SENZTEK

SolaStat™-Plus-ET



Installation Guide

FOR QUALIFIED PERSONNEL ONLY

Tank Transfer Variation of SolaStat-ET

Version1.1

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For technical help contact your distributor.

Distributor Details:

Contact: ……..

Phone: ……..

Address: ……..

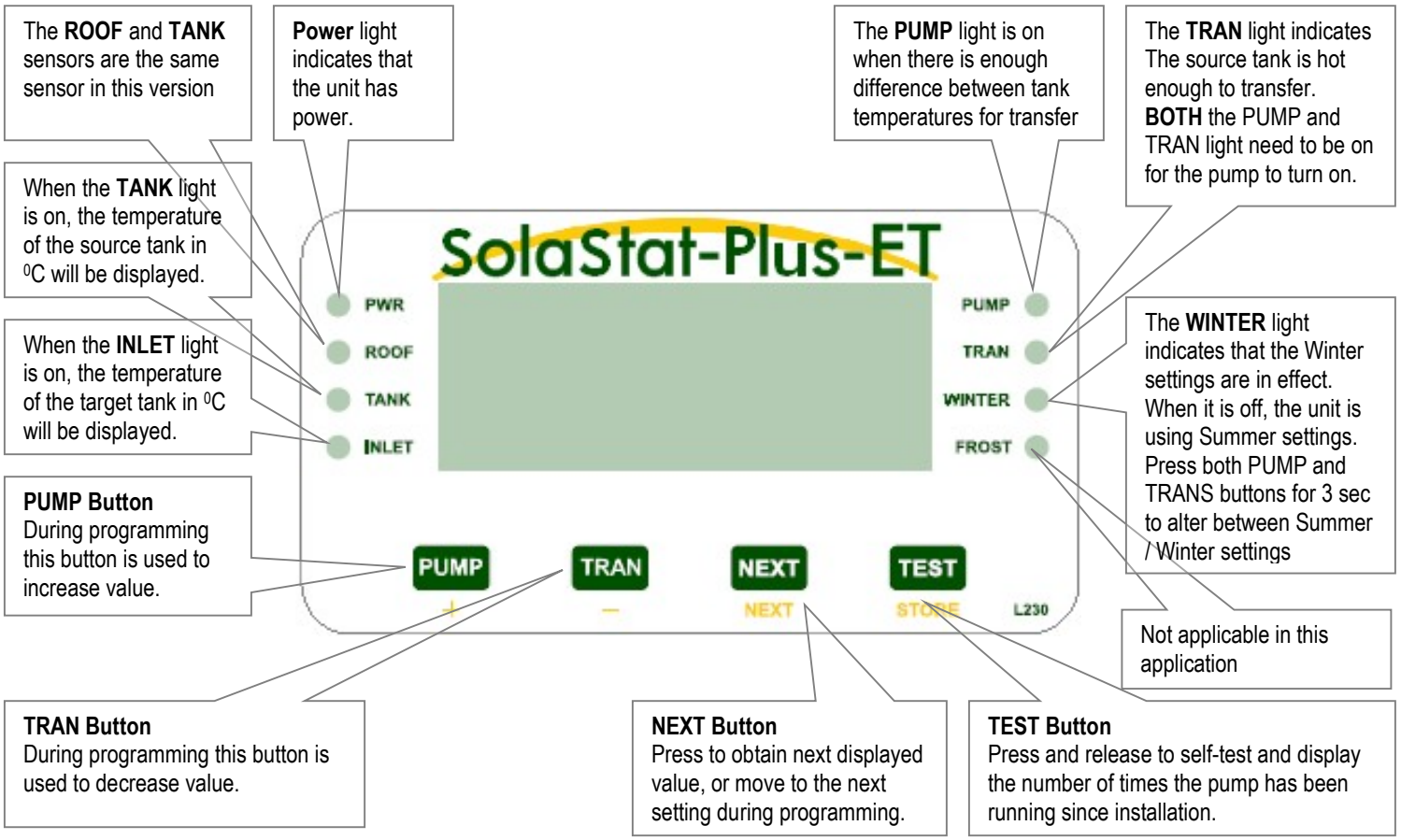
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THE DISPLAY PANEL



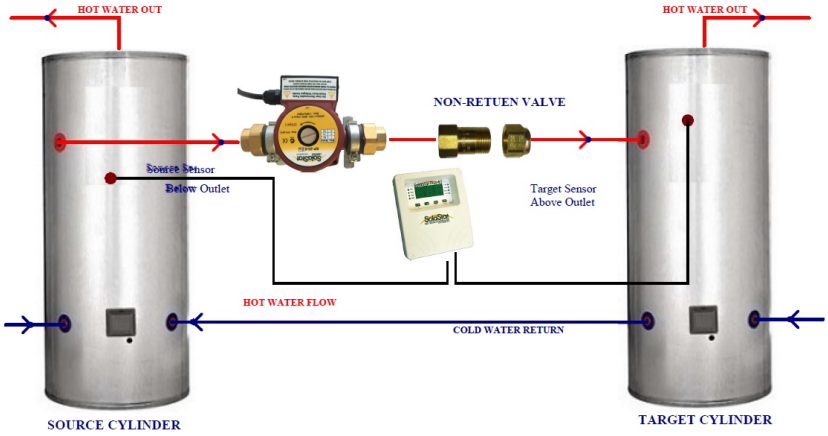
Note: Both Pump and Tran buttons need to both be pressed together for at least 3 seconds to change between Summer / Winter settings

FUNCTION

Principle of Operation

The SolaStat™-Plus-ET is a pump controller for hot water tank transfer from a source tank to a destination tank. It measures water temperatures at the source tank and the target tank. When the source is hot enough AND there is sufficient difference in temperatures between the tanks the pump is turned on until either the source cools down below a preset value (runs out of surplus hot water) or there is no significant difference between the tank temperatures (to avoid the pump running continuously).

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.



- **ENERGY TRANSFER function** is a combination of **PUMP** (differential) and **TRANS** (absolute temperature – set points) allowing excess hot water to be transferred to an external tank.
- **WINTER mode** allows for easy user selection of seasonal variations of what constitutes surplus hot water
- **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 -40ºC to 150ºC.

Note: It would be appropriate to have an intelligent element control method on the Target tank that ensured the transfer was effective by not constantly heating the target to 60ºC and yet ensure the water is safe from Legionella infection (like Senztek's BioSafe©) while ensuring the target does not run out of hot water.

We suggest the advanced **Smart Hot Water Controller** or more cost effective **AlphaStat-Plus.** Visit www.senztek.com for more information.

USING YOUR SOLASTAT™-PLUS-ET

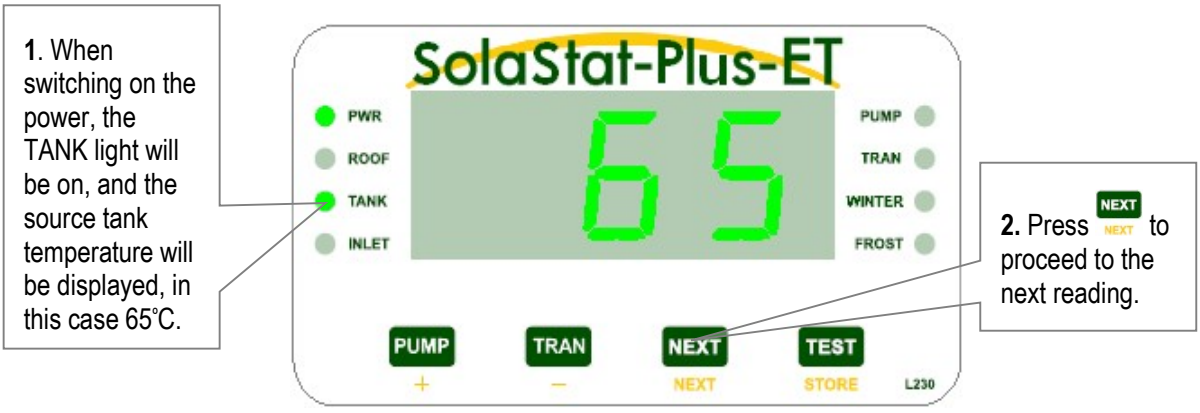
Reading the Display

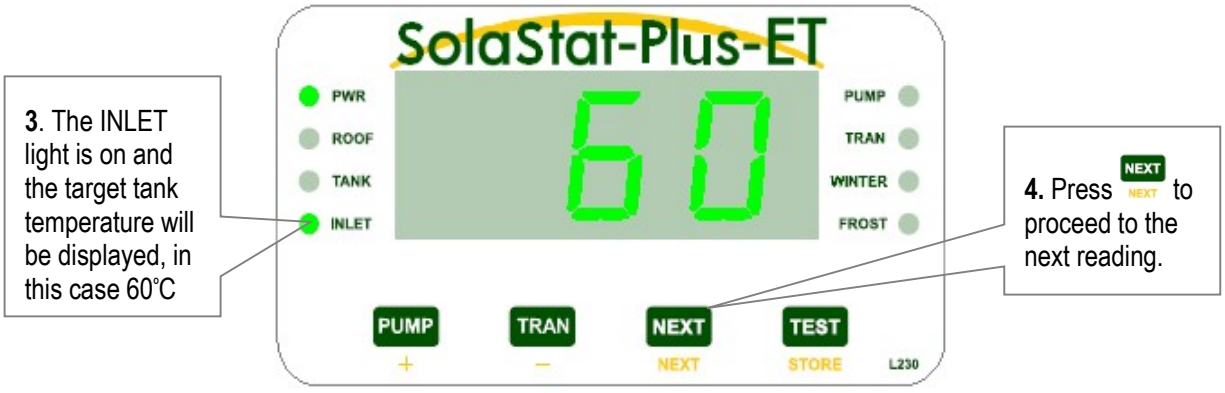
There are 3 parameters that can be displayed individually:

- ROOF Temperature
- TANK Temperature
- INLET Temperature

To read each reading, follow the steps below.

Roof and Tank are the same sensor in this application and are measuring the **Source** tank





USING YOUR SOLASTAT™-PLUS-ET, CONTINUED

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 hot water transfer system
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 hot water system.

Continued on next page

USING YOUR SOLASTAT™-PLUS-ET, 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.



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 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 the system. Please note:

1. The 3m 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. Liberally apply heat transfer compound between the sensor and the lining of the 'pocked' or in the case of the S3, against the copper foot.
2. The 3m 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..

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. Do not mount sensors in direct rain or sunlight.

INSTALLATION AND WIRING

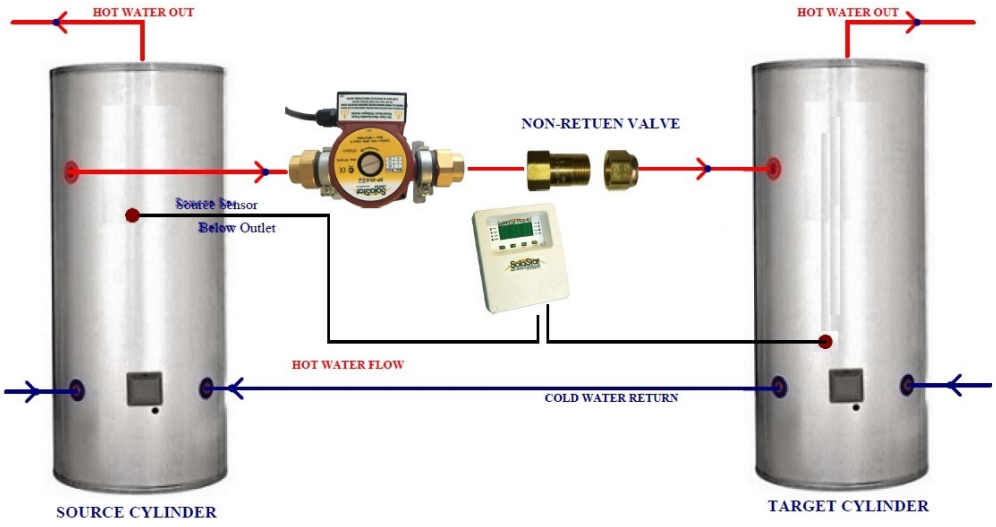
Connect the Pump

Plug in the pump to the PUMP socket on the SolaStat™-Plus-ET. This should not exceed the ½ HP load rating.

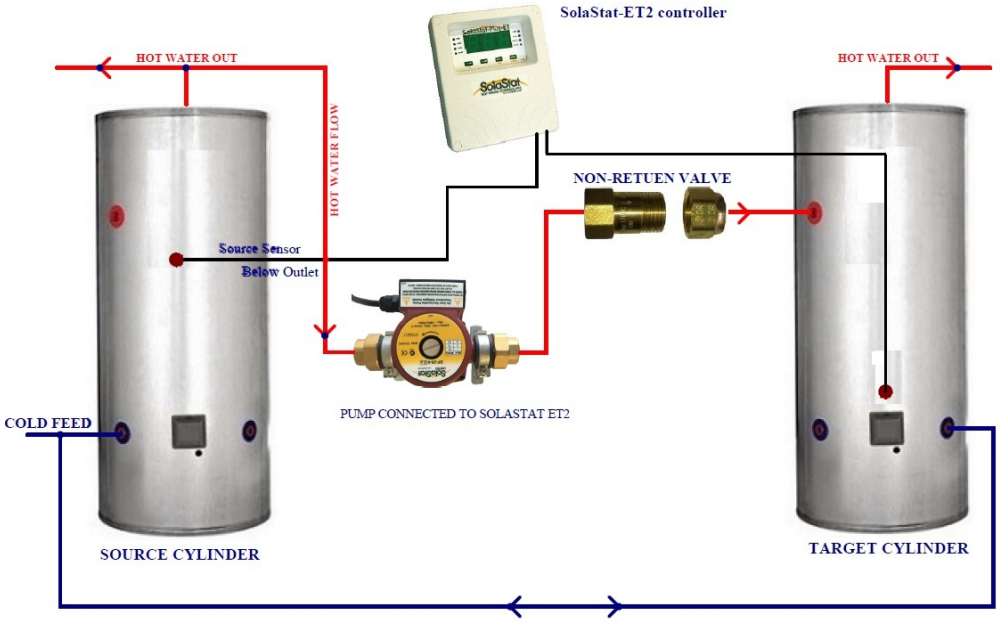
Installation

The best way to install the SolaStat™-Plus-ET is shown below.

Note: The sensor positions are critical



Another option if the ports are not available.



- If there is only one hot water outlet on both tanks connect the pump between the two outlets. It will still work but is the least desirable.

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.

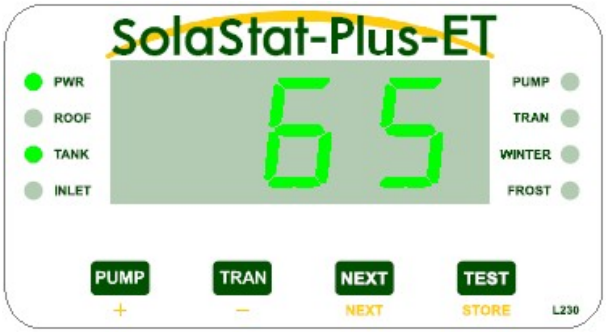
Ensure suitable over-current protection and RCD Protection for the SolaStat™-Plus-ET is in place. Check that there is no water, metal shavings or other electrical hazards to contaminate the plug, socket, wiring or surrounding environment.

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 ºC.
- The PWR light and the TANK light should be on.
- Right lights will be on indicating how the system is operating.



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: Not applicable in this variation – set to off
8. Topout: Not applicable in this variation – set to off

These are explained in more detail below.

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.

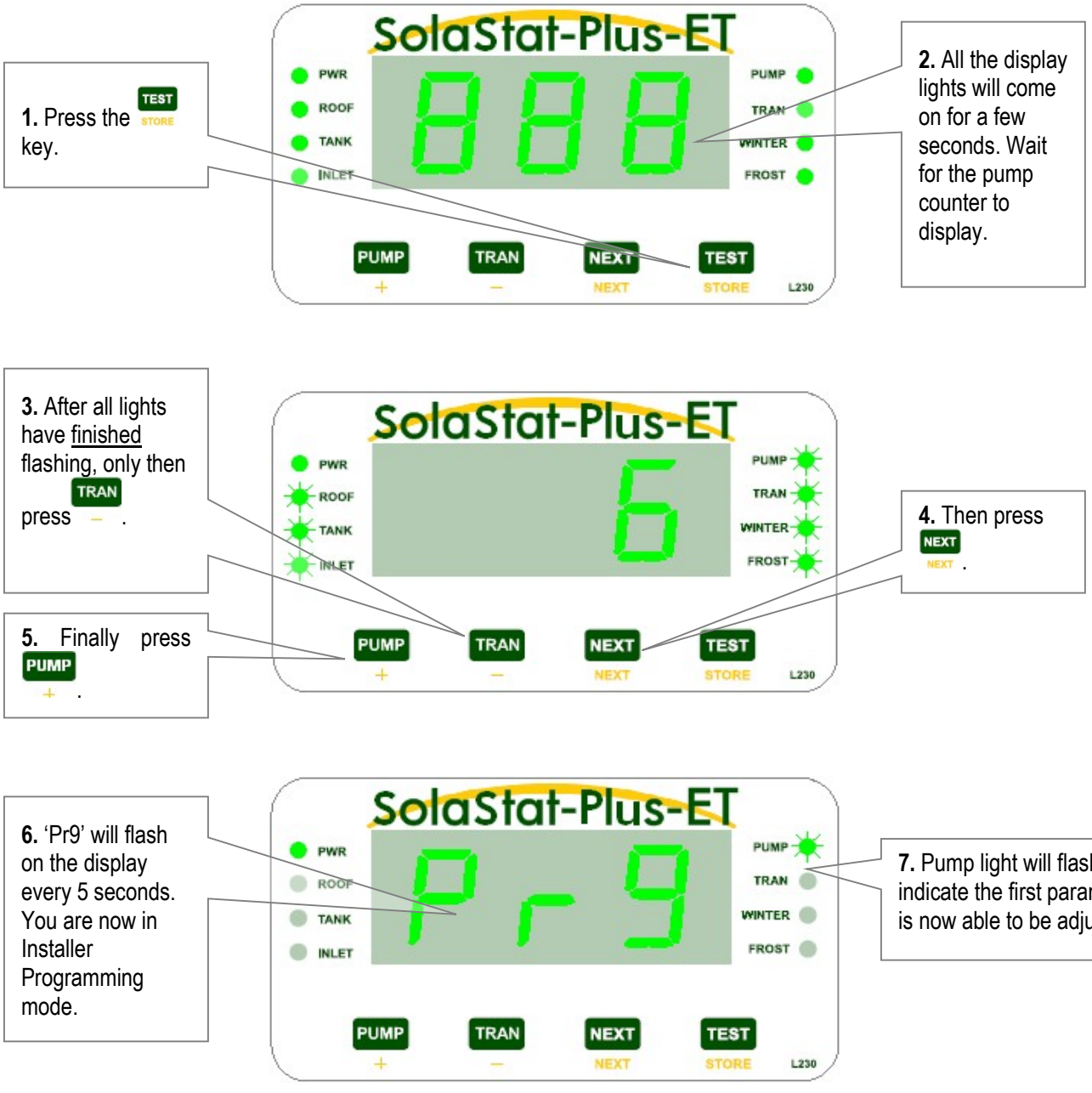
Programming Table for Adjustable Values					
Adjustable Values	**Light Indication**	**Typical (Factory Values)**	**Range**	**Disabled**	**Installation Values**
Pump Off	PUMP Flashing	6ºC	1ºC ~20ºC	N/A	_____ºC
Pump On	PUMP Steady	12ºC	2ºC ~21ºC	N/A	_____ºC
Energy Transfer Off in Summer	TRAN Flashing Slow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

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INSTALLER PROGRAMMING, CONTINUED

How to program Adjustable Values

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



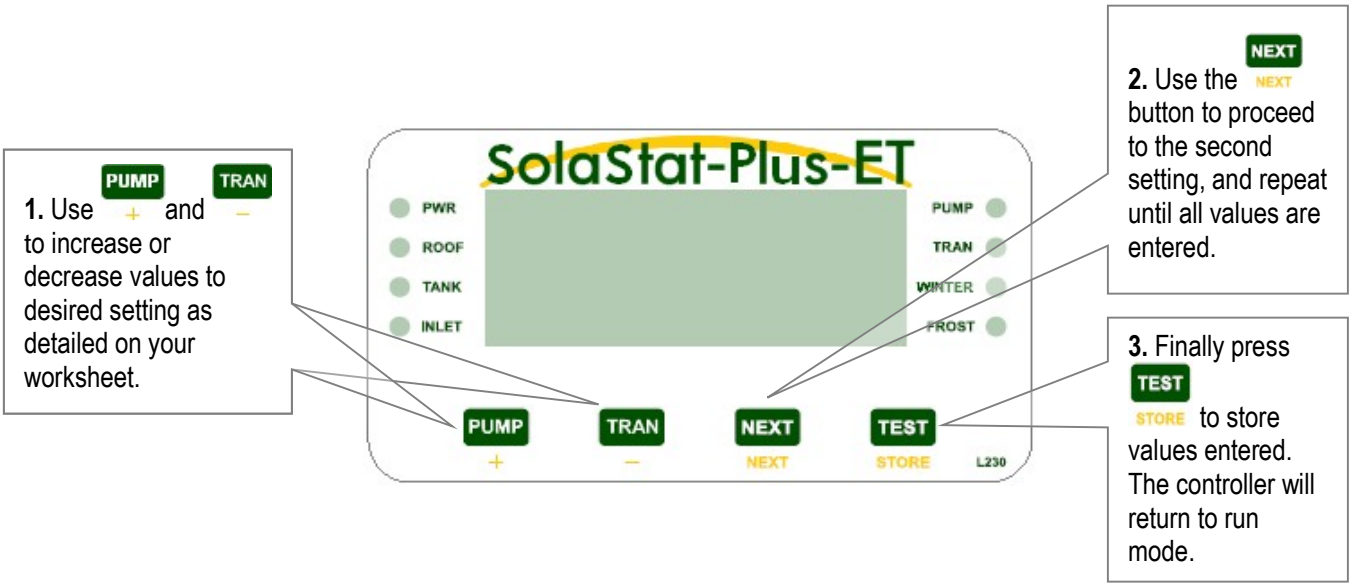
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INSTALLER PROGRAMMING, CONTINUED

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	2ºC
	Pump On	4ºC
	Energy Transfer Off in Summer	45ºC
	Energy Transfer On in Summer	60ºC
	Energy Transfer Off in Winter	40ºC
	Energy Transfer On in Winter	55ºC
	Frost	OFF
	Topout	OFF

Step 1: Press PUMP + to increase or TRAN – to decrease Pump Off value to 2.

Step 2: Press NEXT NEXT to enter value and proceed to next setting. Press PUMP + to increase or TRAN – to decrease Pump On value to 4.

Step 3: Press NEXT NEXT. Press PUMP + to increase or TRAN – to decrease Energy Transfer Off in Summer value to 45.

Step 4: Press NEXT NEXT. Press PUMP + to increase or TRAN – to decrease Energy Transfer On in Summer value to 60.

Step 5: Press NEXT NEXT. Press PUMP + to increase or TRAN – to decrease Energy Transfer Off in Winter value to 40.

Step 6: Press NEXT NEXT. Press PUMP + to increase or TRAN – to decrease Energy Transfer On in Winter value to 55.

Step 7: Press NEXT NEXT. Press PUMP + to increase or TRAN – to increase Frost value to 10 (OFF).

Step 8: Press NEXT NEXT. Press PUMP + to increase or TRAN – to decrease Topout value to 1 (OFF).

Step 9: Press TEST STORE 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 0.5mm^2 stranded speaker wire.
- Firmly attach wires to each other by either soldering (heat shrink 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 screwdriver. 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 wires 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.
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. 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.

SOLASTAT™-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.

Installed by Plumbers

Any water system involves professional level plumbing, Senztek NZ Ltd recommends any installation is carried out by a registered and qualified plumber. All parts including the pump must be rated for any temperatures and pressures found in the hot water system.

Non Return Valve / System

To avoid unwanted thermosiphon transfer between the tanks it is important to fit a non return valve.

Cavitation

A pump is used to circulate the water between the tanks.
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 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.

Minimizing 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 20mm.
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.

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 themosiphoning. 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.

SOLASTAT™-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 Output **(**240Vac)

. ½ HP motor rating
10A resistive combined load

Sensors.

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

Installer Adjustable Values Range (Adjustable in Installer Programming Mode)

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