pass the stored water to the load.

Note:

1. The Energy Transfer On value must always be higher than the the Energy Transfer Off value.
 2. Pressing the 'TRAN' button will manually initiate an energy transfer from the Hot Water Tank. However if the temperature at the tank sensor is below the 'Energy Transfer Off' value then no operation can take place.
-

Frost

This is the temperature at which the pump turns on to stop the collector from freezing. This is critical to avoid damage to the solar collector. The appropriate value depends on variables such as geographic location, angle and type of solar collector, sensor placement, fluid used, etc. All of these must be considered when determining frost value. This is the installer's responsibility.

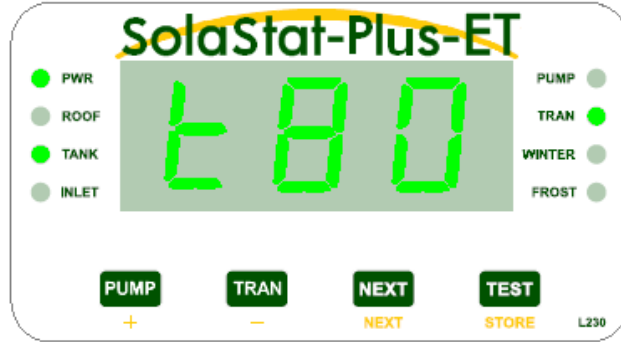
We recommend 4°C as a minimum in mild frost areas only, but this may need to be increased for some installations. Frost can be disabled if necessary and it is indicated as 'OFF'.

Continued on next page

INSTALLER PROGRAMMING, CONTINUED

Topout

This is the value stored as the maximum allowable hot water tank temperature. If the tank reaches to the topout temperature, 't' will be displayed at the left side of the screen for ROOF/TANK/INLET reading. The pump will be disabled until the temperature drops at least 2°C lower. It is shown as followed:



Continued on next page

INSTALLER PROGRAMMING, CONTINUED

Adjustable Values Worksheet

The unit will need to be programmed where the adjustable values from the factory are inappropriate for the installation. Once new values are stored, they are permanently written into memory and will be retained when power is removed.

Immediately after programming (at installation or after any change in program adjustable values) please fill out the Programming Table for Adjustable Values below.

Programming Table for Adjustable Values					
Adjustable Values	Light Indication	Typical (Factory Values)	Range	Disabled	Installation Values
Pump Off	PUMP Flashing	6°C	1°C ~20°C	N/A	_____ °C
Pump On	PUMP Steady	12°C	2°C ~21°C	N/A	_____ °C
Energy Transfer Off in Summer	TRAN Flashing Slow	60°C	1°C ~70°C	<1°C = OFF	_____ °C
Energy Transfer On in Summer	TRAN Flashing Fast	70°C	2°C ~90°C	N/A	_____ °C
Energy Transfer Off in Winter	TRAN Flashing Slow + WINTER Steady	40°C	1°C ~70°C	<1°C = OFF	_____ °C
Energy Transfer On in Winter	TRAN Flashing Fast + WINTER Steady	55°C	2°C ~90°C	N/A	_____ °C
Frost	FROST Steady	4°C	1°C ~10°C	>10°C = OFF	_____ °C
Topout	PUMP + TRAN + WINTER + FROST Steady	80°C	1°C ~120°C	<1°C = OFF	_____ °C

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INSTALLER PROGRAMMING, CONTINUED

How to program Adjustable Values

A) To enter **Installer Programming Mode** follow these steps:

1. Press the **TEST** key.

2. All the display lights will come on for a few seconds. Wait for the pump counter to display.

3. After all lights have finished flashing, only then press **TRAN**.

4. Then press **NEXT**.

5. Finally press **PUMP**.

6. 'Pr9' will flash on the display every 5 seconds. You are now in Installer Programming mode.

7. Pump light will flash to indicate the first parameter is now able to be adjusted.

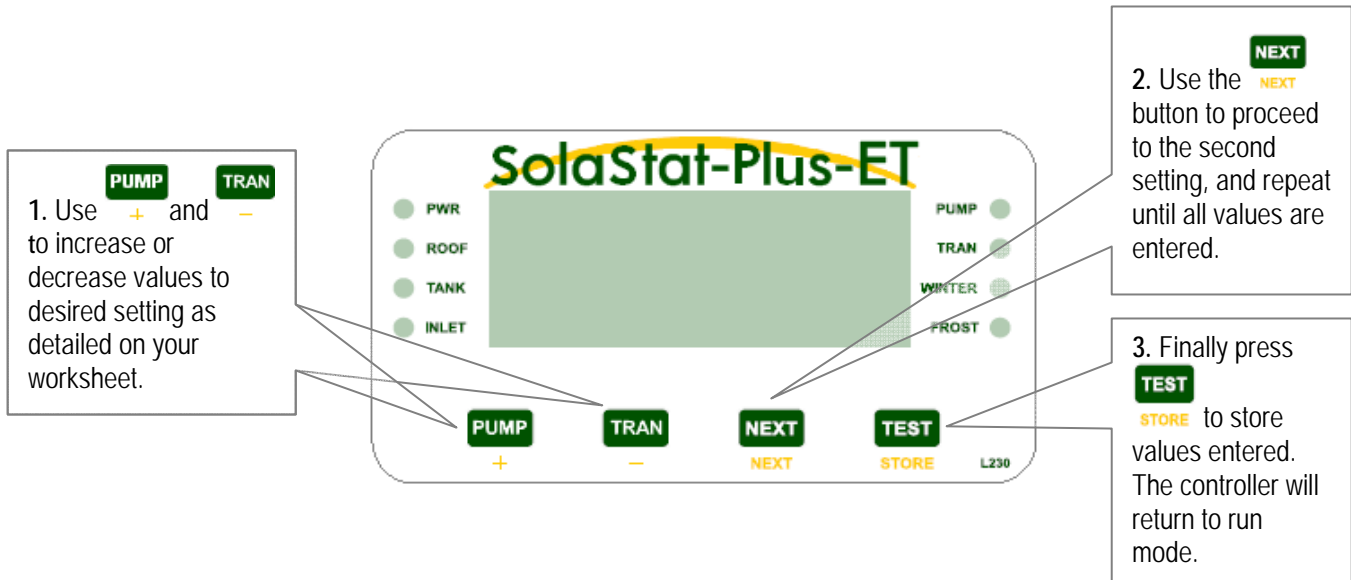
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INSTALLER PROGRAMMING, CONTINUED

B) Enter Adjustable Values

Note 1: The PUMP light will be flashing. The unit is now ready to accept the first value entry.

Note 2: After each key press, you have a minute to press another key before the unit times out.




























See next page for an example.

Continued on next page

INSTALLER PROGRAMMING, CONTINUED

For example:	Pump Off	6°C
	Pump On	12°C
	Energy Transfer Off in Summer	60°C
	Energy Transfer On in Summer	70°C
	Energy Transfer Off in Winter	40°C
	Energy Transfer On in Winter	55°C
	Frost	4°C
	Topout	80°C

- Step 1:** Press  + to increase or  - to decrease Pump Off value to 6.
- Step 2:** Press  to enter value and proceed to next setting. Press  + to increase or  - to decrease Pump On value to 12.
- Step 3:** Press  . Press  + to increase or  - to decrease Energy Transfer Off in Summer value to 60.
- Step 4:** Press  . Press  + to increase or  - to decrease Energy Transfer On in Summer value to 70.
- Step 5:** Press  . Press  + to increase or  - to decrease Energy Transfer Off in Winter value to 40.
- Step 6:** Press  . Press  + to increase or  - to decrease Energy Transfer On in Winter value to 55.
- Step 7:** Press  . Press  + to increase or  - to decrease Frost value to 4.
- Step 8:** Press  . Press  + to increase or  - to decrease Topout value to 80.
- Step 9:** Press   to store the values entered. SolaStat™-Plus-ET will now return to normal operational mode.

SENSOR MAINTENANCE

Lengthening Sensor Wire

Poor connections or induced interference can cause false temperature readings. The sensor wire can be lengthened within certain guidelines:

- The sensor is not polarized – it can be connected either way around.
 - The wire normally used for sensor lengthening is twin 0.5mm² stranded speaker wire.
 - Firmly attach wires to each other by either soldering (heatshrink over each joint) or by quality screw terminals. Joints must be kept dry.
 - It is recommended that sensor leads be kept 300mm away from mains and comms cables.
 - Over 20m, care must be taken to avoid electrical interference being picked up.
 - In noisier electrical environments, screened cable may be required.
 - The absolute maximum cable length is 100m.
-



CAUTION:
Dangerous Voltages may be present. The SolaStat™ has no user serviceable parts.
Protective enclosure only to 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).

1. Remove the mains power supply. Make sure no other power source is feeding back through other connections.
2. Remove the 4 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.
3. Remove the 4 screws that hold the lid on.
4. Unscrew the damaged sensor from the terminal block.
5. Loosen the cable clamp for the sensor leads.
6. Carefully pull the wire back through the opening in the bottom case.
7. Thread the new sensor wire back through where the old one came from.
8. Place the wires of the new sensor into the terminal block where the old sensor came from and retighten the screws.

Continued on next page

SENSOR MAINTENANCE, CONTINUED

Replacing a Sensor, continued

9. 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.
10. Replace the lid, replace the 4 screws and tighten.
11. Push in 4 new screw covers available from your distributor or Senztek Ltd. Note: there are locating lugs to ensure correct orientation.
12. Reconnect the SolaStat™-Plus-ET and turn on the power.
13. Check sensor is reading correctly and check SolaStat™-Plus-ET operation as per What You Will See section of this manual.

Sensor Resistances

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

Follow the above procedure for removal of a sensor.

Sensor Resistances	
Temperature	Resistance in kΩ
0C	27.25
25C	10.00
50C	4.162
75C	1.925
100C	0.973
Above 150C or 'short' 'SSd' on display Sensor light on	<0.300
Below -40C or 'open' 'SSd' on display Sensor light flashing	>200

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.

An 'open' circuit can be caused by the sensor wires being broken. Check the wires are not broken and that moisture is not getting into the sensor causing corrosion.

SOLA STAT™-PLUS-ET PLUMBING ISSUES

Disclaimer

For full information on compliance and safety standards for solar hot water systems the appropriate local standards must be referred to. All plumbing to be carried out by qualified plumbers only.

We provide the following information as a guideline only to help obtain the greatest efficiency from the system. Any information supplied here is based on feedback to us by experienced solar hot water professionals and in no way represents a complete guide to plumbing such a system, as we are not plumbers and do not represent ourselves as such. Best plumbing practices must be used in all instances.

Introduction

Any solar hot water system involves professional level plumbing and water much hotter than would normally be seen in standard domestic hot water systems. For this reason Senztek NZ Ltd recommends any installation is carried out by a registered and qualified plumber. All parts including the pump must be rated for the elevated temperatures found in solar hot water systems.

Non Return Valve / System

Hot water rises and cold water falls. If the solar collector is colder than the tank, such as during the night, the hot water from the tank can self thermosiphon up to the collector. The collector now radiates the heat to the cool night air and the water descends back down to the tank. To stop this loss of hot water at night or during cloudy skies there has to be a one way or 'non return' valve fitted.

The failure of this non return valve is a common problem with solar hot water systems. The orientation of the valve as per manufacturer's instructions is critical. Also the valve sometimes will not close when swarf or other debris get caught in the valve seat.

Pressure Relief Valve / System

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 avoid possible catastrophic rupturing somewhere in the system, probably the tank.

Qualified plumbers using best industry practice must decide on adequate pressure relief valves, the number and placement of them.

Continued on next page

SOLA STAT™-PLUS-ET PLUMBING ISSUES, CONTINUED

**Air Relief
Valves /
Vacuum
Break**

It is important that air relief valves are fitted (especially in a low pressure system) to the highest point of both the feed to and the return from the solar water collectors. Otherwise air locks can occur within the piping etc., and not just the pump. (An air lock in the system will increase the head that the pump is working against and for some installations this is too much and the water ceases to circulate. For systems where air locks occur, the pump may need to be set to a higher speed or a higher head pump installed).

Cavitation

A pump is used to circulate the water between the tank and the collector. If the pressure at the inlet or impellor of the pump falls below the vapour pressure of the liquid being pumped, cavitation will occur. Cavitation in a pump is more likely to occur as the temperature of the water rises and/or the pressure of the water decreases.

Bubbles form when the water is sucked into the pumps impellor and collapse again as small implosions when the water is ejected out of the impellor which can be so rapid that a rumbling/cracking noise is produced (it sounds like stones passing through the pump) and there can be damage to the impellor and other sensitive components as well as a drop in water volume moved.

Mains pressure solar hot water systems are less susceptible to cavitation than low pressure systems as the extra pressure will make it less likely that vapour bubbles will form. As cavitation gets worse, less and less water is moved, often reaching a point where no water at all moves. Since the solar warm water controller is still reading a 'differential' requiring water to flow, then the pump stays on until the vapour point drops. The vapour point drops either by water pressure increasing or water temperature decreasing. When the pump is cavitating it may run continuously for several hours.

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SOLA STAT™-PLUS-ET PLUMBING ISSUES, CONTINUED

Minimising Cavitation

To minimise cavitation:

1. Make sure the pump is appropriate for the installation.
 2. If a variable speed pump is used then select the best setting (a slower speed that still has enough head pressure is best as this will create the lowest pressure difference in the pump).
 3. Mount the pump as low as possible to achieve highest water pressure out of the tank feeding into the pump.
 4. Lower the resistance to water flow into the pump, such as less bends or more gradual bends, or wider diameter pipes. Recommended minimum diameter pipe 1/2".
 5. In exceptional cases a larger pump with a larger impellor may need to be fitted to reduce vacuum at the impellor.
 6. Convert the system to mains pressure.
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TROUBLE SHOOTING GUIDE

Symptom	Cause	Solution
No operation, no display and no lights.	a. No power	1. Check mains outlet. 2. Check fuses.
POWER light ON but no display or corrupted display.	a. Power brown out (power not running at full voltage) b. Unit damaged	1. Switch off power while mains power is in brown out condition 2. Switch off power for 10 minutes, switch on power and see if unit is operating. If not, unit needs repair.
Display on, pump not running and yet is sunny outside. PUMP light is ON.	a. Pump faulty or disconnected. b. Pump Timer has turned pump off	1. Check for pump becoming unplugged. 2. Wait one minute for pump to restart.
Display on, pump not running and yet is sunny outside. PUMP light is OFF. 't' is not shown on the screen.	a. Sensor not mounted properly. b. Water not hot enough yet. c. Roof sensor reads 'Hi' on display.	1. Check sensor is thermally bonded to solar collector outlet. 2. Check temperatures of Roof and Pool, they need to be greater then the difference programmed for pump ON. Wait. 3. Normal operation, pump disabled.
Display on, pump will not operate and yet is sunny outside. PUMP light is OFF. 't' is shown on the screen.	a. Topout temperature has been exceeded.	1. If Pool temperature is greater then User Adjustable Topout temperature, then unit is working normally.
Pump running for very long periods.	a. May be normal operation. b. Pump is cavitating. c. Settings incorrect. d. Airlock.	1. Check with the installer. This might be a special installation where long pump on times are normal. 2. If pump is making noise like stones passing through it, then it is cavitating. See Plumbing Issues. 3. Check programming is correct. 4. Air Relief Valves not installed/functioning.
Pump runs at night. FROST light is ON.	a. Frost outside.	1. Normal operation.
Pump runs at night. FROST light is OFF.	a. System is reverse thermosiphoning.	1. The non-return valve is not fitted correctly or is faulty. Plumbing measures required to solve this problem.
Hot water drops significantly overnight yet little or no draw off of how water by the user	a. System is reverse thermosiphoning. b. System is in an high frost area. c. Tank is losing heat.	1. The non-return valve is no fitted correctly or is faulty. Plumbing measures required to solve this problem. 2. Discuss non frost sensitive options with provider. 3. Install better insulation on hot water tank.
'Lo' on display	a. Sensor below -20C.	1. Check outside temperature.
'Hi' on display	a. Sensor above 140C.	1. Check Collector has water in it.
'SSd' on display. ROOF light flashing.	a. Wire to Roof sensor broken. b. Roof Sensor damaged. c. Roof Sensor below -40C.	1. Repair wire. 2. Replace Roof Sensor. 3. Check outside temperature.
'SSd' on display. ROOF light is ON.	a. Wire to Roof Sensor shorted. b. Roof Sensor damaged. c. Roof Sensor above 150C.	1. Repair wire. 2. Replace Roof Sensor. 3. Check Collector has water in it.
'SSd' on display. TANK flashing.	a. Wire to Tank Sensor broken. b. Tank Sensor damaged.	1. Repair wire. 2. Replace Pool Sensor.
'SSd' on display. TANK light is ON.	a. Wire to Tank Sensor shorted. b. Tank Sensor damaged.	1. Repair wire. 2. Replace Pool Sensor.
'SSd' on display. INLET light flashing.	a. Wire to Inlet sensor broken. b. Inlet Sensor damaged	1. Repair wire. 2. Replace inlet Sensor.
'SSd' on display. INLET light is ON.	c. Wire to Inlet Sensor shorted. d. Inlet Sensor damaged.	3. Repair wire. 4. Replace Inlet Sensor.

SOLA STAT™-PLUS-ET SPECIFICATIONS

Power Supply.

Supply Voltage. -H 85~264Vac/dc (Standard model)
 -M 22~85Vdc. (Must be specified at time of ordering.)
 -L 10~28Vac/dc. (Must be specified at time of ordering.)
 Max power usage. 5VA + external loads.

Relay Outputs

Supply Voltage. Three options are available (All ratings at 240Vac)
 -1 1.1hp motor
 10A resistive flexible wiring
 -2 2x1hp motor. 1hp combined load
 10A resistive combined load flexible wiring

Sensors.

Display range -20 ~ +140°C
 Control Range -40 ~ +150°C
 Stainless steel tip -40 ~ +150°C; 6mm diameter x 30mm
 PVC Sensor cable -40 ~ +105°C; 4mm diameter, UV resistant. (Standard Models)
 Silicon Sensor cable -40 ~ +150°C; 4mm diameter, UV resistant. (Special Order)
 Accuracy +/-1C @ 25°C

Installer Adjustable Values Range (Adjustable in Installer Programming Mode)

Pump On 2 ~ 21°C (Roof –Inlet Sensor)
 Pump Off 1 ~ 20°C (Roof – Inlet Sensor)
 Energy Transfer Off in Summer 1 ~ 70°C
 Energy Transfer On in Summer 2 ~ 90°C
 Energy Transfer Off in Winter 1 ~ 70°C
 Energy Transfer On in Winter 2 ~ 90°C
 Frost Protection 1 ~ 10°C with +2°C hysteresis or OFF
 Topout 1 ~ 120°C with +2°C hysteresis or OFF

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: 0~60C
 Operating Humidity: 90% RH Max. Non-Condensing
 Enclosure Construction Polycarbonate - Impact Resistant
 UL94 V-2 Non Burning, UV Stabilized
 Water resistant or rear entry option available.
 Dimensions L=167, W=142, H=40mm, excluding glands and cables
 Weight. Standard model + sensors + packaging = 1200grams

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 25C, unless otherwise specified. Each product is subject to the 'Conditions of Sale'.
