

SWIM PC USER AND INSTALLATION MANUAL

SOLAR WATER INTERNET MONITORING PROGRAMMABLE CONTROLLER

IMPORTANT WARNINGS AND SAFETY INSTRUCTIONS

Attention Installer: This manual should be given to the owner and/or operator of this equipment. When installing and using this electrical equipment basic safety precautions should always be followed including the following:

 **WARNING- DANGER RISK OF ELECTRIC SHOCK WHICH CAN RESULT IN SERIOUS INJURY OR DEATH.** Before attempting installation make sure that all power to the circuit supplying power to the system is disconnected/turned off at the circuit breaker. Grounding/earth bonding is required. The SWIM PC and ISWIM PC should be installed by a qualified professional.

 **WARNING-** High voltage is present inside the controller box. Do not poke inside with a screwdriver or metal object. Only low voltage wiring is accessible at the surface of the unit on the upper terminal strip but disconnect all power before wiring sensors and motorized valves anyway.

 **WARNING-** Wiring this unit to a line cord and plugging into an open electrical outlet is not up to electrical code. Electrical outlets outdoors or in pool mechanical rooms can not be permanently open and exposed. The unit must be hardwired and all high voltage wiring inside a conduit.

 **WARNING-** Before installing this product, read and follow all warning notices and instructions which are included. Failure to follow safety warnings and instructions can result in severe injury, death, or property damage.

 **WARNING-** Water temperature in excess of 100 degrees Fahrenheit may be hazardous to your health. Prolonged immersion in hot water may induce hyperthermia. The effects of hyperthermia include 1) Unawareness of impending danger, 2) Failure to perceive heat, 3) Physical inability to leave the water, 4) Fetal damage in pregnant women, and 5) Unconsciousness leading to drowning.

 **WARNING-** To reduce risk of injury do not allow children to use this product unless closely supervised at all times

 **WARNING – The use of alcohol can greatly increase the risk of fatal hyperthermia in hot tubs , spas, and over heated pools.**

 **WARNING-** This control system shall not be used to override the built in high temperature limit of the pool or spa heater. This unit is not to be used with a heater that does not have a built in high temperature safety limit. When used to control a boiler or gas heater setpoint this product can only lock the gas heater out by opening circuiting the heater's safety circuit. Do not turn the heater's thermostat to maximum. Set it to the normal desired swimming pool temperature. The SWIM PC or ISWIM PC will lock out the heater to reduce the effective setpoint ONLY!

 **WARNING-** Do not use this product to control an automatic swimming pool cover. Swimmers may become entrapped underneath the cover

 **WARNING-** For units intended for use in other than single family dwellings, a clearly labelled emergency switch shall be provided as part of the installation. Th switch shall be readily accessible to the occupants and shall be at least 10 feet (3.05m) away , adjacent to, and within sight of the unit.

General Installation Requirements

1) All work must be performed by a licensed electrician and must conform to all national, state, provincial and municipal codes.

2) Install to allow drainage of compartment for electrical components

3) To reduce the risk of electric shock ground the unit to the grounding means provided in the electric supply service panel with a continuous copper wire equivalent in size to the circuit conductors supplying this equipment (no smaller than 12AWG). The bonding lug on this unit is intended to connect a minimum of one 8 AWG for US installation and two 6AWG for Canadian installations solid copper conductor between this unit and any metal

equipment, metal enclosures, or electrical equipment , metal water pipe or conduit within 5 feet (1.5m) of the unit.

4) Supply conductor must be sized to support all loads.

5) Strain relieve all electrical wires into the SWIM PC and seal openings with silicone. If wires are not in conduit use a plastic female conduit connector in the conduit holes in the SWIM PC. This provides a pocket to accept and hold the silicone sealant. If you don't seal the holes bugs can crawl inside and nest.

SWIM PC GENERAL OPERATION

All SWIM PC models require 3 sensors, the solar sensor (SOLAR), the pool water temperature sensor (POOL) and the return from solar sensor (RETURN). A fourth precision sensor input is available labelled OTHER. The basic differential thermostat function of any solar controller is to compare the pool temperature with the temperature the solar collectors would be at if there was no water going through them . If the solar sensor is (differential on default 6) degrees C warmer than the pool temperature and the solar setpoint has not been reached then solar is on. 24VAC will be present between C and NO to power the motorized valve to the solar on position (sending flow to solar). If this difference drops to only (differential off- default 3) degrees C then solar is deactivated and 24VAC is present between C and NC. The valve turns until its internal limit switch opens the 24VAC circuit but 24VAC remains present.

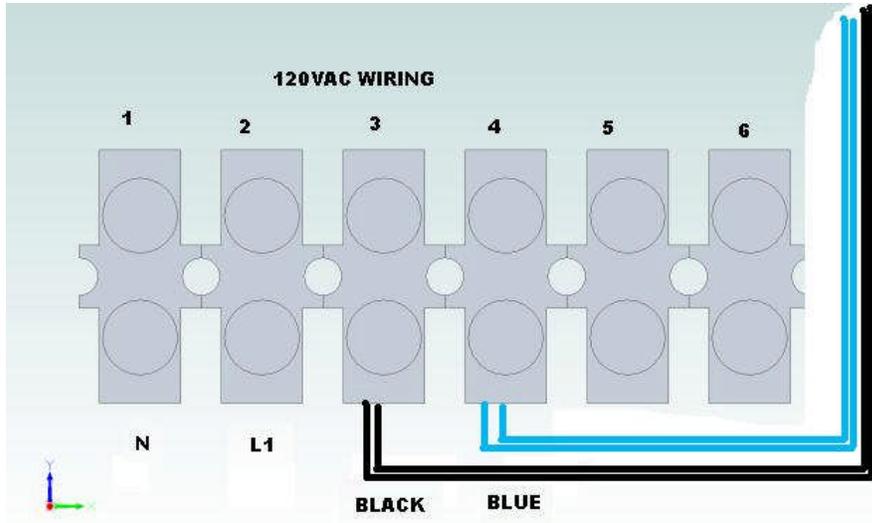
Relay 2 is used to lock out a boiler on a web based programmable schedule or to power the pool pump on a web based spreadsheet style schedule or something other than the solar on off function itself. Relay 2 is not powered. It is a switch only. Both relays are rated at only 24VAC and 1 amp. Do not use these relays to switch a pump. Use them to switch an external 24VAC relay that switches a pump if solar is to be pump controlled. Note the SWIM PC can control a Pentair VS pump through its RS 485 communications port located on the back of the circuit board. The VS pump can be the pool pump or the solar pump. Units are custom configured via the internet before or after they are connected in the field.

The SWIM PC can control a boiler or a separate solar or pool pump or other valve function through a web based interface but an additional electrical box housing the additional high voltage relay and manual override switch(es) is required because the basic SWIM PC enclosure isn't large enough for these extra parts.

SWIM PC HIGH VOLTAGE WIRING

At the base of the unit inside the box there is a protected high voltage wiring terminal strip. The factory setting is 240 VAC. L1 and L2 wire to terminals one and two as indicated on the label. If wiring to 120 VAC , N and L1 (white neutral and black line 1) are connected to the same terminals one and two (counted left to right). Before hooking

up 120 VAC power the unit must be reconfigured for 120VAC. To power the unit with 120VAC simply move the existing black wire bundle from terminal 5 to terminal 3 and the blue wire bundle from terminal 6 to terminal 4 as shown here after the internal wiring change.



120VAC wiring changes- Move blue wires from 6 to 4 and black wires from 5 to 3. Then hook 120VAC to 1 and 2. Factory set up is for 240VAC in which case simply connect L1 and L2 to 1 and 2, Use solid wire or connector ends to avoid strands of stray stranded wire contacting the base plate.

GROUND connects to a ground screw on the metal base plate inside unit. Follow electrical codes for earth bonding via bonding lug.

SWIM PC LOW VOLTAGE WIRING

System Website:
www.powerstripsolar.com/swimpc/04C008

SOLAR WATER INTERNET MONITORING PROGRAMMABLE CONTROLLER

24 VAC		SOLAR VALVE			24 VAC OUT			RELAY #2 OUTPUT			24 VAC OUT		ETHERNET		PULSE INPUT		TEMPERATURE SENSORS				
TRANSFORMER	TRANSFORMER	C	NC	NO	COM	NC	NO	COM	NC	NO	SYSTEM ID	FLOW	FLOW	OTHER	OTHER	RETURN	RETURN	SOLAR	SOLAR	POOL	POOL
											04C008										

- SD Card
- DHCP IP
- DNS IP
- Network
- Pump #1
- Pump #2
- Relay #2
- Solar Valve

The solar motorized control valve wires to the 3 terminals under the “SOLAR VALVE” heading labelled C for common, plus NC and NO

Wire the temperature sensors with 22 awg stranded wire or larger. 18AWG security system wire is often available.

MOTORIZED VALVE:

Motorized valves usually have a toggle switch on them. If this switch is set to the middle position the valve will not rotate. This switch should be set to one direction or the other. To reverse the operation of the valve this switch can be toggled. This has the same effect as switching the NC and NO terminals on the terminal strip. Motorized valves have a common C as well as the NO and NC wires. For Compool and Jandy valves the common is the black wire. Strip the 3 wires and secure to the terminal strip. Don't worry which wire is NC or NO. Just switch the actuator's toggle switch later if you guessed wrong.

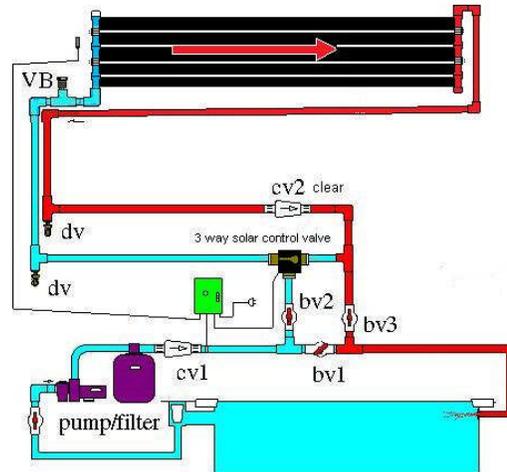
It is important to understand a Jandy or Compool valve. Just imagine the indicator marked “off” opposite the valve handle extends through the valve body. On the 3 way valve below the “off” indicator is at the top meaning none of the ports are blocked. Turn the valve handle 90 degrees clockwise and the port to the right would be blocked. The port on the bottom would connect to the port on the left. Then turn the valve handle 180 degrees and the left port would be blocked allowing flow from the bottom port to the right. If the water always comes in the bottom the handle itself actually points to the direction of flow.



3 way valve



cva 24t actuator (motor)



To keep life simple always feed 3 way valves from the branch. In other words water enters the middle port and exits left or right. It is possible to configure the cams inside the actuator to only rotate 90 degrees and accommodate other variations but its not worth it. It just confuses people. Plumb your solar heater to match our diagrams manuals and videos so everyone can understand what is going on. Note the orientation of the actuator body on the image above left.

Remove the valve handle and the appropriate 4 screws and attach the actuator with the longer screws supplied with the actuator. Use the correct Phillips head screw driver. Sometimes this assembly is difficult. Reattach the valve handle. It only assembles one way.

The 3 way valves are nominal 1.5" or 2". You can actually glue fittings over the outside so a 2" valve can glue into a 2.5" pvc fitting. Use P70 primer and heavy bodied grey PVC cement or orange CPVC cement to plumb PVC pipe or fittings to the 3 way valve.

SENSORS:

SOLAR SENSOR

The solar sensor or roof sensor or sun sensor senses the temperature the solar collector would be at if there was no water moving through it. Other manufacturers feel that a small diameter probe of plastic or a block of aluminum mimic this temperature accurately. They are wrong. Only a piece of solar panel material with the sensor element embedded inside will accurately reflect the temperature we want. The sun sensor that comes with the SWIM PC looks just like the unglazed solar panel. Locate it at the same pitch and in the same sun as the solar collectors. This does not have to be on the roof alongside the solar collectors but usually this is the preferred placement. Use 18 AWG security system wire and solder the connection to the sensor lead. Polarity does not matter. Sensors are 10,000 ohm negative temperature curve thermistors. They change resistance with temperature. At about 77F they are 10,000 ohms. The same stainless steel

probe with a thermistor element potted inside is used in all Hot Sun temperature sensors. These are fully compatible with all pool industry temperature sensors except Compool linear sensors. Those are expensive and have a polarity and are only used with certain Compool pool control systems.



The roof sensor can be glued to the roof surface with construction mastic or silicone. Normally on residential installations the wire is not put in a conduit. It is simply strapped to the pipe with nylon ties. On commercial installations conduit is used and our roof sensor can glue to the lid of a conduit box and easily be turned into a sealed unit meeting all codes. It is important to solder all wire connections. The most common solar system fault is a broken or loose wire connection to a sensor.

POOL WATER TEMPERATURE SENSOR:

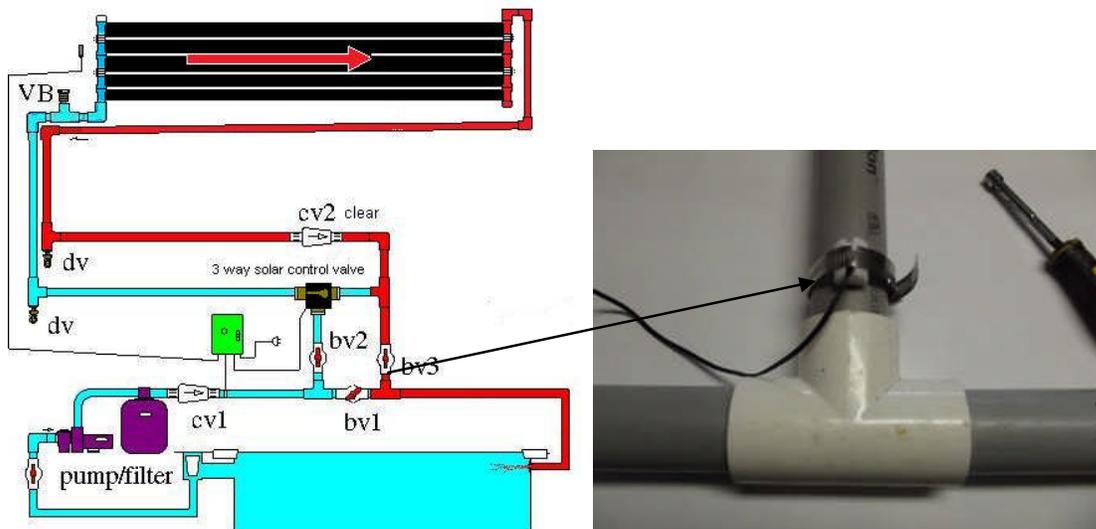
The pool water temperature sensor needs to drill into a pipe. Obviously this should be a pipe that carries water at pool temperature. This pipe should be downstream of the filter so a leak shows up as a drip of water rather than air getting into the pump. It should be upstream of the solar tie in point so it is sensing pool water temperature not solar heated water temperature. Drill a 1/4" diameter hole in the pipe and simply clamp the white plastic sensor head, O-ring, ss probe and ss band clamp to seal the assembly as shown.



The "o ring" is a standard "dash 202" made of epdm or silicon. The band clamp is a #32 for 1.5" pipe or #40 for 2" pipe. The sensor head is machined for 2" or 1.5" nominal diameter pipes.

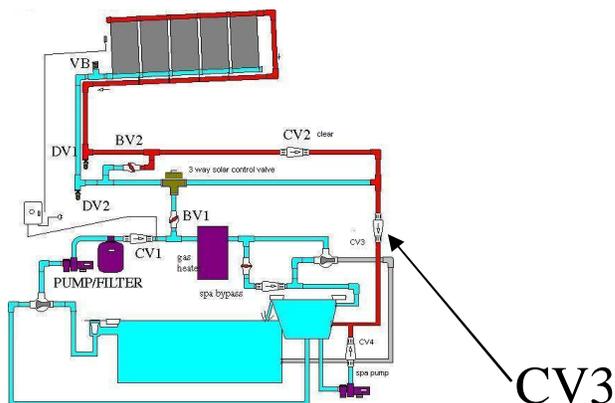
RETURN SENSOR:

An identical sensor is used for the return from solar temperature sensing element. The placement of this sensor is very important. We want it to see the temperature of the water coming from solar when solar is on and when solar is off we want it to see pool temperature. This is because we calibrate this sensor via the web interface in relation to the pool temperature whenever solar is off. Thermistors are very repeatable and don't drift or vary but one can be out half a degree from another so calibration is the key to accuracy. The difference between these temperatures and the flow rate when solar is on tells us the energy delivered by the solar heater. The SWIM PC incorporates special high accuracy A/D converters to eliminate precision loss due to noise in electronics.



LOCATION OF RETURN FROM SOLAR SENSOR

In the plumbing configuration above the return from solar sensor could be located just above the tee where the solar heated water returns.



If the system was plumbed as above the return from solar sensor should be plumbed next to CV3 so that it sees solar heated water when solar is on and pool water when solar is off.

“OTHER” SENSOR and RELAY#2

There is a fourth set of precision temperature input terminals that can be used to monitor a fourth temperature, perhaps air temperature. If a back up heater is used then this OTHER sensor should be downstream of the gas heater. This will show you when the gas heater fires on the monitoring web page. The SWIM PC could be programmed so this receives a second roof temperature sensor. Relay #2 could then control a second motorized valve. In this manner the SWIM PC could control two solar heaters or solar heaters on two different roof spaces optimally. It is important to understand the primary concept behind this technology in general. You don't have to program anything. Its all done case by case and its all done on the web site for the individual unit. The unit updates itself via its internet connection with its own web site. Each SWIM PC is custom configured for the unique situation. We even add photos of your site and specifications of your solar system. The monitoring page is public domain. The secure page that controls your settings is not.

FLOW RATE

A pulse flow meter can be connected to the unit so flow rate is monitored. Flow meters are available from Hot Sun. The SWIM PC is compatible with any pulse flow meter. We need the calibration factor so we can set the program on the unit's web site so the unit can download it automatically. In the case of solar pool heaters you don't need a pulse flow rate meter because the flow is almost always the same when solar is on. All you need is a Flow vis flow meter. Hot Sun is an authorized distributor for the FlowVis product line.

PRESSURE

The SWIM PC is equipped to monitor pressure as well. Contact Hot Sun for instructions/specifications

MANUAL vs AUTOMATIC

The SWIM PC is set up to be very intuitive and straightforward. Any programming or set up is done on the web site side meaning no-one has to go through a 100 line menu tree just to set the system up.

The SWIM PC has 4 buttons. The first is the status. Toggle this button to “LOCAL” and setpoints will be as set on the unit itself. Toggle the unit to “MANUAL” and you can manually turn solar on for testing. Toggle the unit to “REMOTE” and the schedule and settings on the units' web site takes over. Think of these 3 options in the following way.

The solar system can be controlled automatically or manually. In MANUAL mode you can change pump speeds and whether the boiler is locked out or not and you can turn solar on or off regardless of sensor temperatures. MANUAL is like Service mode. Automatic means everything operates automatically. Solar comes on or off based on sensors. Under the category of automatic we have REMOTE or LOCAL. LOCAL means we can change the setpoints like the maximum temperature solar will heat the pool to. REMOTE means settings and schedules can be set on the system's web page.

Pressing UPDATE on the system's web page takes the system out of MANUAL or LOCAL mode and puts it into REMOTE. To prevent this you can unplug the Ethernet cable.

The high limit is 99.9 degrees F. The maximum allowable by law for a hot tub is 104F. MANUAL off means solar will not be activated regardless of sensor temperatures. This is the mode you want if the system is winterized. Note that with Hot Sun's plumbing recommendations you normally don't have to do anything with the control or motorized valve for winterizing. You open the bypass valve and close the isolation valves after draining the system and the position of the motorized valve does not affect anything. MANUAL on might be used to cool the pool in a once off fashion running solar at night. It might also be used to test a new installation for leaks. MANUAL on is commonly used to force water thru solar all the time regardless of sensor temperatures.

INTERNET

Plug an active Ethernet cable into the unit and it will log its data to its web site every 24 minutes. If you prefer a wireless interface to the unit you simply use a wireless booster or wireless bridge to get the signal to the pump room area where the SWIM PC is located and plug an Ethernet cable between that bridge and the SWIM PC. Often the best way to bridge internet from a router to the SWIM PC is through the use of a "powerline" adapter. These units transmit the ethernet signal via existing power lines similar to the way X10 communications work.

SD CARD:

The SWIM PC comes equipped with a micro SD card installed. It is capable of storing about 44 years worth of data if there is never an internet connection. The SD card is located under the front cover of the SWIM PC. Just remove the top screw and the micro SD card can be accessed. If you don't have internet or can't get a reliable signal the unit still logs all the data. You can remove the SD card and copy the file from it to your computer and e-mail it to Hot Sun and we can post it to your unit's web site never at any cost to you. If there is ever a need to upgrade the unit or change the program the micro sd card files can be swapped as e-mail attachments. You need a USB to micro sd card adapter or at least the micro sd to sd card adapter included with the unit (if you have an

sd slot on your computer). Adapters are available and if you can't find one we can supply. This technology is analogous to the black box on an airplane. If there is every a question as to the failure cause we can go back and look at every temperature and relay position every minute of every day for the entire history of the unit and this will usually tell us what went wrong.

TROUBLESHOOTING:



There are 8 indicator lights across the top of the display. X means off and square means on. In order left to right they are

SD CARD: If square (on) this means the unit has a micro sd card installed and it is formatted correctly. This should always be on.

DHCP IP : This should be off for about 2-10 seconds when an active Ethernet cable is first plugged into the unit. Then, once the router has given our unit an IP address it should stay on. If this light ever flickers or goes off it means the physical connection from the SWIM PC via the Ethernet cable to the router is compromised. Off (x) could also mean

the router is not willing to give our unit an IP address. Some routers have security features that limit the number of IP addresses it will assign. Some will only allow access to clients it recognizes. Try a laptop on the same cable. Try rebooting the router. Try waiting a day to see if the router reassigns its pool of IP addresses.

DNS IP : This will come on after 24 minutes, the first time our unit asks the router for the IP address of powerstripsolar.com/swimpc/xxxxxx (the SWIM PC's mac address) . Once this is successful this light will stay on (square) as long as the IP address for the unit's web site is not lost. If it is lost the light will go out and the SWIM PC will ask the router for a new IP address and this indicator light will come on again once that happens but only after the 24 minute time interval between data uploads.

DATA: This light is on if our unit has data to send. On older units its mistakenly labelled "network"

The next 4 indicator lights indicate the outputs. If the eighth light is square (active) it means the solar valve relay is engaged. The fifth and sixth indicators are for 2 additional relays we have available that are accessible on the back of the circuit board. These are 5VDC outputs that can be used to pilot trigger 5VDC external relays.

THE WEB SITES:

Your SWIM PC comes with its own web site. The web site address is www.powerstripsolar.com/swimpc/xxxxxx where xxxxxx is the mac address assigned to your unit. This is printed on the label of the unit. 24 minutes after plugging your unit into the internet you will see data graphically on this chart. If the site is vacant e-mail ken@h2otsun.com and we'll upload your web site software. Send us photos and we'll add them to the web page. We can also add energy monitoring and other features all at no charge.

Your SWIM PC can be controlled by another web site . The control web site address is at www.powerstripsolar.com/swimpc/xxxxxx/Control You will be assigned a username and password for this site. All settings on this page are schedulable. Being able to adjust things online remotely and to schedule those settings over time amounts to full programmability of your automation system in a way that is far more user friendly than any existing technology.

The settings you can adjust are as follows

SolarSetPoint This is the solar set point. This is the temperature at which solar will stop heating the pool. Yes solar will overheat the pool if you don't limit the solar temperature

Solarspan is the hysteresis or the amount the solar setpoint can float. This band is evenly above and below the solar setpoint. For example if solar span is set to 1 degree then half a degree above solar setpoint, solar will shut off and half a degree below solar setpoint

solar will be allowed to come back on. Without a span solar will come on and off constantly trying to maintain an exact setpoint.

SolarDiffOn is the differential at which solar will come on. The differential is the difference between the solar sensor temperature and the pool temperature sensor. If this difference, the solar differential is above SolarDiffOn, solar will come on (as long as the Solar Setpoint hasn't been reached)

SolarDiffOff is the Solar OFF Differential. With solar on, once the solar differential is below this amount solar turns off.

Boiler Setpoint is the setpoint for the back up pool heater. The SWIM PC's relay 2 can be wired to the fireman's switch on the back up pool heater locking the pool heater out to a lower temperature. The SWIM PC effectively becomes the thermostat for the back up heater and Boiler Setpoint becomes the heater's setpoint.

Boiler span (similar to solar span above) is of course then the hysteresis or the span over which the heater fires avoiding the heater firing on and off too often

Boiler temperature control means we are or we are not overriding the boiler thermostat with our boiler setpoint

Boilerlockoutwithsolar is turning boiler off when solar is on. Sometimes we may want to do that. Sometimes not.

Speeds 1,2,3,4 correspond to programs 1 - 4 in the External Control menu on the Pentair Intelliflo Variable Speed pump. Program 4 should be set to the rpm you want for solar. Whenever solar is on the speed corresponding to program 4 will be the pump speed is solar speed 4 is scheduled during this time.

The highest program number takes priority. By setting solar to program 4 we ensure the pump never overpowers (overpressures) solar. Any rpm can be programmed and if 2 rpms are programmed at the same time the highest number program (not the highest rpm) will operate. In "manual" mode any speed can be selected and solar does not force the pump to be in Program 4. If solar speed 4 is not enabled on the web site then speed 4 will not come on when solar is on and the system will not be failsafed against higher speeds. Aside from this failsafe feature allowing variable speed pumps and solar to operate together, the SWIM PC is programmed the same way a Pentair Intellicom2 is programmed. It tells the VS pump which of its 4 programs to use. This is slightly different than its 4 speeds. See the Intellicom2 manual for precise details.

Chlorinelockout is the lockout for the salt water chlorinator. This normally open extra external relay operating off relay 2 on the SWIM PC (instead of boiler lockout) closes only when the pump is running ensuring the salt system doesn't create chlorine when there is no flow. If you want this feature just e-mail us and ask us to reprogram your unit for it instead of boiler lockout. This happens over the internet.

Solar night cooling will allow solar to automatically cool the pool by running solar at night. Setpoints and differentials still apply.

Freeze recirculation will turn solar on when the roof sensor sees 34F. We recommend against relying on this type of freeze protection as it relies on power. .

LEGAL CONSIDERATIONS and WARRANTY

A web site is provided for each SWIM PC device sold. This web site is set up and maintained and paid for by Hot Sun. Software upgrades are provided free of charge whenever available and if an Ethernet connection is provided to the SWIM PC unit these upgrades are downloaded periodically without the need for any involvement by you the owner. Phone and e-mail support is available for the life of the product at no charge. Similarly you can e-mail us the data from the micro sd card and we can upload that to your unit's web site all at no cost as many times as you like. In exchange for this valuable service and web space on an ongoing basis you agree to let us use the data along with pictures of your solar heater, pool and home in our efforts to promote our solar and controls and monitoring technology. We will not divulge or publish your name or address or phone number or e-mail address without your express permission. We will only publish your general region like "San Diego California" and the particulars of your system such as pool size, target temperature, cover used or not, collector size and number, etc. Additionally we (Hot Sun Industries Ltd.) shall own the carbon credits for the energy displaced by your system. Over time we intend to "aggregate" the carbon credits for all the solar heaters we sell and monitor and eventually we will be able to sell these carbon credits collectively in order to offset the cost of the free services we are providing here. If you intent to sell the carbon credits for the carbon displaced with your solar system then we need to charge you to quantify that carbon with this unit's web site and that agreement needs to be made before such time as the data is collected. Meanwhile we (Hot Sun Industries Ltd) own all the carbon credits and we have the right to sell those credits as part of any cap and trade or carbon exchange program of the future.

With each installation comes the transparency of seeing exactly what is happening. This can be very useful for troubleshooting. The sale of the SWIM PC does not constitute a service or troubleshooting service, only a service to provide raw data. Analyzing the data and using the information as part of a service contract is a separate agreement.

WARRANTY

Internet and data storage is a delicate and less robust process than simply controlling a solar heater. The warranty on the SWIM PC is 2 years parts and labor not including freight as an automatic solar controller, not as a monitoring device. The warranty does not include damage or need for replacement of the SD card. The warranty does not cover internet reliability or the need to reset or any other internet connectivity peculiarity especially those beyond our control.

SECURITY:

There is no security issue with the unit at all because it does not access the home computer. It is simply a client on the local network. The SWIM PC itself initiates all contact with the internet. There is no way for it to be accessed from outside except through its own web site. There is no proprietary data on the SWIM PC that concerns the homeowner. If the SWIM PC is used to control a boiler then the concern would be that someone could hack Hot Sun's server and change the setpoint of your gas heater. This would be analogous to a hacker hacking your bank's secure web server. The worst case there is money issues guaranteed by your bank. The worst case here is your gas heater isn't locked out by the SWIM PC until you change the inputs back and we resolve the security hole. It'll never happen.

SERVICE:

Contact Hot Sun Industries for sales and service and troubleshooting in the USA at 858 683 0800 or in Canada at 778 300 1803. E-mail info@powerstripsolar.com or contact your local dealer. We're a small company. You won't get the run around.