ADVANCED SOLAR CONTROLLER

solarH2Ot®

⚠ WARNING

Always disconnect the power supply before installing or servicing.

Read through these warnings and all installation instructions before beginning installation. Failure to do so can result in fire, shock, property damage, personal injury and/or death. Installation, operation, and maintenance must be performed by qualified personnel, in accordance with applicable codes, standards, and practices.

SolarHOT, Inc. is not responsible for any damages or injuries that result from improper installation, modification, use or applications/configurations other than those detailed in this document.

This control is designed to be mounted indoors; it is neither splash- nor drip-proof and should be protected from extremes in temperature and humidity.

KEEP THIS INSTRUCTION MANUAL AND MAKE IT AVAILABLE FOR ALL END USERS.

TABLE OF CONTENTS

Features

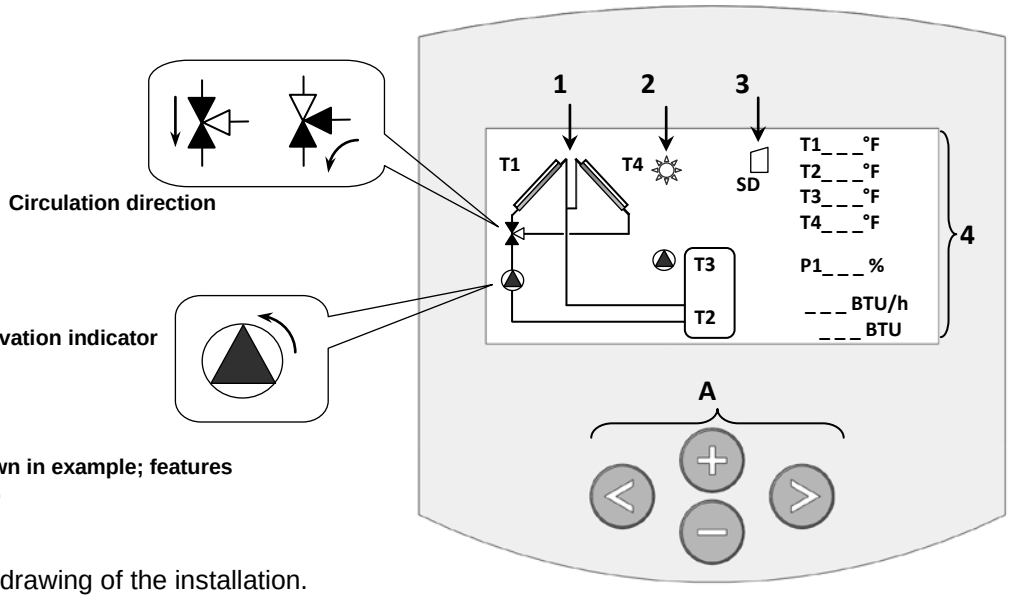
- Large graphic display with backlight
- Easy to use interface (4 keys with scroll menu)
- Several languages available
- System set-up/configuration option using SD card
- Record and view system data (Energy, pump operation etc.) with SD card interface
- Graphic view for temperature, energy etc.
- 8 system configurations with several extra functions possible
- 5 Temperature sensors (PT1000 type)
- 2 Pump outputs (Standard or variable speed)
- 2 Analog Grundfos sensor inputs (Flow and Pressure)
- 1 Impulse flow meter input (for energy measurement)
- Pump exercise function
- 1 Extra output (to control back-up heat, heat dump…)
- Automatic, Off or Manual Test mode
- Monitors system for errors (short or open circuits to sensors, pump failure)
- Choice of collector sensor location (external or internal to collector)
- Collector protection (Freeze, Over heat, and Anti-stagnation)
- Permanent memory storage

Technical Features

Ambient temperature range for normal operation	32°F – 122°F
Electrical Protection **Installation Category** **Pollution Degree**	IP20 II 2
Fuse **Power supply** **Maximum Power Consumption (**with all outputs activated**)**	5A 120Vac (5x20mm) 120Vac +/- 10% 60Hz 4.2A (~504W)
Outputs: **P1** (Main pump with standard or PWM speed regulation): **P2** (Pump with standard or PWM speed regulation, Booster pump, valve): ***NOTE: Combined output of P1 and P2 not to exceed 3A.** **P3** (Extra, Additional heat, cooling…)	 Triac 1.8A***** 120VAC. Triac 1.8A* 120VAC Relay 2A 120VAC
Inputs: **T1** (Collector1): **T2** (Tank1): **T3** (Extra sensor): **T4** (Extra sensor, Tank2, Collector2): **T5** (Collector supply): **T6** (Flow meter): **GDS1** (Grundfos Flow meter): **GDS2** (Grundfos Pressure sensor):	 PT 1000 type PT 1000 type PT 1000 type PT 1000 type PT 1000 type Impulse type (low voltage 5V) Analog type (Grundfos **VFS**) Analog type (Grundfos **VPS**)
Sensors delivered: **1 Collector sensor** **1 Tank** **1 Extra**	 PT1000 (1.5M 356°F) PT1000 (3M 221°F) PT1000 (3M 221°F)
Software version	Displayed during the start-up **Version xxxxxx**

DISPLAY (Screen, Keys, Menus)

Main Display



NOTE: System 4 shown in example; features typical of all systems.

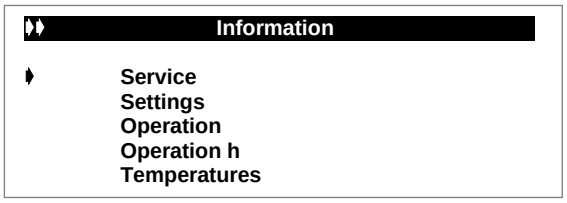
1: Simplified drawing of the installation.
- The pump symbols turn when pumps are activated.
- The filled triangles on the valve symbol indicate the circulation direction

2: Solar storage is working.
3: SD card storage is active.
4: Sensor temperature readings, pump speed indicators, power and stored energy levels.

A: Keypad description

⊕	Navigation key up or plus key	›	Navigation key right
⊖	Navigation key down or minus key	‹	Navigation key left

Main menu:



Press › to enter the Navigation Menu.
(The active menu is highlighted in black at the top of the display)
Use the ⊕ or ⊖ buttons to navigate in the menus. The selection cursor (**⧫**) will indicate the current submenu**.**
Press › to enter the selected menu and/or ‹ to return to the previous menu.

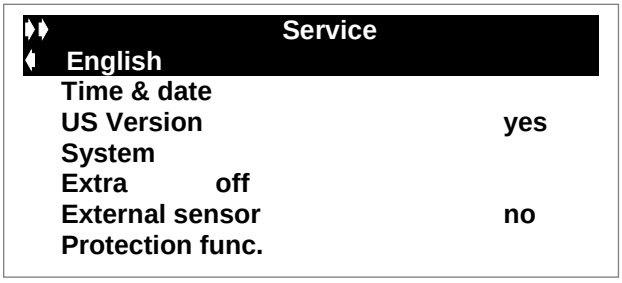
Not all submenus, selections, or options discussed in this manual are available on all systems. Depictions of menus and submenus shown here are representative of their actual appearance on the control when the same series of settings as is described is followed.

IMPORTANT NOTE: The factory default setting on the **Operation Menu** is **OFF.** This prevents system components (**P1**, **P2**, **P3**) from operating until system is set up. To turn on the system, change the setting to **AUTOMATIC (Active)**. See **Operation** menu / **3.1** for further info.

1. Service Menu

1.1. Language:

- With (**+)** or **(-)**select the line "**English**" and press **(>)** to highlight the line.
- Now you can change the language with **(+)** or **(-)**, you have the choice between: English, Deutsch, Français, Espanol, Italiano....



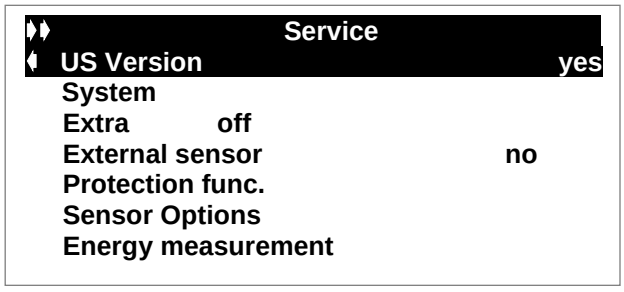
1.2. Time & Date:

- With (**+)** or **(-)** select the line "**Date & Time**" and press **(>)** to enter in the submenu time & Date.
- Now you can select the date or time line with **(+)** or **(-)**, then press **(>)** to highlight the value which must be adjusted.

Note: If power supply is lost, settings will be retained for 24 hours; after that time, the clock will have to be reset.

1.3. US Version:

This selection allows you to select the units of measurement that will be displayed on the control.



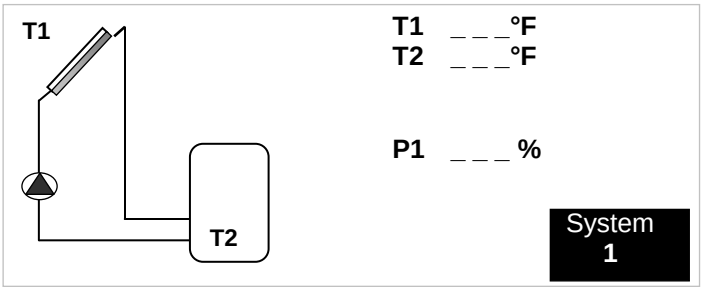
YES = (US Version): °F, 12H am/pm, Gallons, BTU/h and kBTU
NO = (EU Version): °C, 24H, Litres, kWh

1.4. System:

When the line is selected, press **(**>**)** to enter the submenu.
You have the choice between 8 systems with the option to add an extra function (see **1.5**).

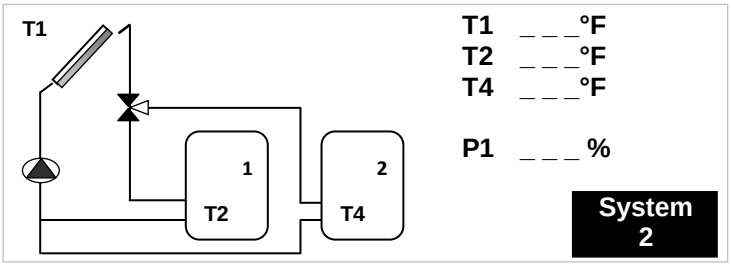
1.4.1. System 1

Basic system, with 1 tank, 1 pump, 1 collector array and 2 sensors.
With this system you can add extra functions with 1 or 2 sensors (**Booster pump**, **Thermostat**, **Cooling, Anti-stagnation,** or **Diffcontrol** function).



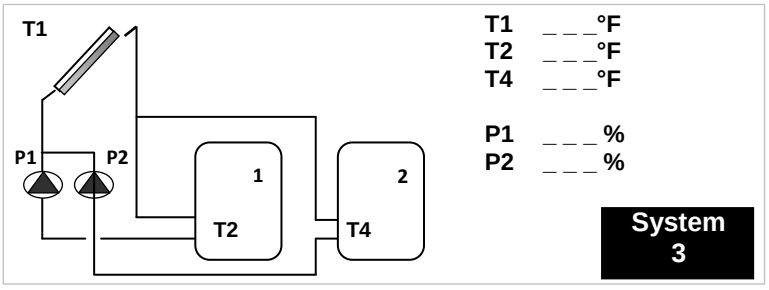
1.4.2. System 2

System with 2 tanks, 1 pump, 1 valve, 1 collector array and 3 sensors.
With this system you can add an extra function with 1 sensor (**Thermostat**, **Cooling, or Anti-stagnation** function).



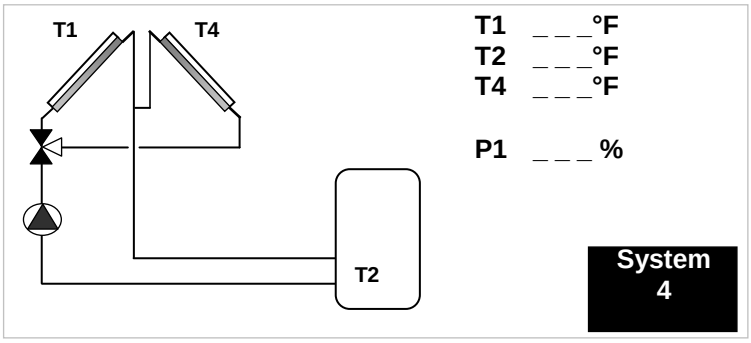
1.4.3. System 3

System with 2 tanks, 2 pumps, 1 collector array and 3 sensors.
With this system you can add an extra function with 1 sensor (**Thermostat**, **Cooling, or Anti-stagnation** function).



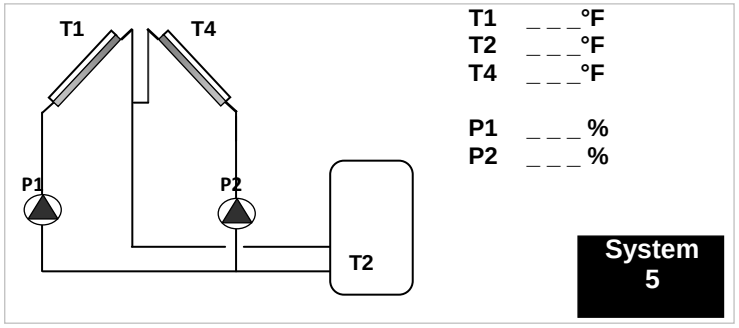
1.4.4. System 4

System with 1 tank, 1 pump, 1 valve, 2 collector arrays with 2 different cardinal directions (East / West) and 3 sensors. With this system you can add an extra function with 1 sensor (**Thermostat**, **Cooling, or Anti-stagnation** function).



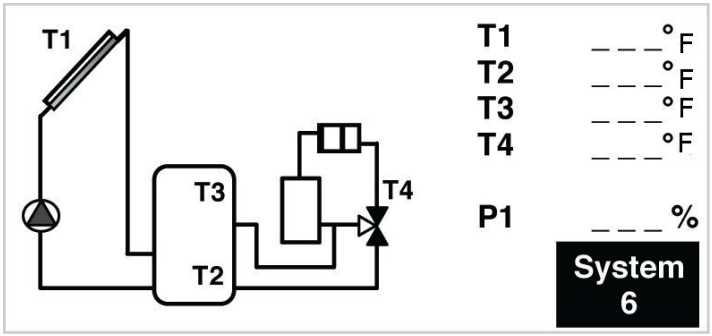
1.4.5. System 5

System with 1 tank, 2 pumps, 2 collector arrays with 2 different cardinal directions (East / West) and 3 sensors. With this system you can add an extra function with 1 sensor (**Thermostat**, **Cooling, or Anti-stagnation** function).



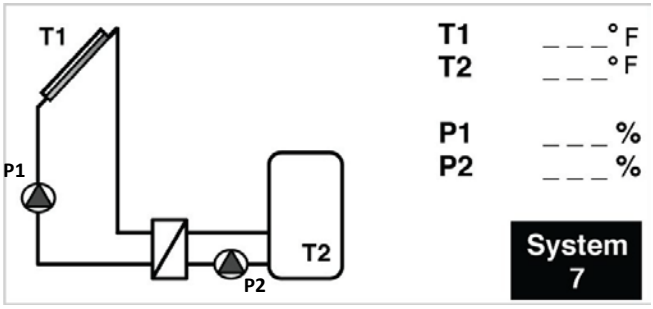
1.4.6. System 6

System with 1 tank, 1 pump, 1 collector array, 1 valve (to be used in an incorporated radiant heating system), and 4 sensors.
With this system you can add an extra function with 1 sensor (**Thermostat**, **Cooling, or Anti-stagnation** function).



1.4.7. System 7

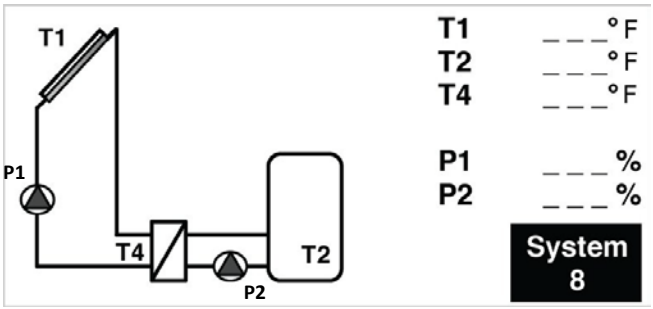
System with 1 tank, 2 pumps, 1 collector array, 1 external heat exchanger, and 2 sensors. With this system you can add an extra function with 1 sensor (**Thermostat**, **Cooling, or Anti-stagnation** function).



- **P2** engages after **P1** according to the time delay set by the user at **Settings/Delay P2** (See Section **2.12**) and disengages at the same time as **P1**.

1.4.8. System 8

System with 1 tank, 2 pumps, 1 external heat exchanger, 1 collector array, and 3 sensors. With this system you can add an extra function with 1 sensor (**Thermostat**, **Cooling, or Anti-stagnation** function).



- **P1** and **P2** act independently; their activation, deactivation, and speed are dependent on readings within their respective circuits only.
- On the Collector circuit, the activation/deactivation of **P1** is triggered by the **Δt** between **T1** and **T2**.
- In the Tank circuit, the **Δt** between **T2** and **T4** controls when **P2** engages/disengages.

1.5. Extra Functions

When the line is selected, press **(>)** to highlight the line.
You have the choice of 4 extra functions; not all options are available on all systems.

For a quick reference on Systems and their related Extra Functions see Appendix A (Pump Functions by System) on page 38.

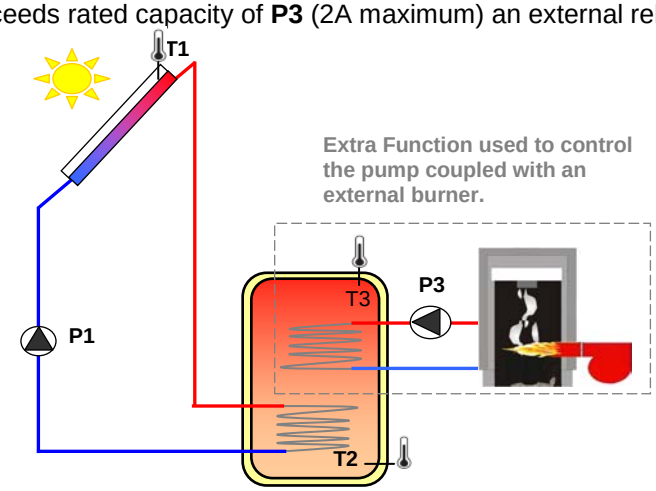
1.5.1. Thermostat Function

This function may be used to connect an auxiliary or back-up heat source to your system.

Some possible auxiliary heat sources:
- Pump controls for Fuel or Gas burner (P3 provides 120V signal)…
- Electrical element inside the solar tank.

NOTE: If electrical usage exceeds rated capacity of **P3** (2A maximum) an external relay must be used.

Example:

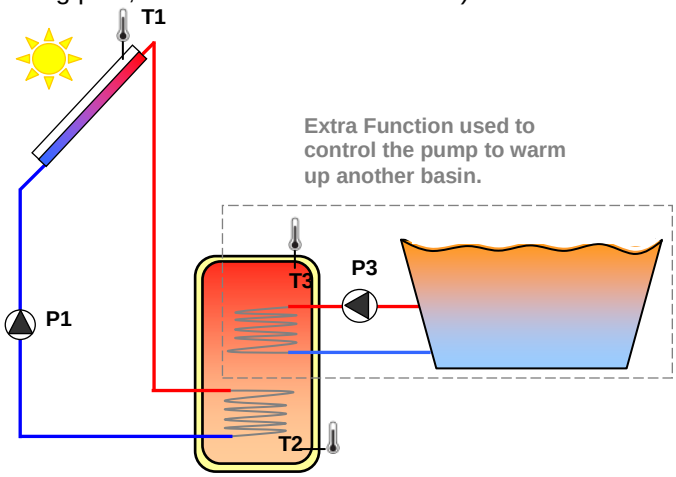


This function is available only if selected on the Extra Menu

1.5.2. Cooling Function

The cooling function may be used to cool down the primary solar tank during times of high solar irradiation. This function allows for the accumulation of excess energy in another heat storage area/device (Swimming pool, additional tank or heat sink).

Example:



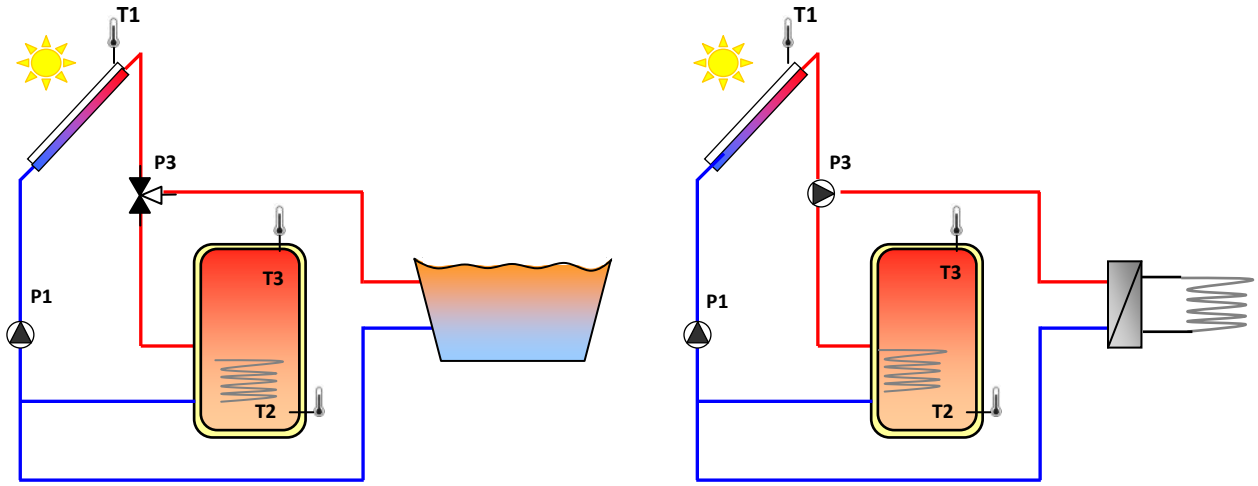
This function is available only if selected on the Extra Menu

1.5.3. Anti-stagnation

The anti-stagnation function is designed to protect the solar fluid and collector during times of high solar radiation.

- If the collector circuit sensor (**T1** on single collector systems, **T1** & **T4** on east-west collector systems) registers over the **Anti-stagnation Start** temperature on the **Settings** menu, the designated valve or pump is activated.
- When the collector circuit has cooled down to below the **Anti-stagnation stop** temperature (**Settings** menu) the valve or pump will deactivate.
- See **Settings** menu/**Extra Functions**/**Anti-stagnation** for further information.

The anti-stagnation function can be used to direct excess heat from the system into a designated heat dump, i.e., fan coil, ground loop, or hot tub/pool.

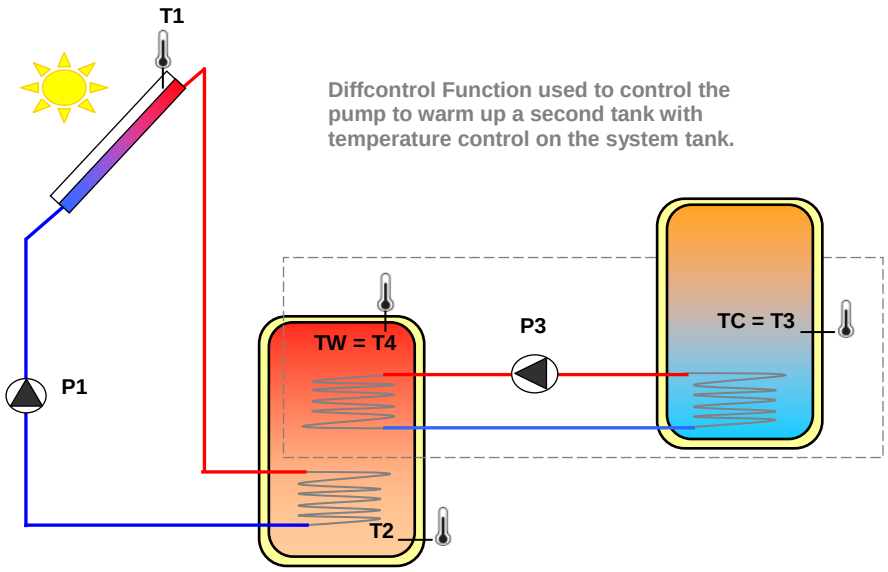


This function is available only if selected on the Extra Menu

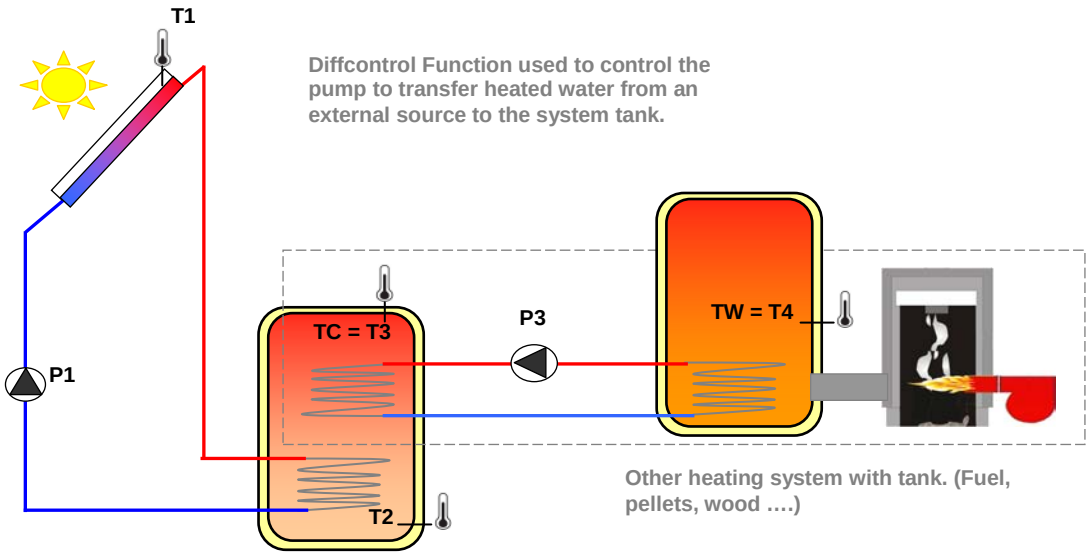
1.5.4. Diffcontrol Function:

The **Diffcontrol** function (only available on **System 1**) may be used to transfer heated water from one storage tank to another independent of the solar collecting function.
This extra function allows separate temperature control of both tanks with user-defined temperature settings (see **Settings** menu).

Example #1 Additional tank w/no auxiliary heat source



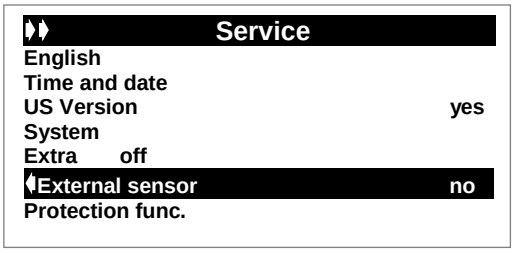
Example #2 Additional tank w/auxiliary heat source



This function is available only if selected on the Extra Menu

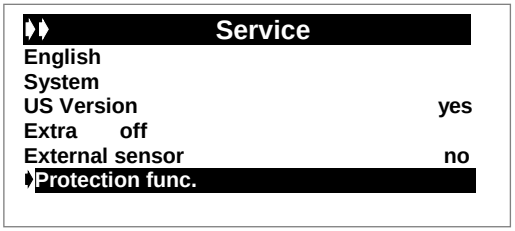
1.6. External Sensor

This option is useful for collectors that require the sensor to be mounted on the piping external to the collector manifold.

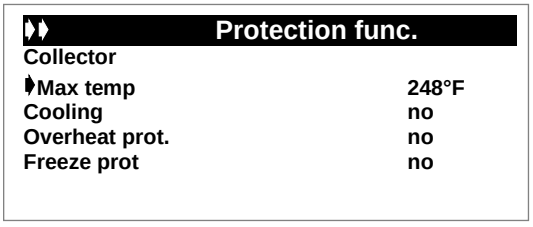


- Select **External sensor** and press **(>)** to highlight the line.
- Now select **yes** [using the **(+)** or **(-)** keys] if the collector sensor is not mounted directly on the collector (e.g. on the return pipe). This function will energize the collector pump for 30 seconds twice per hour to ensure that the collector fluid temperature is accurately measured and avoid collector short cycling.

1.7. Protection function :



- Once the line is selected, press **(>)** to enter the submenu.



- Use **(+)** or **(-)** to select the desired protection function.
- Press **(>)** to select.
- Use the **(+)** or **(-)** buttons to select **yes**.

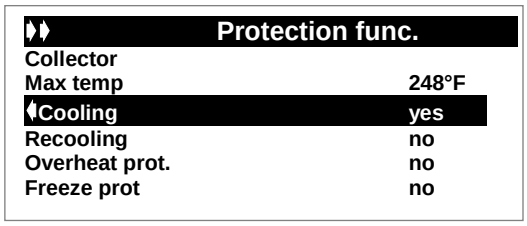
The **Maxtemp** setting is used in the following three protection functions which are designed to prevent overtemp in the collectors. If one or more of the protection functions are activated, the system will automatically activate when the collector temperature reaches the **Maxtemp** threshold regardless of the tank temperature settings.

(**Maxtemp** is adjustable from 230°F to 302°F with factory default set at 248°F)

For safety, however, the pumps will automatically shut down when the water temperature in the tank reaches 203°F.

Code listed and approved hot water tempering valves should be installed throughout the system to ensure that water temperatures at the points of use are within a safe and acceptable range.

1.7.1. Cooling:



This option is for the protection of the collector fluid. It activates the solar pump (**P1** or **P2)** if the temperature on the collector arrays (**T1** or **T4)** exceeds the collector **Max temp** value even if the set maximum temperature in the tank is exceeded. The circulation stops when temperature has dropped 20°F.

(The pumps will be stopped if the water temperature in the tank reaches 203°F).

- When **Yes** is selected on the **Cooling** function, the **Recooling** function becomes accessible.

1.7.1.1. Recooling

When **Recooling** is set to YES, the following safeguards are in place:
When the water temperature inside the tank is above **Maxtemp tank1** (refer to section 2.1) and the collector temperature is 20°F lower than the actual tank temperature (**T2**), the pumps will activate to cool the tank through the collector array (typically at night).
The pumps will run until either

- the temperature of the tank drops below the **Maxtemp tank1** setting, or,
- the temperature difference between the tank and the collector array is less than 4°F.

1.7.2. Overheat protection *(should only be used in conjunction with Cooling function)*:

When set to **YES**, this function will stop all collector circulation (**P1** and **P2**) when the collector temperature registers more than 20°F above the collector **Maxtemp** setting. This function is intended to protect any temperature sensitive system components (Tank, lines, pumps...) in the event of the failure of, for example, tank sensor **T2.**

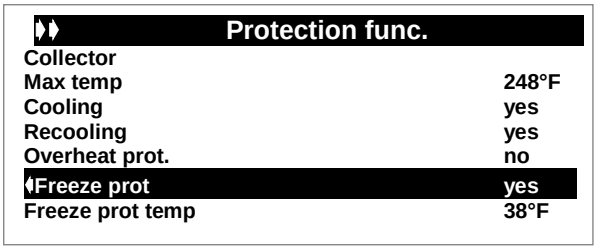
1.7.3. Freeze protection:

When set to **YES**, this option will keep the solar panel temperature (**T1** or **T4)** above the **Freeze Protection Temperature** setting level (see below) by activating the pump (**P1** or **P2)**.

- This option could be used to reduce snow accumulation on the panel for increased efficiency during the day or to avoid potential damage due to freezing.

Note: This function uses energy from the storage tanks and may result in reduced available thermal capacity.

- Adjust the **Freeze prot temp** setting to the desired temperature.
- (Adjustable from -4°F to + 45°F with factory default of 37°F)

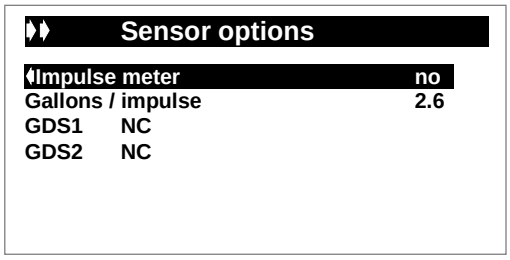


1.8. Sensor Options:

The sensors are used for energy measurement and system monitoring. Both flow and pressure sensors can be used.

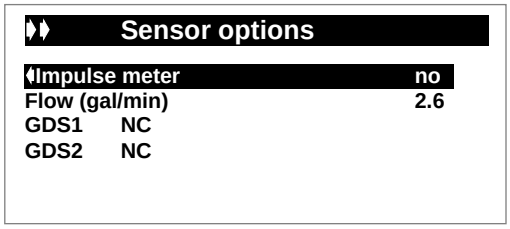
1.8.1. Impulse Flow Meter

The flow can be measured using a mechanical flow meter (if installed).



- If impulse flow meter is installed (on **T6 / PF**) select "**Yes**", then you must use **(+)** or **(-)** to enter the flow meter characteristics in gal / impulse. (Adjustable 0.26 to 6.6 gal/imp with factory value 1.0 gal/imp).

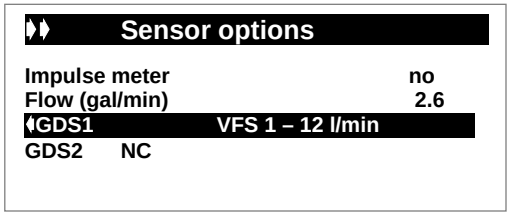
- If no flow meter is installed (factory default setting) you must manually enter the maximum pump flow in gallons/minute using the **(+)** or **(-)** buttons. The manufacturer's specification is generally found in the pump literature or on the manufacturer's website.



1.8.2. Grundfos Flow Sensor (GDS1)

The controller has 2 dedicated inputs for analog GRUNDFOS sensors (Type VFS Flow sensor or VPS pressure sensor).

- The Flow sensor is used for energy measurement and monitoring
- The Pressure sensor is used only to monitor the pressure on the primary circuit.



GDS1 may be connected to either a flow or pressure sensor.

Four different GF Flowsensor models are supported by **GDS1:**

VFS1 - 12 l/min	(3.2 gal/min)	Flow sensor
VFS 2 - 40 l/min	(10.6 gal/min)	Flow sensor
VFS 5 - 100 l/min	(26.4 gal/min)	Flow sensor
VFS 10- 200 l/min	(52.8 gal/min)	Flow sensor

Three different GF Pressures sensor models are supported by **GDS1**:

VPS 0 – 4 bar	(58 psi)	Pressure sensor
VPS 0 – 6 bar	(87 psi)	Pressure sensor
VPS 0 – 10 bar	(145 psi)	Pressure sensor

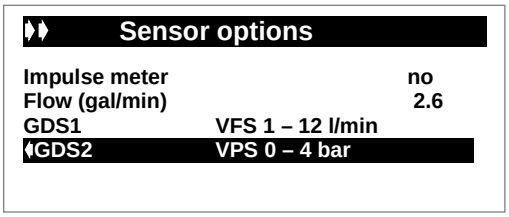
To change the sensor type, press **(>)** then select either your choice or **NC** (Not Connected) with the (**+**) or (**-**) buttons.

You can also check the operation of the sensor on the submenu **3.2 Manual testing**.

See the controller schematic for more information on the electrical connection.

1.8.3. Grundfos Flow Sensor (GDS2)

This input is reserved for connection of a Pressure sensor to monitor the primary circuit.



Three GF Pressure sensors are supported on the **GDS2** port:

VPS 0 – 4 bar	(58 psi)	Pressure sensor
VPS 0 – 6 bar	(87 psi)	Pressure sensor
VPS 0 – 10 bar	(145 psi)	Pressure sensor

To change the sensor type, press **(>)** then select either your choice or **NC** (Not Connected) with the (**+**) or (**-**) buttons.

You can also check the operation of the sensor on the submenu **3.2 Manual testing**.

See the controller schematic for more information on the electrical connection.

1.8.4. Flow Monitoring

System flow is monitored whether or not a flow meter is installed.

If no flow meter is installed

- the difference between collector temperature and tank temperature is used as indication of an error in the flow.
- A difference of greater than 140°F for more than 30 minutes is interpreted as an error.
-

When a flow meter is installed

- If no flow has been measured for ten minutes after the pump engages, an error is indicated.

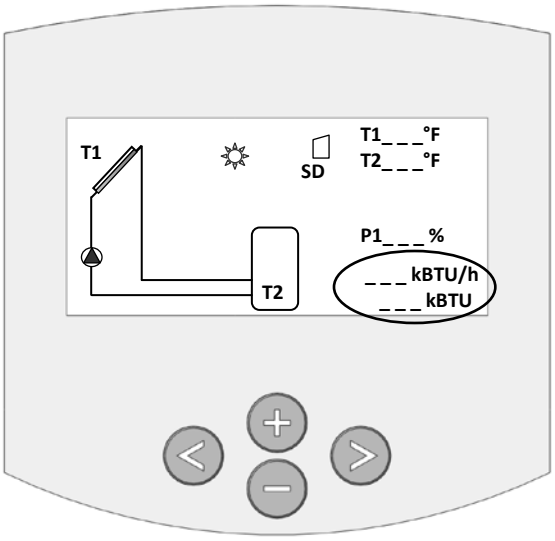
When an error is detected, an error message is shown in the display.

1.9. Energy Measurement

The Advanced Solar Control has multiple options for measuring energy. Both instantaneous energy (**kBTU/h**) and accumulated energy (**kBTU**) are displayed on the **Main Display** screen.

Energy is calculated using ΔT, flow, and fluid constants:

- Flow can either be input by the user or measured by various types of flow sensors (see section **1.8 Sensor Options**).
- Fluid constants will depend on whether the system contains glycol or not. If glycol is used, the percentage can be selected in section **1.12 Glycol.**
- The Advanced Solar Control has multiple options for which ΔT is used. This gives the user the flexibility to choose both the sensors as well as the locations in the system across which they want energy to be measured.



Service	
US Version	yes
System	
Extra off	
External sensor	no
Protection func.	
Sensor Options	
Energy Measurement	

1.9.1. Warm Sensor

Options for which sensor should be used to measure the higher temperature include the following:

- **Auto:** the control will use the default sensors according to the system chosen (T1 or T1 and T4)
- **T3** (if not being used by an Extra system)
- **T5**
- **GDS1 temp**

1.9.2. Cold Sensor

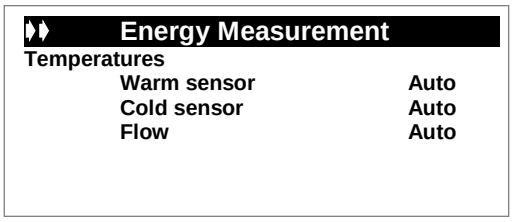
Options for which sensor should be used to measure the colder temperature include the following:

- **Auto:** the control will use the default sensors according to the system chosen (T2 or T2 and T4)
- **T5**
- **GDS1 temp**

1.9.3. Flow

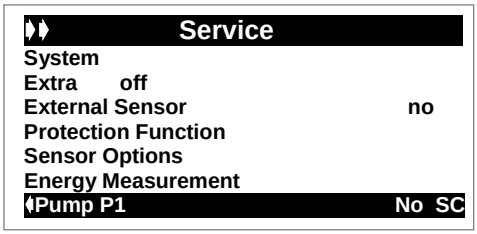
Options for which sensor should be used to measure the flow include the following:

- **Auto:** the control will use the Max. Flow entered in section **1.8**
- **Impulse Meter**
- **GDS1**



1.10. Pump P1

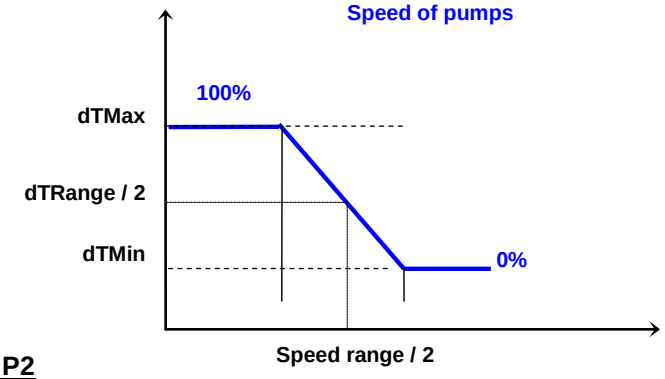
This function allows you to choose the type of the pump control used on the output **P1**.
To change the pump type, press **(>)** then select your choice with the (**+**) or (**-**) buttons.



There are 3 choices:

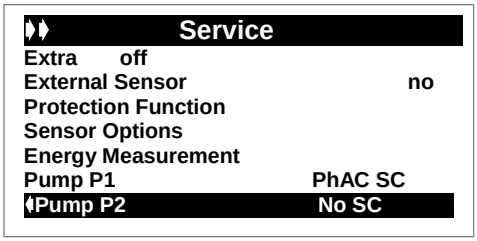
- **No SC** - For standard pump without speed control.
- **Phase SC (PhAC SC on Display)** - For standard pump with speed control.
  - The speed regulation is done by TRIAC (phase control).
  - Check the following before changing the setting:
    - Whether or not your pump will work with this type of speed regulation,
    - The minimum speed rating of the pump, and,
    - The speed selector on your pump must be put on the maximum position.
    - See Section **2.8 Min rev pump** for further applicable settings and information.
- **PWM SC** - For PWM pump with speed control.
  - The speed regulation is done by PWM control.
    - Available with GRUNDFOS SOLAR PM type.

Note: If you have selected **PWM SC** on the **Pump P1** or **Pump P2**, the pump speed will begin to decrease when the **dT** value is under the **dTMax** setting for the appropriate tank. At the applicable **dTmin** setting, the pump will shut off.



1.11. Pump P2

This function allows you to choose the type of the pump used on the output **P2**.
To change the pump type, press **(>)** then select your choice with the (**+**) or (**-**) buttons.



Pump P2 settings are the same as described in the previous section for **Pump P1** (**No SC**, **Phase SC**, **PWM SC)**.

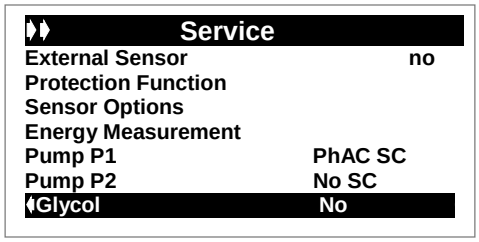
In addition, Pump P2 offers a **Boost** setting for use with a booster pump, commonly used in drainback systems. This setting should be used when a second pump is installed in series on the primary circuit to assist **Pump P1** at system start-up.

The run time for the booster pump is set when the **Boost** operation is selected on the **Service** menu (Boost 1 min, Boost 2 min, etc.).

Important Note: **Boost** is only available for **System 1** (see **1.4.1 System 1**)

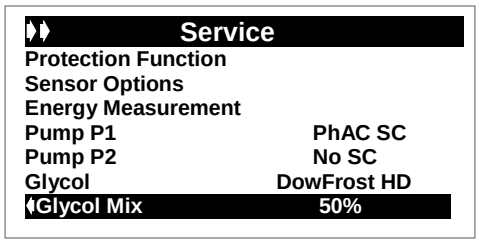
1.12. Glycol

This submenu allows you to select either **NO** or **DowFrost HD** according to your system setup.



1.13. Glycol Mix

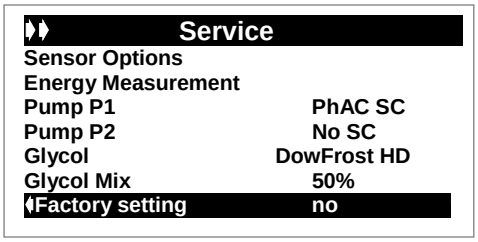
- If you have chosen to use a propylene glycol solution in your system, you must specify the concentration on this submenu.



- To set the concentration, press **(>)** then select a percentage between 0 and 50% (in 10% increments) with the (**+**) or (**-**) buttons

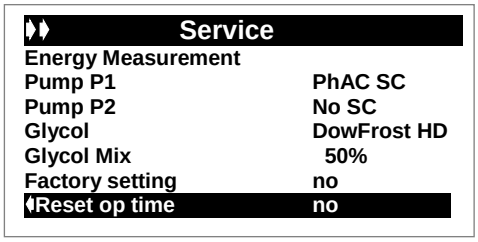
1.14. Reset to Factory default settings:

- Press **(>)** to highlight this line if you want to reset all settings to their factory default.
- Select "**yes**" with **(+)** key.
- Press **(<)** repeatedly to return to the main



IMPORTANT NOTE: The factory default setting on the **Operation Menu** is **OFF.** This prevents system components (**P1**, **P2**, **P3**) from operating until system is set up. To turn on the system, change the setting to **AUTOMATIC (Active)**. See **Operation** menu / **3.1** for further info.

1.15. Reset op time:



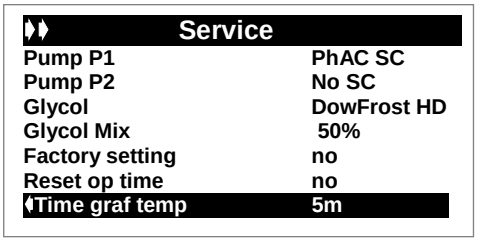
To reset the all of the operation hours to zero:

- Press **(>)** to highlight the line.
- Select "**yes**" with **(+)** key.
- Press **(<)** repeatedly to return to the main menu.

Caution: This will erase all previously recorded data (Power, Energy, temperature…)

1.16. Time graph temp:

Adjusts the graphical scale for the Temp vs. Time graphs (adjustable from 1 to 60 minutes).

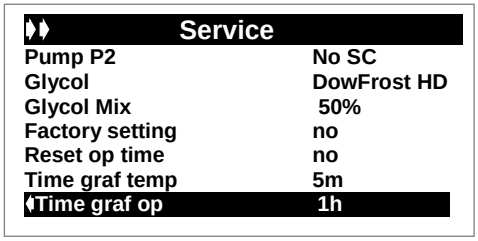


See **Temperature (section 5)** for more detailed information.

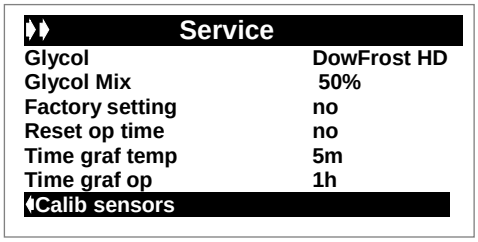
1.17. Time graph op:

Adjusts the graphical scale for the **Operation h menu** vs. time graphs (adjusts from 1 to 48 hours).

See **Operation h (section 4)** for detailed information.



1.18. Calibration of sensors:

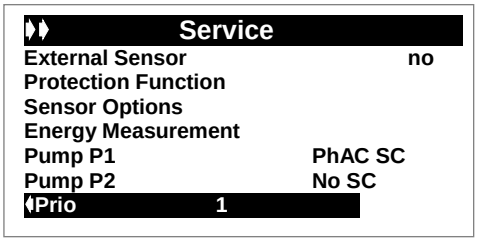


On this submenu you can calibrate all the temperature sensors connected to your system.

CAUTION: Check the temperature with a calibrated thermometer before adjusting.

(Calibration range is from -6°F to +5°F with factory default setting of 0°F)

1.19. Priority Tank:



This option will only display if you are configuring a system with two tanks (as discussed in sections **1.4.2 / System 2** and **1.4.3 / System 3**)

Designate one of the system tanks as **priority** (**tank1** or **tank2**). The **priority** tank will always be activated first unless one of the following situations occur. **NOTE: Default setting is No Prio**

The second tank will become operational when:

- The **priority** tank reaches the **Maxtemp** value entered on the **Setting** menu (**Section 2**) for that particular tank (if **tank1** is designated **priority**, the applicable setting will be the **Maxtemp tank1**; if **tank2** is **priority**, **Maxtemp tank2**).

Note: When the temperature in the **priority** tank falls below the temperature set for **MinTemp Prio** (**Setting** menu), **priority** will switch back from the second tank to the original **priority** tank.

2. Setting Menu:

This menu allows you to set all adjustable parameters of your system.
Not all options are available with all systems.

Settings	
Maxtemp tank1	149°F
dT Max tank1	49°F
dT Min tank1	38°F
Maxtemp tank2	149°F
dT Max tank2	49°F
dT Min tank2	38°F
Mintemp prio tank	32°F

2.1. Maxtemp tank1:

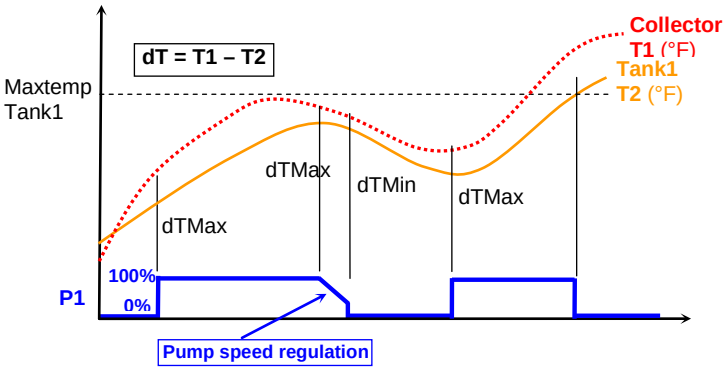
Maximum value of desired water temperature in **tank1** during normal operation.
(Adjustable from 59°F to 203°F with factory default set at 149°F)

2.2. dTMax tank1:

Difference (ΔT) between collector temperature (**T1**) and **tank1** temperature (**T2**) that will automatically engage **pump1**.
(Adjustable from 7°F to 72°F with factory default set at 12°F)

2.3. dTMin tank1:

Difference (**ΔT**) between collector temperature (**T1**) and **Tank1** temperature (**T2**) that will automatically disengage **pump1**.
(Adjustable from 4°F to 63°F with factory default set at 5°F)
NOTE: dTMin will always be 3-7°F less than dTMax



Note: If the installed system has two tanks, the adjacent graph is also valid when using the sensor information from the second tank.

2.4. Maxtemp tank2: *Only applicable on systems with two tanks (as discussed in sections **1.4.2 / System 2** and **1.4.3 / System 3**).*

Sets the maximum value of desired water temperature on the **tank2**.
(Adjustable from 59°F to 203°F with factory default set at 149°F)

2.5. dTMax tank2: *Only applicable on systems with two tanks (as discussed in sections **1.4.2 / System 2** and **1.4.3 / System 3**).*

Difference (**ΔT**) between collector temperature (**T1**) and **tank2** temperature (**T4**) that will automatically engage **pump1** with **system2** or **pump2** with **system3**.
(Adjustable 7°F to 72°F with factory default set at 12°F)

2.6. dTMin tank2: *Only applicable on systems with two tanks (as discussed in sections **1.4.2 / System 2** and **1.4.3 / System 3**).*

Difference (**ΔT**) between collector temperature (**T1**) and **tank2** temperature (**T4**) that will automatically disengage **pump1** with **system2** or **pump2** with **system3**.
(Adjustable from 3°F to 63°F) with factory default set at 5°F)

NOTE: dTMin tank2 will always be 3-7°F less than dTMax tank2

2.7. Mintemp prio tank:

This will only display on systems configured with two tanks (as discussed in sections **1.4.2 / System 2** and **1.4.3 / System 3**)

Settings	
Maxtemp tank1	149°F
dT Max tank1	49°F
dT Min tank1	38°F
Maxtemp tank2	149°F
dT Max tank2	49°F
dT Min tank2	38°F
Min temp prio tank	85°F

This option allows the user to define the minimum temperature setting for the **priority** tank (as designated in the process described in the **Service** menu / **1.19 Priority Tank**). When the temperature in the **priority** tank falls below this setting, the system will switch back from the second tank (temporarily deemed **priority** due to overheating in the main tank) to the original **priority** tank.

(Adjustable from 32°F to the **MaxTemp** tank setting for the **priority** tank with factory default set at 32°F)

2.8. Min rev pump:

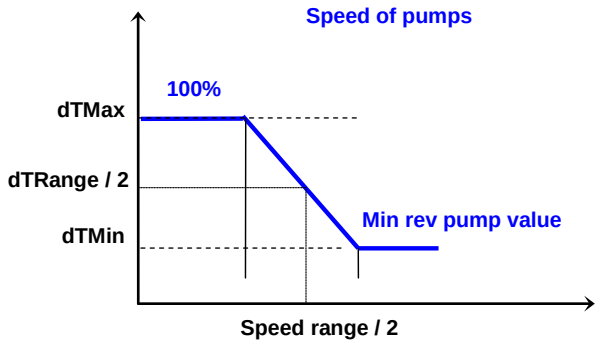
This option will only display if Phase Speed Control (**Phase SC**) is selected on the **Service** menu **1.10 Pump P1** or **1.11 Pump P2**.

Settings	
Maxtemp tank1	149°F
dT Max tank1	49°F
dT Min tank1	38°F
Maxtemp tank2	149°F
dT Max tank2	49°F
dT Min tank2	38°F
Min rev pump	100%

- Highlight **Min rev pump** and press **(>)**
- Use the **(+)** or **(-)** buttons to set the minimum speed of the pumps
  (Adjustable from 30% to 100% with factory default set at 50%)

WARNING: Setting Min rev pump below 50% may prevent pump operation under various conditions (e.g. high head pressure due to system design or cold/degraded glycol solution).

The speed of the pump will start to decrease when the **dT** value is under the **dTMax** setting for the appropriate tank; the **Min rev pump** setting will come into effect at the applicable **dTmin** setting.

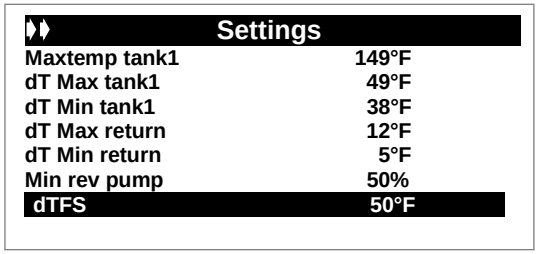


2.9. dTMax return *Available for System 6 only*

Temperature (ΔT T3/T4) that engages the valve and opens the boiler circuit to energy from the solar circuit.

2.10. dT Min return *Available for System 6 only*

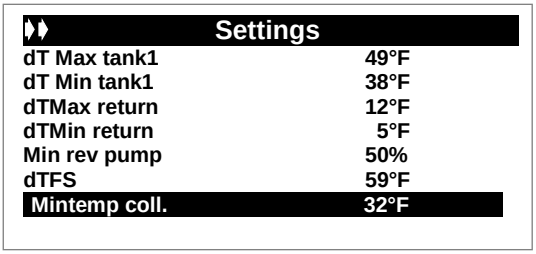
Temperature (ΔT T3/T4) that closes the valve to the solar circuit and re-routes circulation through the boiler circuit only.



2.11. dTFs: Full speed

Temperature (ΔT T1/T2) at which the pump speed will be 100% - allows much finer ΔT control.

2.12. Mintemp Collector:

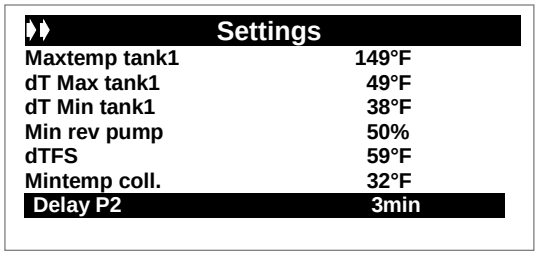


This option allows you to set the minimum collector temperature required for solar loading.

(Adjustable from 32°F to 210°F with factory default set at 32°F)

2.13. Delay P2 *Available for System 7 only*

User defined setting that dictates the length of time after the activation of P1 before P2 engages.



(Adjustable from 0 – 30 minutes with the default set at 3 minutes.)

EXTRA FUNCTIONS

The following three options are only available if you have made the corresponding selection on the **Service / Extra** menu discussed in Section **1.5.**

2.14. Thermostat Function:

Service	
English	
Time and date	
US Version	yes
System	
Extra	off
Extra	thermostat
Protection func.	

2.14.1. Start:

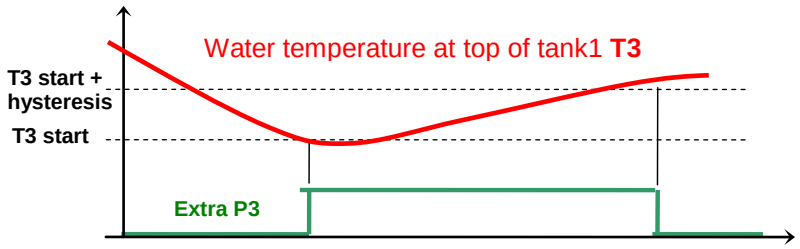
When the water temperature at the top of the system tank (**T3**) falls below this setting, **P3** will engage and start to transfer additional heat from the external tank or heat source.
(Adjustable from 68°F to 194°F with factory default set at 104°F)

Settings	
dT Max tank1	49°F
dT Min tank1	38°F
Min rev pump	50%
dTFS	59°F
Mintemp coll.	32°F
Thermostat	
Start	104°F

2.14.2. Hysteresis:

When the water temperature at the top of the system tank (**T3**) exceeds the **Start** temperature (see **2.14.1** above) plus the **Hysteresis** setting, **P3** will disengage.
(Adjustable from 3°F to 54°F with factory default set at 18°F)

Settings	
dT Min tank1	38°F
Min rev pump	50%
dTFS	59°F
Mintemp coll.	32°F
Thermostat	
Start	104°F
Hysteresis	18°F



2.15. Cooling Function:

Service	
English	
Time and date	
US Version	yes
System	
Extra	off
Extra cooling	
Protection func.	

2.15.1. Cooling start:

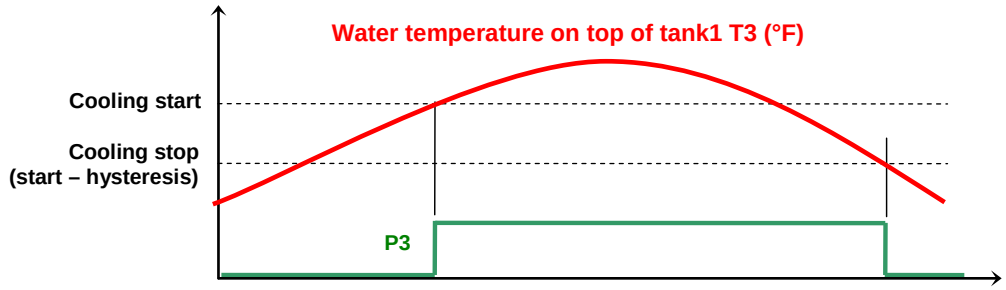
When the water temperature in the top of the system tank (**T3**) rises above this setting, **P3** will activate to start cooling the tank by transferring water to the external tank or heat sink.
(Adjustable from 68°F to 194°F with factory default set at 104°F)

Settings	
dT Max tank1	49°F
dT Min tank1	38°F
Min rev pump	50%
dTFS	59°F
Mintemp coll.	32°F
Cooling	
Start	104°F

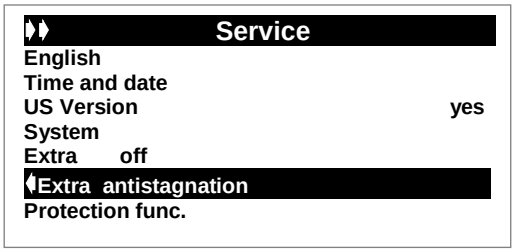
2.15.2. Cooling hyst:

When the water temperature at the top of the system tank (**T3**) falls under the **Start** temperature (see **2.15.1** above) minus the **Hysteresis** setting, **P3** will disengage.
(Adjustable from 3°F to 54°F with factory default set at 18°F)

Settings	
dT Min tank1	38°F
Min rev pump	50%
dTFS	59°F
Mintemp coll.	32°F
Cooling	
Start	104°F
Hysteresis	18°F

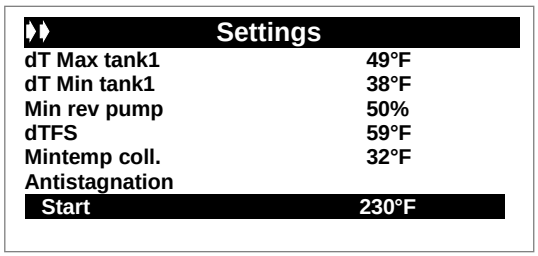


2.16. Anti-stagnation



2.16.1. Start

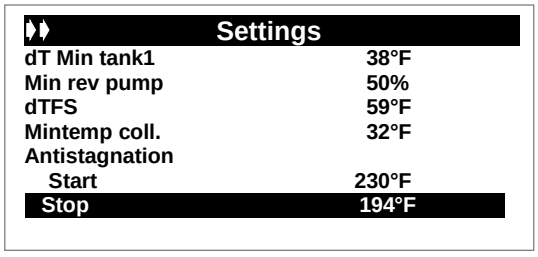
When the temperature of the fluid in the collector rises above this setting, the designated valve or pump is activated.



(Adjustable from 32°F to 392°F with factory default set at 230°F)

2.16.2. Stop

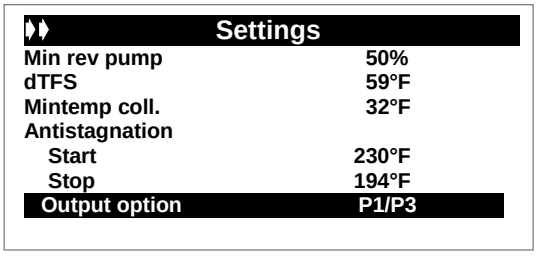
When the temperature of the fluid in the collector falls below this setting, the designated valve or pump disengages.



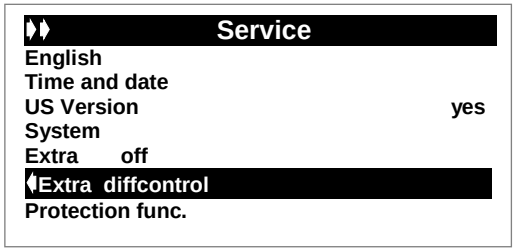
(Adjustable from 32°F to 302°F with factory default set at 200°F)

2.16.3. Output option

This feature allows you to choose to use either **P1/P3** (both) or **P3** (only) to circulate the fluid.



2.17. Diffcontrol Function:



For systems with an additional tank but <u>without</u> an auxiliary heat source (Service/1.5.4 Example #1)

2.17.1. <u>Max cold tank</u>:

When the temperature at the top of the external tank (**T3**) registers above this setting, **P3** will shutoff and the exchange of heat will stop (**T3 = TC**).
(Adjustable from 59°F to 203°F with factory default set at 149°F)

2.17.2. <u>Min warm tank</u>:

The temperature at the top of the system tank (**T4**) must register above this setting before **P3** will engage and the exchange of heat will start (**T4 = TW**).
(Adjustable from 32°F to 203°F° with factory default set at 59°F)

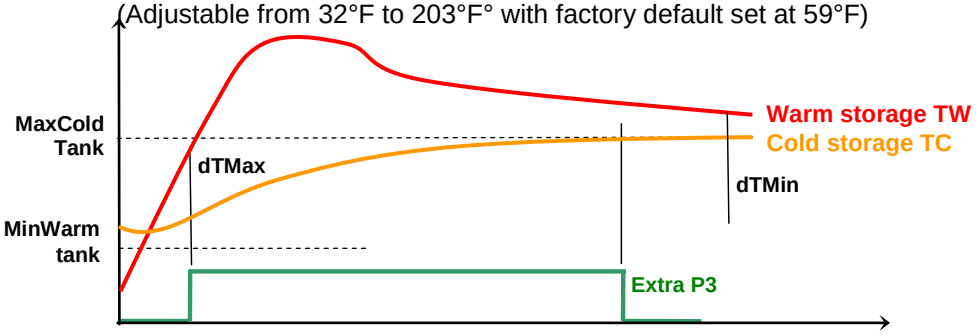
For systems with an additional tank <u>AND</u> an auxiliary heat source (Service / 1.5.4 Example #2)

2.17.3. <u>Max cold tank</u>:

When the temperature at the top of the system tank (**T3**) registers above this setting, **P3** will shutoff and the exchange of heat will stop (**T3 = TC**).
(Adjustable from 59°F to 203°F with factory default set at 149°F)

2.17.4. <u>Min warm tank</u>:

The temperature at the top of the external tank (**T4**) must register above this setting before **P3** will engage and the exchange of heat will start (**T4 = TW**).
(Adjustable from 32°F to 203°F° with factory default set at 59°F)



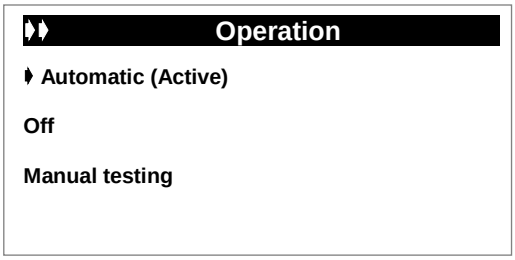
2.17.5. <u>dTMax</u>:

Temperature difference (**ΔT**) between the tank designated as cold storage (**TC**) and the one designated as warm storage (**TW**) at which **P3** will automatically start the exchange.
(Adjustable from 5°F to 72°F with factory default set at 18°F)

2.17.6. <u>dTMin</u>:

Temperature difference (**ΔT**) between **TC** and **TW** at which **P3** will automatically stop the exchange.
(Adjustable from 3°F to 54°F with factory default set at 9°F)

3. Operation Menu:



When the system is set to OFF on this menu, the word OFF will be displayed on the initial screen.

3.1. Automatic and Off operation:

To operate your system in Automatic mode, highlight the line and press the **(+)** or **(-)** buttons to select **Automatic**

- Press **(>)** to activate.

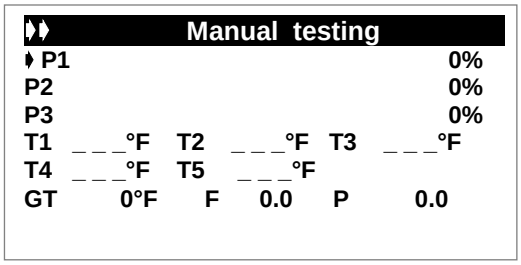
IMPORTANT NOTE: The factory default setting on the **Operation Menu** is **OFF.** This prevents system components (**P1**, **P2**, **P3**) from operating until system is set up. To turn on the system, change the setting to **AUTOMATIC (Active).**

To place your system in **Off** mode, repeat the same sequence detailed above and select **Off**.

3.2. Manual testing operation:

This mode allows you to check the performance of **Pump1**, **Pump2/Valve** and **P3/Extra** outputs. You can also check the data from all sensors (sensors not in use display the maximum value)

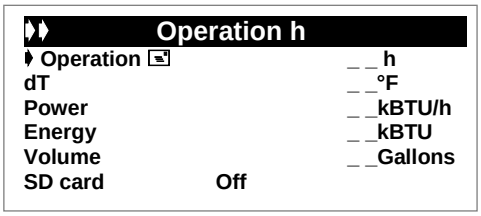
To access this function, select **Manual testing** and press **(>)** to bring up the screen. You can activate different items by using the **(+)** or **(-)** buttons.



The pump readouts will register no lower than the value set previously on the **Setting** menu (Section 2) under **2.8 Min rev pump.** They can be increased from that level to 100% in 5% increments by using the **(+)** key.

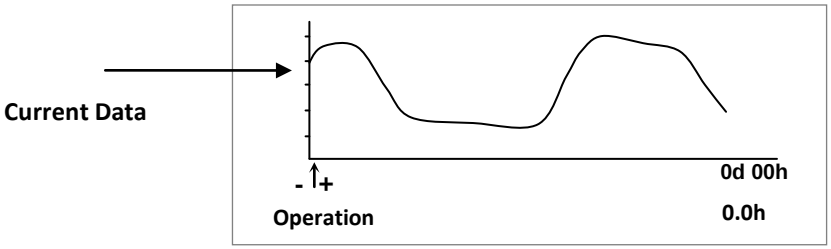
Note: When you exit this menu, all values on this menu return to zero.

4. Operation h Menu:

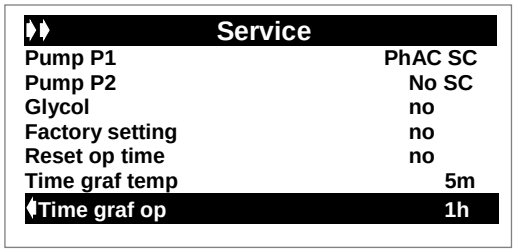


This menu offers both a data view and a graph view for the **Operation**, **dT**, **Power** and **Energy** values.

> **NOTE: WHEN VIEWING GRAPHS ON THE CONTROL DISPLAY**, the most current data always displays on the left side of the graph; historical data scrolls to the right.



You can change the scale of these graphs on the **Service** menu under **Time graf op**.



Using the **(+)** or **(-)** buttons**,** select **Time graph op** and press **(>)** to highlight the line.

- Now you can change the scale with the **(+)** or **(-)** buttons.

(Adjustable from 1 to 48 hours with factory default set at1 hour)

Press **(<)** repeatedly to return to the main menu.

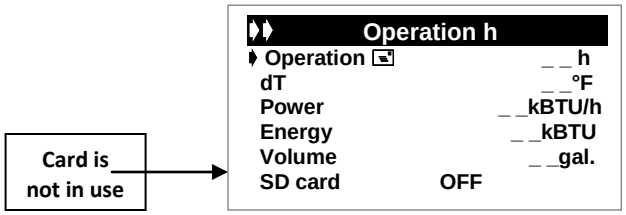
4.1. SD Card Option

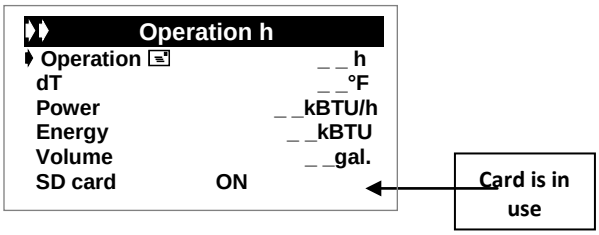
You can use the included **SD Card** to store data and transfer system settings from your PC to the Solar Control. The **Dataviewer** software that is installed on the **SD Card** also allows you to view system performance information in graph form. Information on the **SD Card** is limited to either settings that you write to it from your PC or system data that is recorded while the **SD Card** is inserted into the Control (see below).

4.1.1. Initializing the SD Card

It is important to follow these steps as they are listed. Once initialized, the SD Card can be used to set up multiple controls.

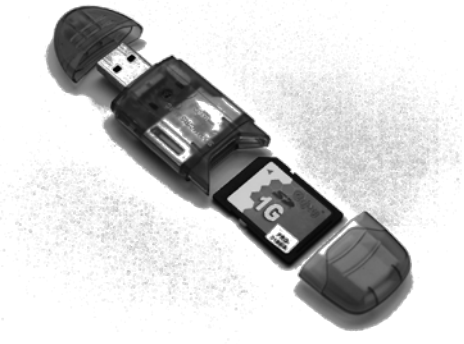
- **Insert the SD Card into the Control**
- When you click on **(>)** to select the **SD Card** line of the **Operation h** menu, The display will change to **ON.**
- Click on **(>)** again, changing the display to **OFF**. **Wait until the display automatically returns to the initial screen before proceeding to the next step.**
- Press gently on the end of the card & it will pop out for easy removal.
- **Insert the SD Card into the Control again.**
- This time, a screen will pop-up and ask if you want to "Update settings from **SD Card**?"
- Click on "**NO**" – you haven't configured them yet. (There is no way to manually write or save settings from the Control to the **SD Card**.)
- Click on **(<)** to leave that sub-menu; the SD Card status display is **ON.**
- Click on **(>)** again, changing the display to **OFF. Again, wait until the display automatically returns to the initial screen before proceeding to the next step.**
- Press gently on the end of the card & it will pop out for easy removal.





NOTE: This procedure will only need to be done once per SD Card.

4.1.2. Configuring/Changing your system settings

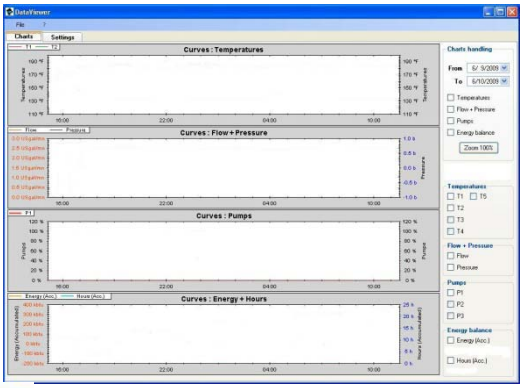


- After initializing and removing the **SD Card** from the **Solar Control**, insert it into the included **USB SD Card Reader**.
- Make sure that the SD Card is securely seated in the slot.
  - If the card is not properly seated, your computer will not recognize the Reader.
  - If this occurs, check to make sure that the SD Card is solidly installed – the SD Card will fit into the Reader if it is turned backwards, but it will not fit far enough in to connect to the card reader.
- Insert the **USB SD Card Reader** into an available USB Port on your PC.
- With the **SD Card** inserted into your PC, you can configure all of the Solar Control settings on a single screen

4.1.3. Using the DataViewer software

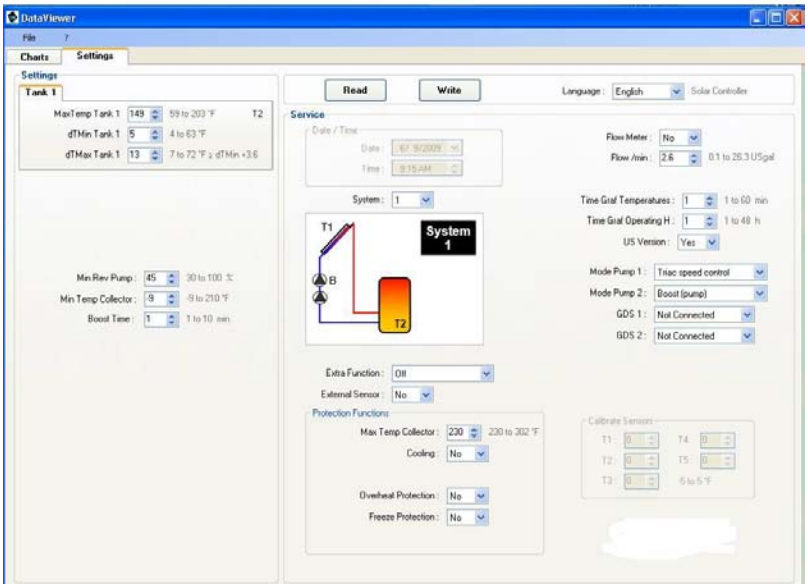
The **DataViewer** software is supplied on the **USB SD Card Reader**.

- When you insert the Reader/Adapter into a USB port on your computer, you will see a screen asking what you want Windows to do. Highlight "Open folder to view the files using Windows Explorer" and click "OK".



- Double click on

- The **Charts** tab (first to appear) will be blank until you have left the card installed in the control long enough for system data to accumulate on it.



Click on the **Settings** tab

In this window you can view and customize the configuration of your system.

Click on the "**Write**" button to save your new settings to the **SD Card**.

4.1.4. Transferring Data from the PC to the Control

- Remove the **SD Card** from your PC and insert it (after removing it from the Reader/Adapter) into the slot on the side of the Control.
- When the screen pops-up and asks if you want to "Update settings from **SD Card**?"
  - Click on **(>)**, changing the display to **YES.**
  - This will change the control settings to the configuration you set up on your PC.
- You can now either remove the **SD Card** (after first making sure that it is turned off on the main **Operation h** menu) or turn the **SD Card** on and leave it in the control to gather system performance data as described in the next section.

Do not remove the SD Card without first deactivating it on the Operation h menu.

4.1.5. Viewing Graphs of System Data

On the Solar Control:

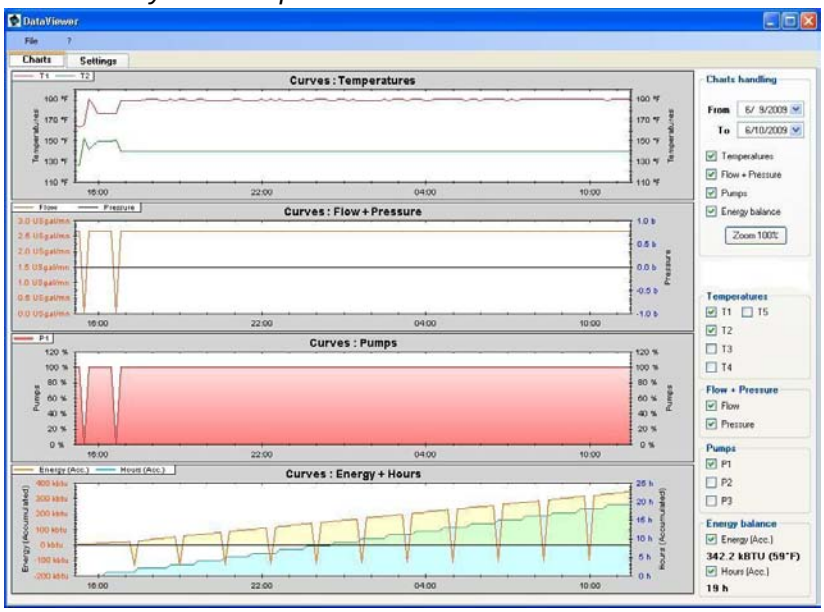
- Graphs that you view on the display screen of the **Solar Control** in the **Operation h** menu are based on all system performance measurements. See previous sections for further information.

With the DataViewer Software:

- When the **SD Card** is inserted into the control and switched **ON**, it will automatically record data on system performance as it is recorded by the control.
- When removed from the control and inserted into your PC, this information will be displayed on the **Charts** tab of the **DataViewer** software.
  - It will only graph information gathered while the **SD Card** is inserted in the control and switched **ON**.

For example:

- *A **Solar Control** is connected to a system and placed into service at 6:00 A.M.*
- *An **SD Card** is inserted into the **Solar Control** at 9:00 A.M. and removed at 10:30 A.M. the same day.*
- *The graphs accessible on the **Solar Control** (**Operation h** menu) show system performance information from 6:00 A.M. to whatever time they are viewed.*
- *The graphs displayed on the **Charts** tab of the **DataViewer** software only represent system performance information that registered on the **SD Card** (between 9:00 A.M. and 10:30 A.M.).*

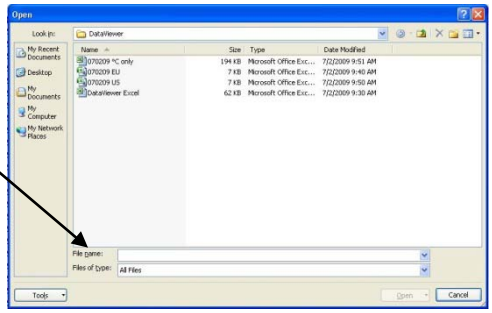


4.1.6. Backup

Choosing this feature on the File menu protects settings and data by saving a copy of the **DataViewer** program and accumulated information to a location specified by the user. If the system SD Card becomes damaged, the information from the Backup file can be loaded onto a new card.

4.1.7. Exporting to Excel

With the **DataViewer** software you have the ability to export the system performance information to **Excel** for further analysis.



- On the *Files* menu in **DataViewer**, select *Excel Export***.** **DataViewer** will export the file (in .csv format) to a location that you select.
- In *Excel*, click *Open* on the *File* menu. (You may have to change the "*Files of type*" to *All Files* to find the exported file.)
- Select Column A in the open file.
- From the *Data* menu, click on *Text to Columns*
- Select *Delimited* (then click Next)
- Select *semicolon* (click Next)
- In the *Column/Data format* you can either leave it as *General*, or select a different format for the entries in each column. Most commonly, Column A would be changed to *Date*.
- Click *Finish*

4.1.8. Send by Outlook Express & Export all Zip

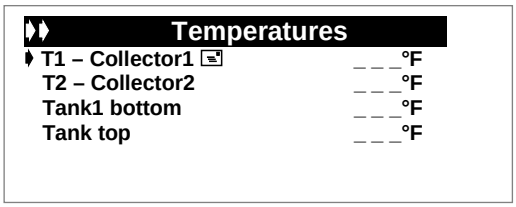
These two options on the File menu are extremely useful as troubleshooting tools. Those that use Outlook Express can use the **Send by Outlook Express** feature to transmit the data and configuration files to another party for remote assistance and/or diagnosis of a problem. Selecting **Export all Zip** creates a .zip file of that same information that can be attached to any email.

4.1.9. Settings File: Save & Settings File: Load

The **DataViewer** software allows the user to design and save more than one system configuration on a single SD Card.

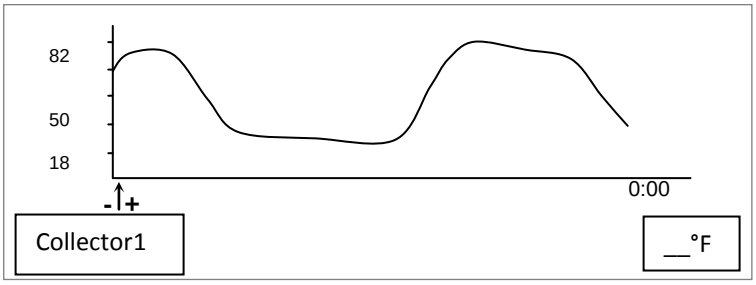
- After configuring a system using the **DataViewer** software, save the settings to the current directory on the SD Card by clicking on the **Write** button at the top of the **Settings** screen.
- Save the configuration by choosing **Settings File: Save** on the drop-down **File** menu. The file will be saved as an .svg file in the SVG folder.
- Configure another system set-up and repeat the above process.
- To access any of the saved files, choose **Settings File: Load** from the **File** menu. This action will display the saved settings as the current (or active) configuration.

5. Temperatures Menu:

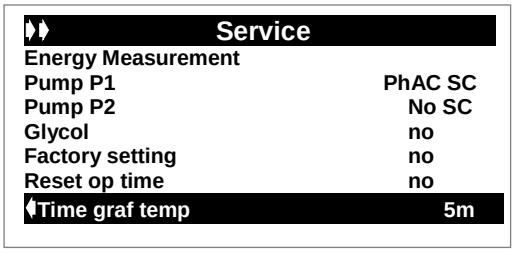


This menu displays the temperatures of all connected sensors except **T5** (see **1.9 Energy Measurement**).

Using the **(+)** or **(-)** buttons you can select a particular sensor and see its time graph by pressing **(>).**



You can change the scale of these graphs on the **Service** menu under **Time graph temp**.



Using the **(+)** or **(-)** buttons**,** select **Time graph temp** and press **(>)** to highlight the line.

- Now you can change the scale with the **(+)** or **(-)** buttons.

(Adjustable from 1 to 60 minutes with factory default of 5 minutes)

Press **(<)** repeatedly to return to the main menu.

6. Special Functions:

6.1. Pump exercise function:

If pumps are not activated for a period of 48 hours, this function will automatically activate them for 15 seconds to avoid jams.

6.2. Dimmer function:

To save power, the backlight automatically dims if there is no keypad activity for a period of 10 minutes.

After automatically dimming, the first push on any keypad key will activate the backlight.

6.3. Security function:

To avoid unintentional/unauthorized changes, **System** type and **Extra Function** selection (**No**, **Thermostat**, **Cooling**, **Anti-**stagnation, or **Diffcontrol**) are inaccessible after the control has been connected to an electrical source and there are no keystrokes for a period of 4 hours.

If you want to modify these parameters at any time past the 4 hour settings lock, you must disconnect and reconnect the power to the controller.

- This action will not reset the control; it will only allow access to make modifications.

To reset all of the control settings to the factory default values, see **Services** / section **1.14 Reset to factory default settings**.

Appendix A

Ohm to °F Conversion Chart for PT1000 Sensors

Sensor temperature can be read with an Ohmmeter as a preliminary troubleshooting measure by the following method:

Perform this test only after disconnecting the sensor.

- Disconnect the sensor leads from the solar control.
- Connect the leads to an Ohmmeter.
- Use the following chart to determine the approximate temperature at the sensor bulb.

-14°F (-10°C)	960 ohms	**140°F (60°C)**	1232 ohms
32°F (0°C)	1000 ohms	**158°F (70°C)**	1271 ohms
50°F (10°C)	1039 ohms	**176°F (80°C)**	1309 ohms
68°F (20°C)	1077 ohms	**194°F (90°C)**	1347 ohms
86°F (30°C)	1116 ohms	**212°F (100°C)**	1385 ohms
104°F(40°C)	1155 ohms	**248°F (120°C)**	1461 ohms
122°F(50°C)	1194 ohms	**284°F (140°C)**	1535 ohms

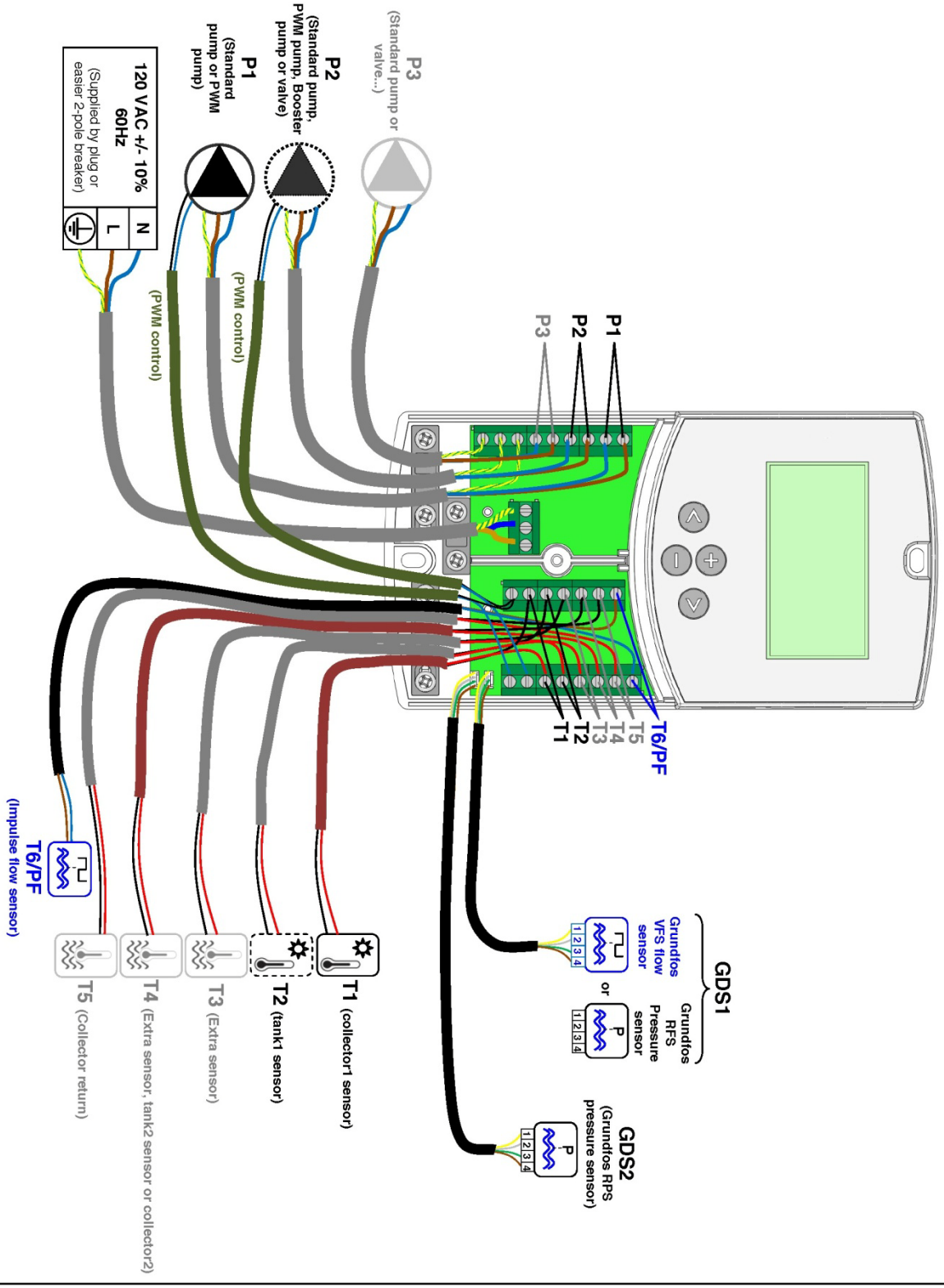
Appendix B

Pump Functions by System

System	P1	P2	P3
1	Primary	Variable-speed Pump/Boost	Thermostat/Cooling/Anti-stagnation/Diffcontrol
2	Primary	3-way Valve	Thermostat/Cooling/Anti-stagnation
3	Primary	Variable-speed Pump	Thermostat/Cooling/Ant-stagnation
4	Primary	3-way Valve	Thermostat/Cooling/Anti-stagnation
5	Primary	Variable-speed Pump	Thermostat/Cooling/Anti-stagnation
6	Primary	3-way Valve	Thermostat/Cooling/Anti-stagnation
7	Primary	Variable-speed Pump	Thermostat/Cooling/Anti-stagnation
8	Primary	Variable-speed Pump	Thermostat/Cooling/Anti-stagnation

Appendix C

Controller Schematic



Limited Warranty

SolarHOT, Inc. warrants this solar control and its associated sensors (the product) to be free from defects in material and workmanship for a period of one (1) year from the date of original purchase. During this period, SolarHOT, Inc. will replace the product or refund the original cost of the product, at SolarHOT's option, if the product is proven defective under normal usage within the warranty period.

This limited warranty does not cover shipping costs, nor does it cover a product subjected to misuse or accidental damage. This warranty does not cover the cost of installation, diagnosis, removal or reinstallation, any labor or other material costs, loss of use, or damage to other property if this product does not work properly.

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