

Installation and Operating Instructions



SolarAttic® Solar Pool Heater Pool Convection System Three™

U.S. Patents 5,014,770 5,452,710 5,746,653

SolarAttic Model PCS3™

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Table of Contents

Table of Contents	1
1. Introduction to SolarAttic	2
• Solar Without Panels	2
• Basic Operation	2
• Description of Technology	2
• Automation	2
2. Consider Before Installation	2-3
3. Cautions & Warnings	4-6
4. Installation	6-15
• ABC's of Installation	6
• Locate the SolarAttic PCS3	6
• Retrofit Support System	6-7
• Basic Plumbing Diagram	8
• Power The PCS3	9
• Internal Wiring Diagram	10
• Float Wiring Diagram	11
• Goldline GL235 Solar Control	12
• Goldline GL235 Circuit Board	13
• Automation Wiring Diagram	14
• Goldline GL235 Wiring Option	15
5. Operation	16
6. General Service Notes	17
7. Spring Start Up	17
8. Winterization	18-19
9. Winter Freeze Warnings	19
10. Unattended Pools	19-20
11. Repairs	20
12. System Troubleshooting	20
• Troubleshooting Guide	21-25
13. Safety Certification Label	26
14. Specifications	27
15. Warranty	28

1. Introduction to SolarAttic

SOLAR Without PANELS: SolarAttic has engineered the Pool Convection System 3 to heat your swimming pool using your attic and roof as a source of free energy. When your attic gets hot, the SolarAttic Swimming Pool Heater can add six weeks on to each end of your swimming season and can raise your pool temperature 10-15 degrees over a non-heated state. That means your family can enjoy the swimming pool without having to pay high heating bills. You get the benefits of solar pool heating without roof mounted solar panels.

BASIC OPERATION:

The simplified graphic diagram to the right shows how the PCS3 works. When the sun shines, the roof acts as a large solar collector.

Heat accumulates inside the attic. The PCS3 safely uses this attic heat to warm your pool. It eliminates the need for solar roof panels. AND, as it heats your pool, it cools your home! This house cooling effect can lower air conditioning costs 25-30% or more.

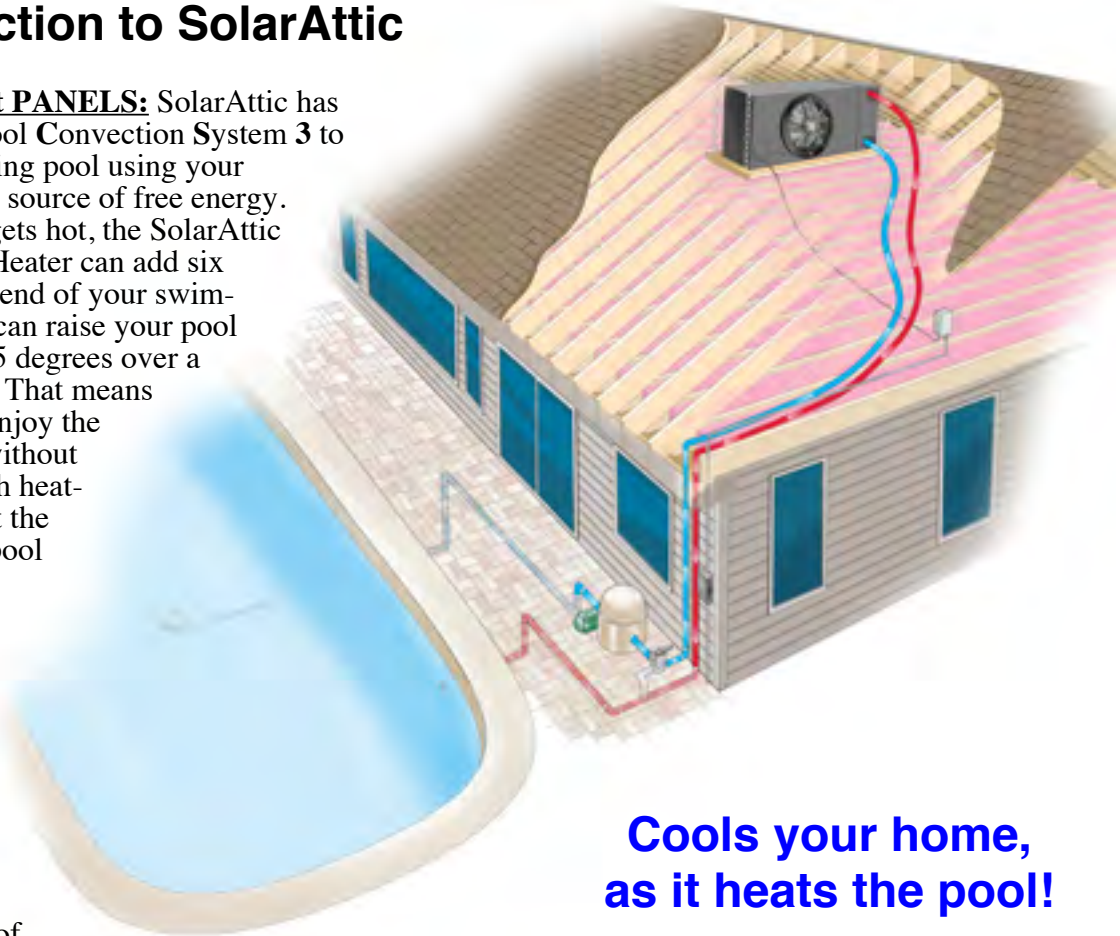
DESCRIPTION OF TECHNOLOGY: Solar radiation strikes the roof and reaches the attic through a process called “conduction.” The SolarAttic pool heater is physically located inside the attic and then transfers this solar radiation from the attic air into the swimming pool’s water through a process called “forced air convection.”

AUTOMATION: Full Automation is achieved by using an optional solar controller. When the attic is 4° F warmer than the pool and the pool needs heat, the GL235 solar control automatically routes water up to the PCS3 and turns it on. The solar control can also synchronize the pool pump turning it on at the same time when an external relay is used in conjunction with the GL235. Temperature sensors sense the pool and attic temperatures. The pool owner sets the desired pool temperature setting and maximum heat extraction in the attic occurs automatically. Note: The pool pump must be turned on during the time the PCS3 is turned on to effect heat transfer. And, water and air flow must be in sync.

2. Consider Before Installation

The following items should be considered prior to any installation.

1. Heat rises in a hot attic. Locate the PCS3 as high in the attic as is practical.



**Cools your home,
as it heats the pool!**

2. Airflow through the PCS3 is important. Do not obstruct air going in or out of the unit.
3. Recirculating the air within the attic works well for heat transfer. Locate the PCS3 within the middle 1/3 of the attic. Do not locate near an end wall where the unit's airflow will become obstructed [finned intake side] or short circuited [air discharge side]. Short circuiting means that discharged cooler air reflects back into the finned intake side of unit.
4. Heat is drawn into the coil or finned side and cooler air is discharged from the fan side [the two blower openings]. If the PCS3 is located off to one side the attic's center 1/3rd, make sure the coil side of the unit is facing the longest portion of the attic.
5. You can suspend the PCS3 on a platform using cargo straps or small chains. You can also allow the PCS3 to sit on a platform that is connected to the attic structure. We recommend that a one inch piece of foam be placed under the PCS3 and that a smitty pan be used as a second layer of leak protection. This is actual plumbing code in some locales.
6. The attic sensor can be cooled by the air discharge of the PCS3. Locate the attic sensor at the peak of the attic and out of the airflow of the unit. This prevents erratic on and off cycling caused by the cooling effect of the discharge air. Note: The discharge air of the PCS3 [blower side of unit] can run 20-30 degrees fahrenheit cooler than the intake air [coil finned side of unit]. All performance criteria was developed on the basis that the attic temperature sensor would sense the PEAK attic temperature. That is the temperature at the very apex of the attic where the roof sections join. If this sensor is lowered from the actual attic peak, heat transfer performance can be dramatically reduced.
7. The pool water sensor can be influenced by the sun and rain. Shelter the pool water sensor as much as is possible. It can even be insulated if necessary with fiberglass or other materials. Midnight rain "cooling" the pool sensor can fake the solar control into thinking the pool needs heat when it doesn't. An exposed pool sensor might also cause erratic on and off conditions if not protected (sheltered or insulated) properly.
8. The ground can "SINK" heat away from pipes going to and from the PCS3. Insulate or wrap all underground pipes so dirt (the ground) does not contact the pipes directly. Simple bubble wrap over the pipes that prevent the "wet ground" from coming into direct contact with the horizontal buried pipes is usually sufficient. It is not necessary to insulate vertical above ground pipes.
9. Use 2" pvc pipe to reduce friction losses and on all pools with a pool pump greater than one horsepower in size. This is especially important for long pipe runs and large pumps.
10. If you use the recirculating freeze protection in the GL235, it will disable the optional leak detection float of the PCS3 and prevent the pump and/or the PCS3 from turning off.
11. The mechanical stress caused by unsupported pipes can crack glued pvc joints. Support all pipes in and outside of the attic with straps or C-clamps that keep the weight of the pipes off of all joints and union connections. Do not allow the pipe to sag in the attic.
12. If excessive attic heat is a local concern, CPVC pipe can be used instead of pvc pipe. All external PVC piping should be painted to avoid deterioration from sunlight. Flex pvc pipe can be used in the attic to avoid cementing joints in a closed and confined area. This will provide a continuous length of pipe inside the attic without joints except at the unit.

3. Cautions & Warnings

The following notes are CAUTIONS & WARNINGS designed to inform you of the existence of areas of potential injury and hazard. These notes help to prevent personal injury and fatalities. They will also help prevent damage to the SolarAttic Swimming Pool heater, swimming pool systems or to the house.

MAKE SURE YOU READ AND UNDERSTAND THESE CAUTIONS & WARNINGS!



CHILDREN CAUTION: SHARP EDGES ON THE SOLARATTIC POOL HEATER CAN CAUSE CUTS OR INJURIES. THIS IS NOT A PRODUCT THAT CHILDREN SHOULD BE ALLOWED TO TOUCH. THEIR NATURAL CURIOSITY CAN RESULT IN INJURY OR ACCIDENT. ****KEEP ALL CHILDREN AWAY FROM THIS PRODUCT TO PREVENT CUTS, INJURIES OR ACCIDENTS****



ELECTRICAL DANGER: THIS PRODUCT USES 115 VAC POWER AND CAN CAUSE A FATAL INJURY IF SERVICED BY INEXPERIENCE PEOPLE. THIS MANUAL ASSUMES THAT AN EXPERIENCED ELECTRICIAN IS BEING EMPLOYED. ALL ELECTRICAL WIRING MUST BE DONE IN ACCORDANCE WITH LOCAL, STATE AND NATIONAL ELECTRICAL CODES.



PLUMBING CAUTION: THIS PRODUCT REQUIRES PVC CEMENT WELDING AND THIS MANUAL ASSUMES AN EXPERIENCED PLUMBER IS BEING EMPLOYED. DO NOT ACCEPT ANY LEAKING PVC JOINTS. DO NOT “LEARN” PVC CEMENT WELDING ON THE EXPENSIVE POOL VALVES PURCHASED. DAMAGE TO THE VALVES FROM POOR PVC WELDING IS NOT COVERED BY THE MANUFACTURERS WARRANTY. ASSEMBLE THE VALVES AND PIPES BEFORE ACTUAL WELDING TO MAKE SURE THE JOINTS FIT PROPERLY. THIS INSURES YOUR PARTS ARE READY FOR PERMANENT CEMENTING.



PLUMBING CAUTION: DO NOT USE DRAIN-WASTE (HOUSE SINK OR DRAIN) PVC FITTINGS (45° OR 90° ELBOWS, STRAIGHT SXS FITTINGS, ETC.) ON YOUR POOL’S SUPPORT SYSTEM RE-ASSEMBLY. USE SCHEDULE 40 PVC OR CPVC FITTINGS. THE DRAIN-WASTE PVC FITTINGS DO NOT HAVE THE SAME DEPTH OF PVC PIPE PENETRATION, WHICH COULD RESULT IN THE POOL’S PVC PIPE POPPING AWAY FROM THE SHORTER DRAIN-WASTE PVC FITTING (ELBOW, ETC.).



FIN CAUTION: THE FINS ON THE WATER COIL ARE SHARP AND CAN CAUSE A RAZOR- LIKE CUT IF YOUR HAND OR ARM COME INTO CONTACT WITH THEM. TAKE APPROPRIATE CARE DURING INSTALLATION AND DO NOT COME INTO DIRECT CONTACT WITH THE FINS OF THE COIL. IF THE COIL FINS ARE ACCIDENTALLY DAMAGED, THEY CAN BE “COMBED” STRAIGHT WITH A FIN COMB [10 FINS PER INCH].



AIR MOVING ASSEMBLY CAUTION: THE PROTECTIVE GRILLE AND OTHER PARTS OF THE AIR MOVING ASSEMBLY, INCLUDING THE BLOWER BLADES AND MOTOR HAVE SHARP EDGES WHICH CAN CUT YOUR FINGER OR HANDS. EXERCISE CAUTION WHEN HANDLING, REMOVING OR INSTALLING ANY PART OF THE AIR MOVING ASSEMBLY.



BLOWER CAUTION: DO NOT OPERATE THE MOTOR WITH THE AIR MOVING ASSEMBLY REMOVED. THE PROTECTIVE GRILLE IS TO PREVENT HARM WHILE THE BLOWER UNIT IS OPERATING. UNPLUG THE SOLARATTIC POOL HEATER DURING SERVICE AND ENSURE THAT THE BLOWER HAS STOPPED ROTATING.



MOTOR CAUTION: DO NOT OPERATE THE MOTOR FOR AN EXTENDED TIME WITHOUT THE SQUIRREL CAGE ASSEMBLY ATTACHED. THE MOTOR IS A “TOTALLY ENCLOSED AIR OVER” MOTOR [TEAO] AND THE AIRFLOW OVER THE MOTOR FROM THE CAGE PROVIDES MOTOR COOLING. OPERATING THE MOTOR WITHOUT THE CAGE ASSEMBLY ATTACHED WILL LEAD TO THE MOTOR OVER HEATING AND A THERMAL CUTOFF OF THE MOTOR [INTERNALLY].



TEKS SCREW CAUTION: DO NOT REPLACE ANY SELF-TAPPING #10-1/2 TEKS SCREW USED ON THE REAR COIL SIDE WITH ANY SHEET METAL SCREW GREATER THAN ONE-HALF INCH (1/2”) IN LENGTH. DOING SO CAN DAMAGE THE WATER COIL BY PUNCTURING ONE OF THE COIL’S WATER PIPES OR MANIFOLDS. AS A GENERAL RULE, DO NOT USE ANY SHEET METAL SCREW GREATER THAN 1/2 INCH IN LENGTH ON THE SOLARATTIC POOL HEATER.



WEIGHT CAUTION: THE PCS3 WEIGHS ABOUT 221 LBS CRATED AND 142 LBS UNCRATED. IN ADDITION, THE UNIT IS BULKY. CAUTION SHOULD BE TAKEN WHEN LIFTING THE UNIT SO AS NOT TO TWIST FROM THE WAIST OR TO PLACE A BURDEN ON THE LOW BACK. NO ATTEMPT SHOULD BE MADE TO LIFT THE UNIT ALONE. TWO OR MORE MEN SHOULD BE PRESENT. ATTEMPTING TO LIFT OR HANDLE THE PCS3 ALONE CAN LEAD TO PHYSICAL INJURY. NOTE: THE PCS3 FILLED WITH WATER WEIGHS ONLY 163 LBS.



POOL CHEMISTRY CAUTION: AN IMPROPERLY MAINTAINED POOL WILL TURN ACIDIC VERY FAST AND DAMAGE ALL OF THE POOL’S SUPPORT EQUIPMENT INCLUDING THIS HEATER. MAINTENANCE OF POOL WATER CHEMISTRY IS A SERIOUS RESPONSIBILITY OF OWNING A SWIMMING POOL. LOCATE ALL CHEMICAL DISPENSERS DOWNSTREAM FROM THE PCS3.

NOTE: IF YOUR POOL WATER IS CRYSTAL CLEAR, DRINKABLE AND DOES NOT SMELL OF CHLORINE -- YOU HAVE THE RIGHT POOL CHEMISTRY. CHECK WITH YOUR LOCAL POOL CHEMICAL DEALER IF YOUR POOL DOES NOT HAVE THESE ATTRIBUTES!



BUILDING CODE CAUTION: INSTALL ALL EQUIPMENT IN ACCORDANCE WITH LOCAL, STATE AND NATIONAL BUILDING CODES TO PREVENT ANY INJURY, FATALITIES OR DAMAGE TO EQUIPMENT.



INSTALLATION DANGER: USE ADEQUATE VENTILATION WITHIN THE ATTIC IF YOU PLAN TO CEMENT PVC JOINTS. PVC CEMENT FUMES CAN BE TOXIC IN THE ATTIC AND CAN LEAD TO HEALTH PROBLEMS OR INJURY. COMPLETE ALL ATTIC INSTALLATION TASKS IN THE MORNING WHEN HEAT BUILD UP IS MINIMAL TO PREVENT HEAT STROKE OR OTHER INJURY. NOTE: A CONTINUOUS LENGTH OF FLEX PVC PIPE CAN BE USED IN THE ATTIC TO MINIMIZE PVC CEMENTING IN THE CLOSED ATTIC ENVIRONMENT.



INSTALLATION CAUTION: SOME LOCAL BUILDING CODES REQUIRE THAT A SMITTY PAN BE INSTALLED UNDER ANY ATTIC EQUIPMENT FOR ADDITIONAL PROTECTION FROM ATTIC EQUIPMENT FAILURE. NOTE: A SMITTY PAN IS AN EXTRA WATER COLLECTION TRAY PLACED UNDER ATTIC EQUIPMENT THAT IS TAPPED AND CONNECTED TO A HOSE TO DRAIN EXCESS FLUIDS OUTSIDE.

NOTE: SMITTY PANS CAN USUALLY BE PICKED UP AT LOCAL PLUMBING SUPPLIERS. THEY CAN ALSO BE BUILT BY ANY SHEET METAL FABRICATOR. A SMITTY PAN INSTALLATION IS RECOMMENDED AS AN ADDED LAYER OF PROTECTION FOR ANY INSTALLATION WHERE THERE IS A HIGH DEGREE OF CONCERN FOR MAXIMUM PROTECTION AGAINST POTENTIAL FAILURE OF ATTIC EQUIPMENT. SMITTY PANS ARE A GOOD CONSTRUCTION PRACTICE.



SERVICE DANGER: UNPLUG THE SOLARATTIC POOL HEATER BEFORE ATTEMPTING ANY SERVICE! FAILURE TO UNPLUG THE UNIT PRIOR TO ANY SERVICE CAN LEAD TO SERIOUS INJURY OR DEATH. SERVICE SHOULD NOT BE ATTEMPTED BY AN INEXPERIENCED TECHNICIAN WITHOUT FIRST READING THIS ENTIRE MANUAL!



SERVICE CAUTION: DO NOT CREATE A SITUATION THAT WOULD ALLOW POOL WATER TO BE INADVERTENTLY ROUTED TO DISCONNECTED ATTIC PIPES. IF THE SOLARATTIC POOL HEATER IS DISCONNECTED FROM THE ATTIC PIPES, DISCONNECT THE PUMP AND REMOVE THE VALVE CONTROLS AND HANDLES DURING SERVICE. OR RECONNECT A BYPASS PIPE IN PLACE OF THE SOLARATTIC POOL HEATER DURING ITS REMOVAL. FAILURE TO OBSERVE THIS CAUTION CAN LEAD TO SUBSTANTIAL WATER DAMAGE.

4. Installation

Installation of the SolarAttic Pool Heater involves three basic steps:

- A) Locate the SolarAttic Pool Heater in the attic.
- B) Connect the SolarAttic Pool Heater to the pool's support system.
- C) Connect the SolarAttic Pool Heater to power or Automation equipment.

LOCATE THE POOL HEATER IN THE ATTIC

The PCS3 is the third generation SolarAttic Pool Heater. It has been reduced in size and depth to make installation in the attic easy. While physically reducing the size, SolarAttic has maintained the 60,000 Btu/hour nominal rating of the original PCS1 pool heater. The PCS3 is expected to fit directly through 95% of all existing attic access panels. The PCS3 basic box dimensions are only 22H x 14W/D x 46L inches and the unit can be easily and completely disassembled by removing the sheet metal screws if needed. Therefore, it can be completely disassembled for extremely small access openings and then reassembled within the attic with nothing more than a battery operated drill and a 5/16 hex driver bit.

Before physically locating the SolarAttic Pool Heater inside the attic, it is a good idea to take the right service panel off and install mating female pvc union fittings to the 2 inch male pipe threads. When mating pvc female fittings to the copper pipe threads, we recommend using silicone sealant and allowing the joints to properly cure for 24 hours before placing them into use. Do not use teflon tape!

Locate the pool heater inside the attic. The shipping crate base may be used as a mounting platform if not too damaged during shipping and simple cargo straps or small hardware chain can be used to suspend the unit from the apex of the attic. The PCS3 can also sit on a platform secured to the attic trusse structure as the unit is vibration and noise free. If noise occurs in the wood structure, ensure that a 1" piece of foam is under the PCS3 and the unit itself is not physically connected to the trusse. Some unit flexibility is needed for normal winterization of the system in areas where the pool is winterized. Once the PCS3 is fully installed, there should be little or no noise or vibration heard from within the house.

Remember to place the unit in the center 1/3rd of the attic and locate it as high as possible and practical inside the attic. This completes the first step. The pool heater now has to be plumbed and powered.

RETROFIT SUPPORT SYSTEM

Connect the SolarAttic Pool Heater to the pool's plumbing. The existing pool pump is sufficient to move water to and from the pool in 99% of all installations. Retrofitting the support system is the most difficult part of plumbing the PCS3. The reason for this is the generally rigid and permanent nature of the typical PVC type support system plumbing. This usually means having to carve up the PVC pipe and not being able to salvage and reuse the fittings and in some cases the existing valves also. The good part about PVC type support systems is that PVC pipe, fittings and general purpose valves are relatively inexpensive and can be purchased in many hardware, plumbing and home building stores.

If you have a PVC support system that needs to be retrofitted, plan on redoing the entire plumbing layout. This should be done on paper first, before you actually start cutting PVC pipe in the support system.



CAUTION: If you are in an area that freezes, it is common to find a gate valve on all lines going to the swimming pool. These are the pool's main drain line, the pool's return line and the pool's skimmer line. In some instances, there may be more than just these three lines [such as two skimmer lines, etc.]. Do not remove these valves! They are needed to winterize your swimming pool. In some cases, they may have to be removed and later reinstalled.

Plan on connecting the new valves and PCS3 to the valves and pipes leading to the swimming pool. When it comes to the filter and pump, simply rearrange these as is needed, as you reconstruct the pool's support system's plumbing.

In the case where copper pipes and brass valves have been used, they can be reused. If copper or brass has been used, you will need to mate these to pvc pipe which is generally done using a metal to rubber "mission" coupling that adapts directly to the outside dimensions of both pipes involved. Example: 1 1/2 inch copper pipe has a different O.D. [outside diameter] than 1 1/2-inch PVC pipe. The appropriate union to couple these pipes will have a rubber insert that matches the different size pipes.

The bypass valve supplied is 2" PVC and can be reduced down to 1 1/2" by using a "reducing bushing". Some PVC valves accept both 1 1/2" and 2" PVC fittings directly. Some accept 2 1/2" pipes. NOTE: Be sure to read the valve manufacturers instructions. Also, it may be easier to use sections of rigid 2" PVC pipe for installing the valve shipped with the PCS3. This would include using some 2" PVC fittings.

The PCS3 inlet and outlet lines go to the attic. Having the support system located in a convenient spot for easy attic access is a good strategy. Support systems located far away from the attic can be relocated closer by extending the pool's support piping. Extremely long pipe runs may require added horsepower from the pool's pump. If your pump is inadequate for the added lift to the attic, it will reduce the flow of water and result is poorer filtration and it may thermally cut itself off from over heating.

As a general rule, a 1 HP pump can handle a 250 feet round trip and up 25-30 feet in terms of vertical lift. Each pump has a specific pressure and flow curve that can be referenced if needed to ensure your pump is adequate. However, with 25 years of experience, I do not know of a single system that HAD to have a pump upgraded for the SolarAttic solar pool heater. **For max heat transfer**, use the top opening as the inlet and the bottom as the outlet. If plumbed opposite, it will not dramatically affect performance.

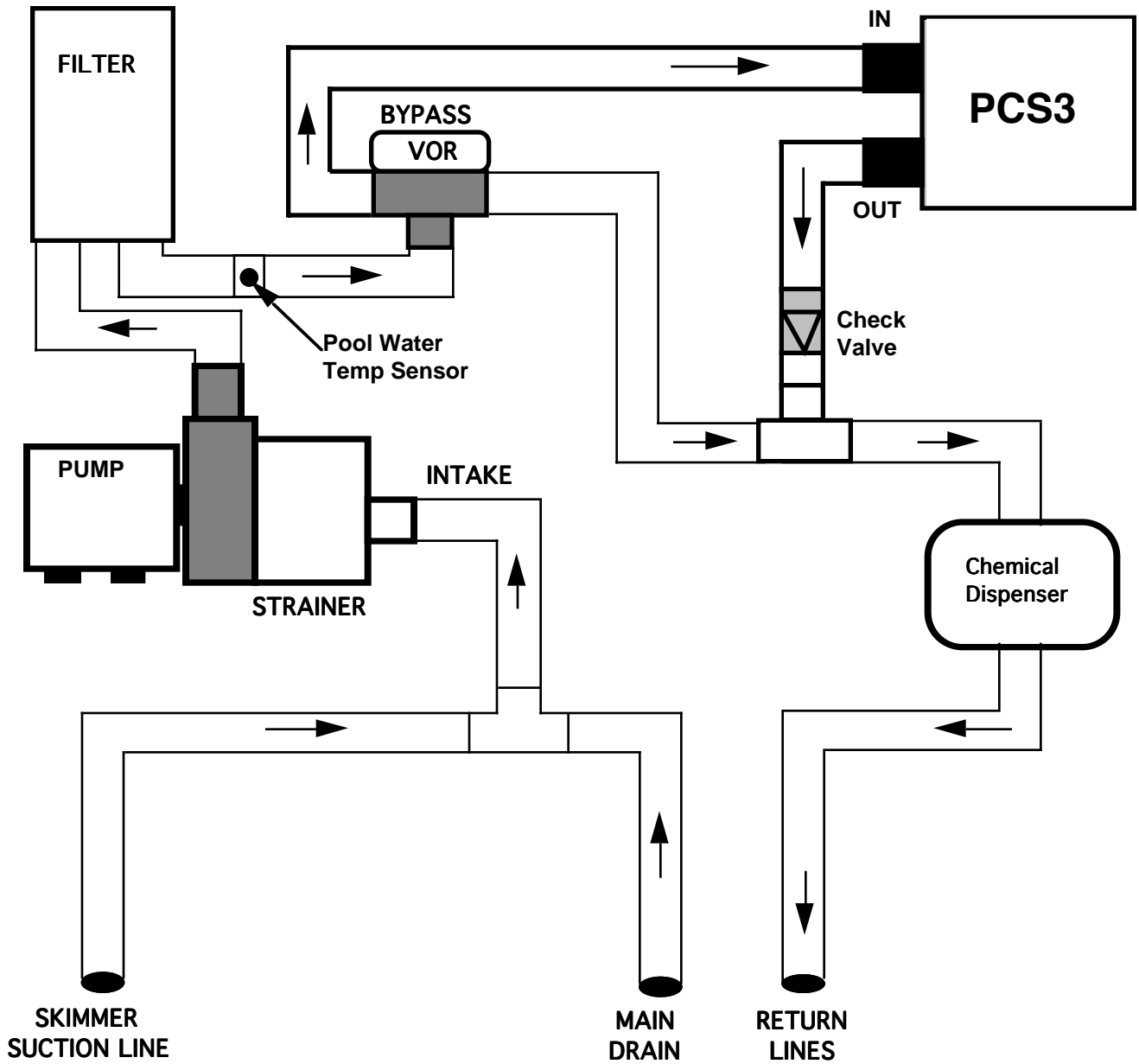
NOTE: Do not upgrade your pump simply because it feels hot! Your pump will feel "too hot" to touch by hand under normal operating conditions. If you are building a new pool and installing the PCS3 at the same time, there is no expense associated with retrofitting the support system.

NOTE: Additional specialty plumbing and wiring diagrams are available at www.solarattic.com and inside the PCS1 Technical Manual, which can be freely downloaded as needed. The PCS1 Manual has indepth information concerning solar theory and heat transfer performance curves. Everything in the PCS1 Manual applies to the PCS3 with the exception of the electrical wiring. The PCS1 is a 220-240 vac system and it requires different wiring considerations. However, the PCS3 is a 110-120 vac system and plugs into a standard household electrical outlet usually switched by the GL235 solar control. The nomenclature 110 vac, 115 vac and 120 vac all refer to the same standard household power and are used interchangeably in various support documents.

The diagram on the next page is the basic plumbing diagram for the SolarAttic Pool Heater. Additional plumbing diagrams and plumbing options may be found at www.solarattic.com/plumb.htm.

PLUMB THE POOL HEATER AS DESIRED.

Basic Plumbing Diagram



POWER THE PCS3

The final step in the installation is supplying power to the SolarAttic Pool Heater. The PCS3 is supplied with a power cord that plugs into any standard 120 vac electrical outlet. In the simplest installation, an outlet is wired to a manual switch and power is turned on as desired. The PCS3, however, is capable of cooling as well as heating. Operating the system manually will not optimize the heat for the pool and its resultant cooling for the home. If, for example, the manual system is turned on when the pool is actually warmer than the attic, the attic will be warmed and the pool will be cooled. Therefore, automation with the Goldline GL235 or other solar controller is highly recommended.

Following the use of a simple manual on/off switch is the use of an attic temperature switch wired in series with the PCS3 power and set to power the unit when the attic only reaches a set temperature. This produces semi-automated operation. However, the heat extraction process will still not be optimized.

To optimize heat extraction requires full automation. This can be achieved with a variety of optional solar control systems. Wiring diagrams for the Goldline GL235 solar control are illustrated in this manual as an example. The Goldline GL235 is a simple solar control that does not require programming and is the only solar control supported by SolarAttic's technical staff.

Page 10 shows the "INTERNAL ELECTRICAL WIRING" diagram and it is presented here for reference purposes. Please note the location of the motor starting capacitor. If the motor fails to start, it might be a thermal overload or the starting capacitor. However, failure of the capacitor is rare.

Page 11 shows the "AUTOMATION FLOAT WIRING DIAGRAM" and how to wire the optional internal float switch in SERIES with the attic (solar) 10K ohm temperature sensor. Note: Place the attic sensor above the PCS3, out of the air flow and at the apex or peak of the attic. The discharge air of the PCS3 can cool the temperature sensor down causing erratic cycling on & off of the unit. Therefore do not locate the attic sensor where it can be influenced by the discharged cooler airflow of the PCS3.

Page 12-13 shows the "GOLDLINE GL235 CONTROL and INTERNAL CIRCUIT BOARD" and how to connect the sensors and plugs inside the GL235 controller. **Important Notes:** It may be necessary to remove the top circuit board of the GL235 in order to wire the temperature sensors or to access the jumper options as shown on the upper right graphic of page 12. Page 13 shows the board installed. **Do not wire 220vac power to the GL235 terminals used for 110vac. It will destroy the GL235.**

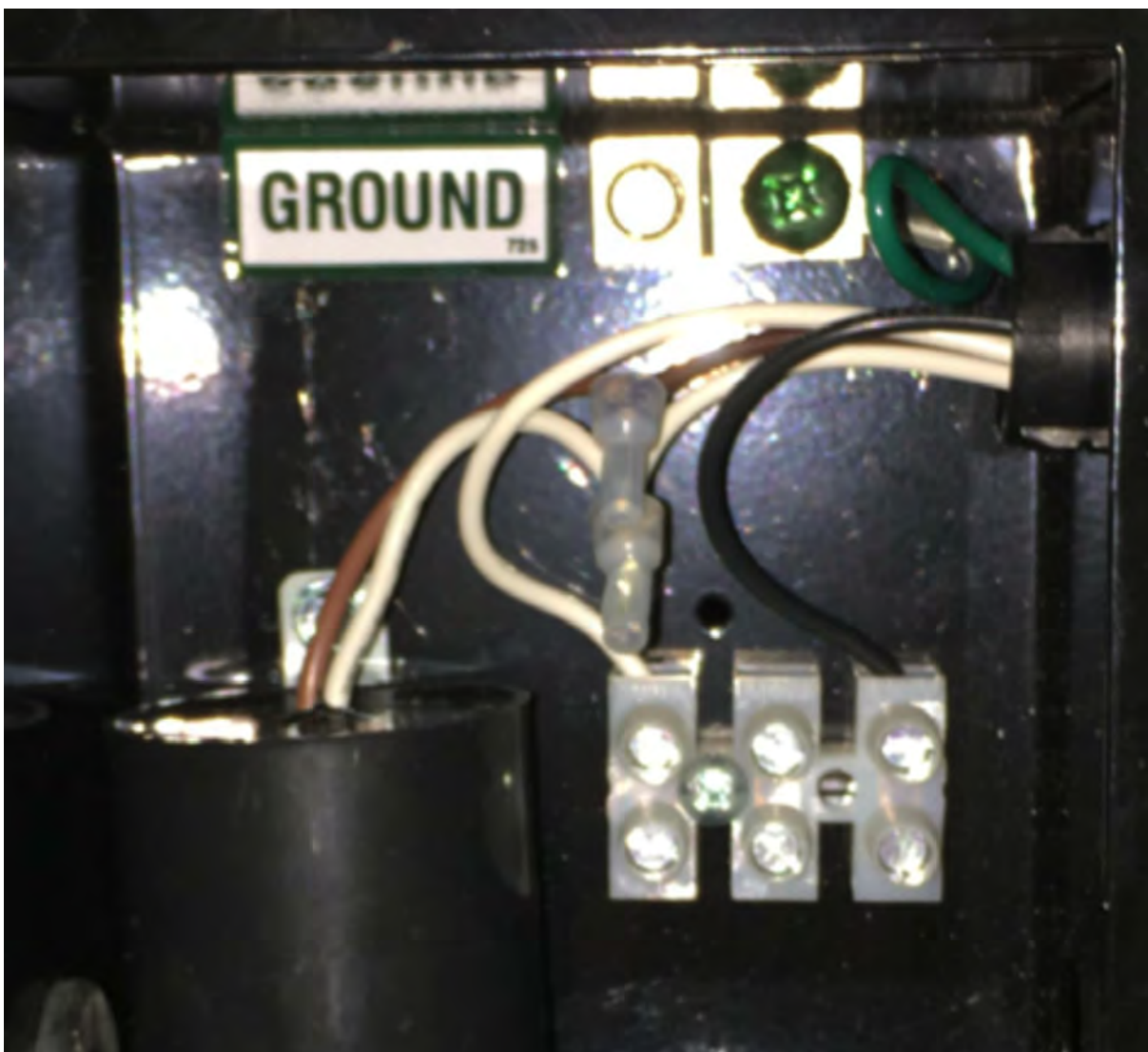
Page 14 shows the "AUTOMATION WIRING DIAGRAM." This diagram shows the full automation wiring using the GL235 or a similar solar pool heater controller. Optional wiring diagrams are available on SolarAttic's web site and include: 1) How to use an auxiliary relay to slave the pump [or other equipment] to the GL235 and ensure that water and air flow in the attic unit are synchronized; 2) How to use a timer to enforce a minimal amount of filtration time during inclement weather when the sun does not shine. **Important Note:** Heat transfer cannot occur unless both air flow and water flow are present at the PCS3 at the same time. This is usually the problem when a system initially appears not to work. The attic should feel "cooler" once the PCS3 has operated 20 minutes. If not, water and air are out of sync.

Note: The additional wiring diagrams and wiring options, including how to slave other equipment like the pump to the GL235 control may be found at <http://www.solarattic.com/wiring.html>.

Page 15 shows the "GOLDLINE GL235 WIRING OPTION FOR 220VAC TIMERS."

Use the above pages and the Automation instructions you received with your optional solar controller to complete the wiring of the SolarAttic Pool Heater PCS3.

YOUR INSTALLATION SHOULD NOW BE COMPLETED.

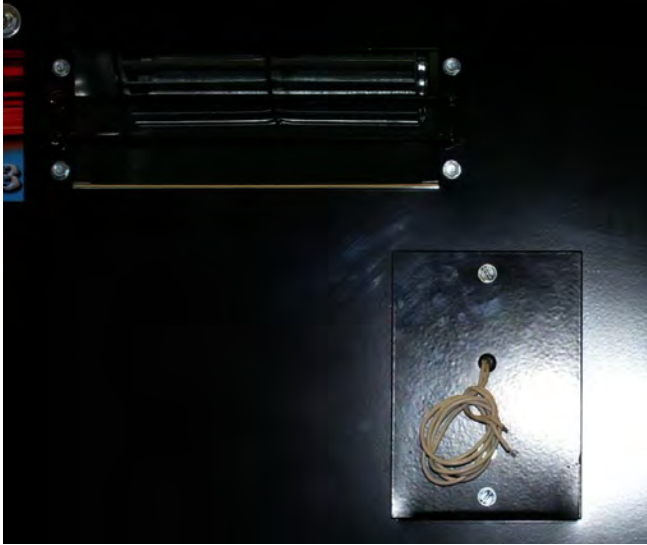


Internal Electrical Wiring

On the lower left of the frontside of the PCS3 [facing the blower outlets] is where the internal wiring of the PCS3 resides.

Inside on the left of the terminal block is a 20 microfarad 120 vac motor starting capacitor. The motor is wired at the factory to its high speed and heat transfer is based on this speed.

If the blower just hums, this motor starting capacitor will have to be replaced. Turn the power off, remove the electrical cover panel and replace the capacitor. Ensure the new capacitor is wired as the original was and is as shown. The motor wiring diagram is shown on the inside of the electrical cover panel. The ETL certification requires that the unit ship without a power cord due to its location in the attic. Wire the power to the PCS3 in accordance with local electrical codes for safe operation of the unit.

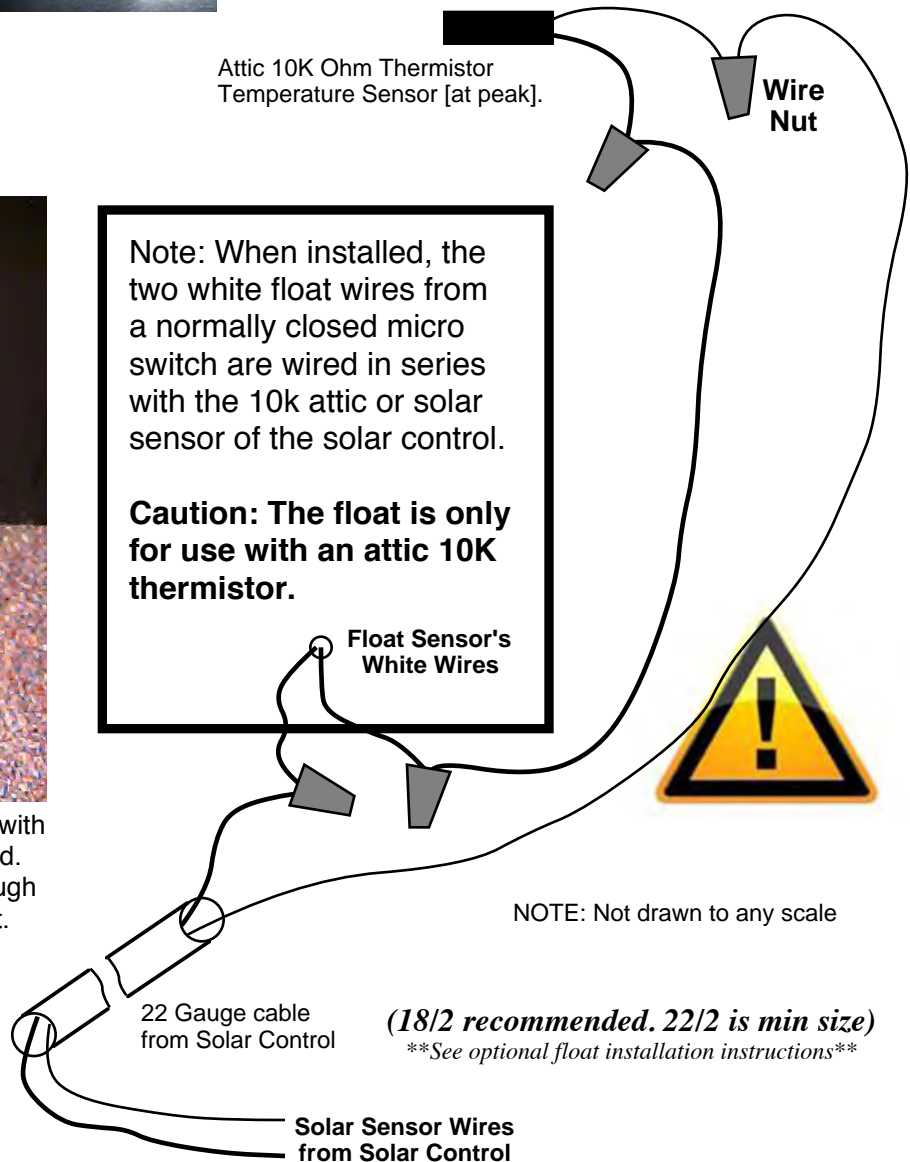


Float Wiring Diagram

An optional float for use with automation controls can be installed in the PCS3. If installed and the base pan has excess condensate or water, the float will rise and will open the attic 10K attic (solar) sensor circuit. Solar controls in AUTO will interpret the open circuit as a cold attic and shut down the PCS3. An open float also results in a flashing “check sensor” red light on the Goldline GL235 solar control. The PCS3 must operate in the AUTO mode of the GL235 for the internal float to work.



Photo shows float panel opened up with the optional automation float installed. Note: the float wires are routed through the opening on the panel to the front.



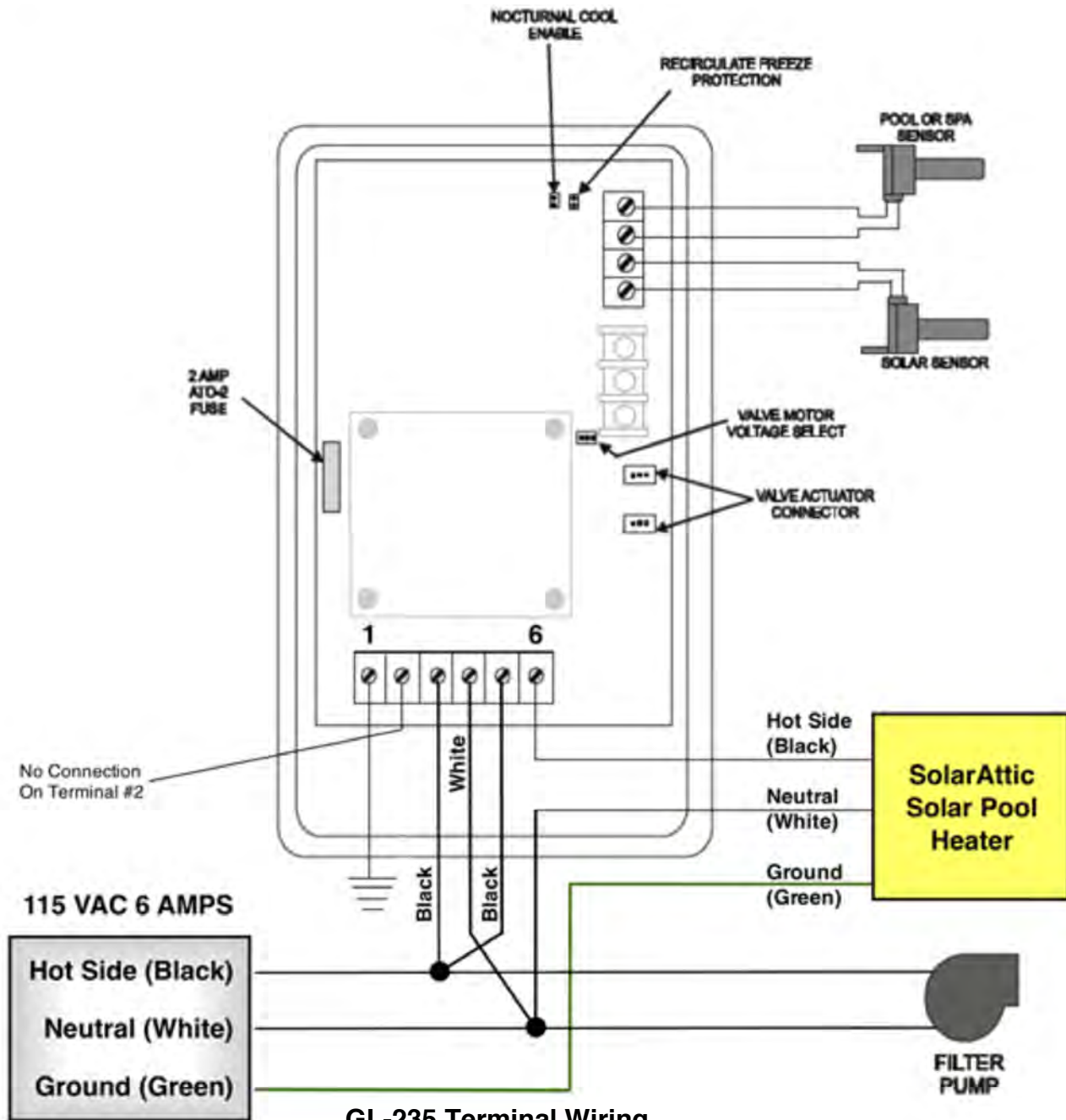
Goldline GL235 Solar Control



Goldline GL235 Circuit Board



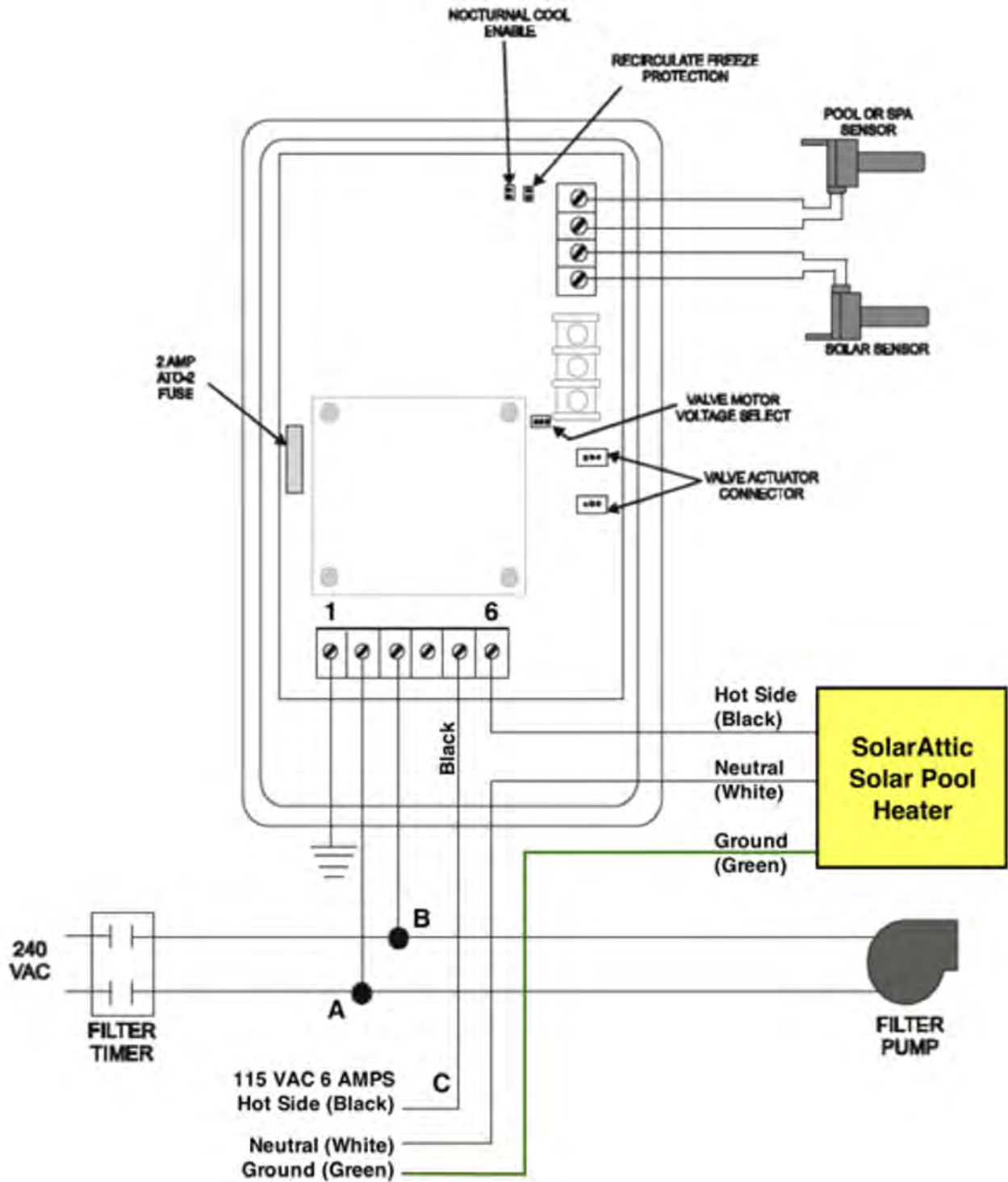
Automation Wiring Diagram - 115 VAC



GL-235 Terminal Wiring

- 1 - Ground from timer (green)
- 2 - No connection
- 3 - 115 vac Hot Side from timer (black)
- 4 - 115 vac Neutral from timer (white)
- 5 - 115 vac Hot Side from timer to GL-235 Relay (black)
- 6 - 115 vac Hot Side from Relay to SolarAttic Outlet (black)
- Neutral directly to SolarAttic Outlet (white)
- Ground directly to SolarAttic Outlet (green)

Goldline Wiring Option - 220 VAC



5. Operation

MANUAL INSTALLATION

In this installation, a manual bypass valve is installed after the filter pump and is used in conjunction with a manual power ON/OFF switch. To turn the pool heater ON, requires that the power be turned ON and that water be routed to the PCS3 at the same time.

To turn the system OFF, you reverse the process turning the power switch off and the bypass valve to bypass the pool heater. It is a good idea to limit water flow through the PCS3 to only when it is actually being used. That is the reason for the bypass valve. It enables you to use the pump for filtration or cleaning when you do not want to use the SolarAttic pool heater.

NOTE: In this type of installation, the owner decides when the attic is warmer than the pool. Use of a temperature sensor in the attic can help make this an intelligent decision. Wireless digital thermometers are relatively inexpensive at Radio Shack stores. Turning the pool heater ON when the pool is warmer than the attic will warm the attic and cool the pool. This is the opposite of what is usually desired.

SEMI-AUTOMATED INSTALLATION

In this installation, an attic temperature switch is used in conjunction with the SolarAttic Pool Heater to limit its ON time to only when the attic reaches a certain fixed temperature. One or more timers can be used to control the pump and/or the attic power. However, the bypass valve must be either manually turned on or otherwise automated. The exact nature of your semi-automated installation will determine how you turn the PCS3 (system) ON and OFF.

AUTOMATED INSTALLATION

In both of the above installations, maximum heat extraction is limited by human intervention or semi automated devices like switches or timers. However, heat extraction can be easily maximized and automated by way of an optional solar controller like the Goldline GL235. Once installed, operation is simple and straight forward.

SET the thermostat on the GL235 to its full clockwise location or maximum temperature setting. This will ensure that maximum heat extraction will occur when the GL235 is in AUTO mode. While the dial is calibrated in degrees F, there is a notorious difference between what the temperature dial reads and what the typical pool thermometer at 18 inches of depth reads. Therefore, with the setting at maximum, use the pool thermometer you have to determine when it is too warm. Simply back down the GL235 temperature setting to a position that “feels” comfortable to you in the pool and disregard the dial setting itself. Your objective is to have an automatically warmed pool that is comfortable. Without a complex temperature gauge installation throughout the pool and attic, it becomes a complex engineering task to determine what the “real” temperature actually is. However, determining what is a very comfortable temperature to you is an easy task.

To turn ON the SolarAttic PCS3, simply place the GL235 mode switch in either the AUTO or TEST (ON) position. Note: The GL235 “ON mode” is a manual ON setting that is useful for testing or manual operation of the system. However, this position does not use the pool and attic temperature sensors or the internal float protection switch. For full automation and maximum heat extraction, ensure that the GL235 mode switch is set to its AUTO mode position and the thermostat is set to maximum.

To turn OFF the SolarAttic PCS3, simply place the GL235 mode switch in the OFF position.

6. General Service Notes

The PCS3 is generally maintenance free and requires only occasional inspection to ensure that everything is working properly. Here are some suggestions:

1. Inspect the PCS3 coil annually during spring startup or fall winterization for any accumulation of dust or debris from attic environment. Vacuum any accumulated dust off of the coil fins. This is not normally an issue to be concerned with. However, it is something to be aware of.
2. Any time service is performed inside the PCS3, disconnect power first.
3. If there is trouble with full automation, inspect to ensure proper installation of the optional float. This is indicated by the float being free to move and being wired in series. If the float switch was defective [open], the automatic mode of the GL235 will not work. Also, the “check sensor” red light on the GL235 control panel will be ON and FLASHING. No debris or obstruction of the float should be present during this examination. The float is accessed by removing one 5/16 hex screw on the right side of the front of the unit. See page 11 for float wiring details.
4. Do not lubricate the motor, as it is maintenance free.
5. During startup, listen to the blower and motor. There should be mostly airflow sound associated with the blower unit. No bearing noise should be apparent. If so, the motor may need to be changed. Note: This is also a very rare occurrence.
6. Some evidence of a small amount of condensate will be present in the form of a water stain in the interior of the PCS3 base pan. This is normal.
7. **CAUTION:** When working on the PCS3 where the inlet and/or outlet union(s) will be disconnected, ensure that (A) the bypass valve is in the “OFF” position bypassing the PCS3; (B) the controller is “OFF”; (C) the valve operator ON1 | OFF | ON2 switch is in the OFF position; and, (D) the manual handle for the bypass valve is removed. These precautions, along with disabling the pool pump, will prevent the pool water from accidentally being routed up to the attic during service. When finished, ensure that the VOR is returned to the same ON1 or ON2 position it was in before you turned it to the OFF position for proper valve operation.



7. Spring Startup

1. Make a visual check of the plumbing for any deterioration or problems.
2. Manually inspect the blower cage for rotation on the motor. With the power off, the assembly can be seen through the two front air outlets. The squirrel cage should not be loose or wobbly.
3. Check the PVC unions on the PCS3 inlet and outlet. They should be tight. Do not over tighten as they could crack. Generally, a 1/4 turn past being hand tight should suffice.
4. Perform other pool startup chores and ensure pool chemistry is properly balanced before pumping any water through the PCS3 heat exchanger.
5. Restart system and inspect attic for any sign of plumbing leaks.
6. System is ready to use for the season.

8. Winterization

1. Winterize pool with air as you normally would. Make sure that power is off to the SolarAttic pool heater and that the pump is disconnected.
2. Blow air through the PCS3 pipes using a shop vacuum or other tool until all water is removed.
3. Perform all other winterization chores.
4. Make sure all pipes by support system are drained completely or they will freeze and bust. Any suspect pipes having “trapped” water should have a hole drilled and a plug installed for winter draining.
5. Remove the PCS3’s outlet and inlet unions. Tilt the opposite side up two inches and drain any coil water into a pan. Next, tilt the inlet/outlet side up two inches followed by a second tilt of the opposite side for draining any additional coil water into the pan. Repeat this process until no water drains from the PCS3.
6. Pour 1/2 to 1 gallon of RV [recreational vehicle] non-toxic antifreeze into the bottom of the PCS3. Note: This dilutes any residual “trapped” water still remaining within the coil and insures no freeze damage. This is the same type of antifreeze used in the pool’s pump and skimmers during the winterization process! It is similar to the process used to winterize RV’s and cabins.
7. Reinstall the outlet and inlet unions.
8. The PCS3 is winterized.



CAUTION: Failure to follow Step #6 above can lead to water coil damage! Even after Steps #1-5, the PCS3 water coil could still retain a small amount of residual water that is “trapped” within the bottom of the coil. The non-toxic “RV” antifreeze [available at local hardware stores] dilutes any residual water and prevents winter freeze damage. Winter freeze damage is totally preventable and is not covered under the PCS3 Warranty. It is the owner’s responsibility to have the system winterized.

Bypass Valve Consideration

In the process of winterization, air is blown through all of the pipes to eliminate water inside of the pipes [and all valves]. The bypass valve should be exercised in both directions a few times to eliminate all of the water within the valve. This can be accomplished using the manual on/off function of the GL235 or by manually turning the valve in both positions [with valve motor removed]. This should eliminate all water inside the bypass valve.

There have been two reported incidents of cracked bypass valves during spring start-up. The bypass valves were found to be cracked along the underside of the valve. This indicates that water was inside the valve during a freeze. This was probably the direct result of either: A) An improper winterization effort; or, B) A bypass valve that is installed in such a position to either “trap” or “collect-back” water into its base. After the pipes have been drained, a small amount of trapped water or moisture may still be present in some of the pipes or valves depending upon how the system is plumbed. If the bypass valve represents such a “trap” or a “collection point” for residual drain-back within the plumbing, it may cause damage to the valve. Water that freezes needs expansion space.

Two approaches can be used to eliminate this type of “plumbing” problem: 1) Install a small drain hole, valve or pitot tube near the bypass valve to drain off any water that could get trapped, drain-back or accumulate back into [or at] the bypass valve. An examination of the plumbing should reveal if any trapped water or drain-back of moisture would be accumulated inside of the bypass valve. OR, 2) Remove the valve operator, top screws and internal valve diverter. Inspect for water accumulation after winterization. There shouldn’t be any. Non-toxic antifreeze can be poured into the valve if desired. Note: #1 is a common approach used in swimming pool plumbing.



CAUTION: The bypass valve should be installed in such a way that moisture or water does not get trapped into the valve or is allowed to drain-back or accumulate inside the valve’s body after winterization. This can create damage to the valve during the winter freeze cycle. Also, improper winterization of the valve will lead to damage.

9. Winter Freeze Warnings

Not all swimming pools require the winterization process as described on the preceding page. For example, swimming pools located in Northern Florida and elsewhere do not require this winterization process. These pools are not located in “hard-freeze” locations [like Minnesota].

However, in some areas that do not winterize the pool, there is still the possibility of a period of one or more days when temperatures below freezing are occurring [or being forecasted] by prevailing weather. OR, you may be simply late in getting around to winterizing your pool. What do you do in such an instance?

The standard operating procedure in such an instance is to keep the pool’s filtration pump running during this brief period of freezing temperatures. This also pertains to the PCS3. You should keep water running through the PCS3 during this period of time.

Temporary Freeze Warning: Operating Procedure

1. Ensure that the pool’s pump is manually ON.
2. Ensure that the bypass valve is manually ON.
3. Keep water flowing through the pool’s pipes and the PCS3 until freezing temperatures are no longer present or a threat. If a prolonged period of hard freeze is present, winterization may be required.



CAUTION: Failure to keep water running [flowing] in such an instance can result in damage to the pool’s plumbing, support system and the PCS3.

10. Unattended Pools

Sometimes it may be necessary to leave your pool unattended for an extended period of time. For example, this could be a two-week vacation or any other situation where the pool will be left alone and unattended. In such a situation, the pool’s water chemistry is a serious concern for the pool owner.



CAUTION: Leaving pools unattended for an extended period of time can lead to poor pool water chemistry. This can then lead to an acidic pool condition which is capable of eating [etching] away the metal throughout your pool’s support system equipment. This includes the PCS3.

One simple solution is to always have someone, who knows what they are doing, maintain your pool water chemistry during this period of time. A second solution is to use automatic chemical dispensing equipment while you are away. Equipment you trust and is capable of maintaining your pool's water chemistry while you are away.

WE RECOMMEND: That the PCS3 be turned off when the pool will be left unattended for extended periods of time. This can be accomplished by turning the GL235 controller to the "OFF" position. Additional security can be obtained by turning the ON1 | OFF | ON2 switch on the valve operator motor to the OFF position and then removing the motor and its handle. Before restarting the PCS3, ensure that the pool's water chemistry has been restored to the proper Ph balance along with all other chemical levels. Ensure that the pool is not in an acidic condition.

Following the instructions and precautions in Sections 6-10 will extend the life of your Model PCS3 SolarAttic solar pool heater.

11. Repairs

Since the PCS3 is generally maintenance free, there is little to repair on the system. Most operating problems encountered will relate to the solar controllers used in your installation.

In the event repair of the PCS3 is required, the unit has been designed for ease of service. For example, virtually all electrical components are accessible from the front or side of the unit. The entire assembly can also be completely dismantled using only a few tools: a) a portable drill or electric drill; b) a 5/16 hex head bit; c) a No. 2 phillips screwdriver or drill bit; and, d) two 1/2" socket or box wrenches.

The following main service tasks each require only a minimal amount of time:

- A. Remove and replace the air-moving assembly with a drill, 5/16 hex bit and two 1/2" wrenches.
- B. Remove and replace the starting capacitor with a drill, 5/16 hex bit and No. 2 phillips bit.
- C. Remove and replace the optional internal float assembly with a drill and 5/16 hex bit.

The only remaining item to replace on the PCS3 would be the water coil. Depending upon the attic installation, the water coil may be easier to remove and replace inside or outside of the attic. Note: The water coil in the PCS3 has been designed for a 20 year life span assuming that the pool water chemistry is properly maintained. Therefore, the longevity of the PCS3 solar pool heater is primarily in the hands of the pool owner. Some electrical tape and a wire cutter will also be needed on item B above.




12. System Troubleshooting



Section 12 is a Troubleshooting Guide. It assumes that an automated PCS3 system has been installed.



CAUTION: Some tests require electrical skills because of the presence of high voltage. The danger of a fatal or serious shock hazard may be present. These tests are indicated by boldface times italic font [*characters like these*] coupled with an international warning symbol. If you do not possess the electrical skills required to perform these tests, obtain the services of a qualified electrician.

PCS3 Troubleshooting Guide

Symptom	Check These Items
<p>THE GL235 POWER ON LIGHT DOES NOT LIGHT</p> <p>(The SOLAR ON light is not ON when the GL235 is in the “Manual ON” position.)</p>	<ol style="list-style-type: none"> 1. Check for tripped breaker at the main power panel. 2. Check for blown 2-amp fuse inside GL235. 3. Ensure that timers are turned on. 4. Check for loose power wires inside GL235. 5. Check for 120 vac power inside the GL235 with a voltmeter. 
<p>PCS3 BLOWER DOES NOT TURN ON [Doesn't rotate]</p> <p>(Solar On light is ON. Check Sensor light is OFF.)</p>	<ol style="list-style-type: none"> 1. Power is incorrectly wired at GL235. 2. PCS3 is unplugged at switched attic outlet or power is missing or the attic outlet is not wired properly. 3. Thermostat is set too low on the GL235. Turn it to the maximum clockwise position. 4. GL235 2-Amp fuse is blown. Replace fuse. 5. GL235 relay is not activating or defective. 6. Internal PCS3 blower motor thermal cutoff. Wait 15 minutes for it to cool off & then retry. 7. Defective PCS3 power cord or plug. 8. Defective Motor starting capacitor. 9. Defective Motor. 10. Defective Solar controller. 11. Check for 120 vac at attic outlet with voltmeter. 
<p>MOTOR HUMS AND DOESN'T ROTATE BLOWER CAGE</p>	<ol style="list-style-type: none"> 1. Turn power off for 15-30 minutes and check again in case of thermal overload. If motor is okay, it will automatically reset/restart after it has cooled down. 2. Disconnect power to check the 20 microfarad 120 vac motor starting capacitor: Remove the two wires on the starting capacitor, which is located behind the front panel and accessed by removing the left side panel. Connect a new capacitor and insulate the terminals with electrical tape. Turn the power on and see if the motor turns. <u>Result A:</u> Motor turns. This indicates that the starting capacitor was defective. <u>Result B:</u> Motor still hums. This indicates motor is defective. This test assumes that the motor is cool to touch and has not been thermally cutoff by an overload. 

<p>PCS3 DOES NOT TURN OFF</p>	<p>1. The PCS3 is not wired for automatic operation by routing the power through the GL235 internal relay at terminals 5 and 6. Review the wiring diagrams on pages 14-15 and correctly wire the PCS3 so it can be controlled by the GL235.</p> <p>Caution: Cutoff all power before working on the power connections to the GL235. </p>
<p>VALVE OPERATOR ROTATES IN THE WRONG DIRECTION</p> <p>("Solar On" turns water off to PCS3.)</p>	<p>1. Valve was mis-staged as it was assembled. Turn valve operator switch to the other "ON" position. I.E. From ON1 to ON2 or vice versa.</p>
<p>VALVE OPERATOR DOES NOT ROTATE TO PROPER STOP POSITION.</p> <p>(Valve stops before it should.)</p>	<p>1. Internal limit switch needs adjusting. 2. Internal cam needs adjusting. 3. Internal mechanical stop needs adjusting. 4. Defective valve operator. Replace.</p>
<p>VALVE OPERATOR ROTATES IN ONE DIRECTION ONLY</p> <p>(Valve rotates to ON position but will not rotate to OFF. POWER ON and SOLAR ON lights are both on. Sensor Service light is OFF.)</p>	<p>TEST: Reverse the VOR Switch. Turn it from ON1 to the ON2 position or vice versa.</p> <p><u>Result A: Valve still does not rotate.</u></p> <p>1. Defective limit switch mechanical stop inside of valve operator. Loose screw on stop, etc. 2. Defective internal limit switch in valve operator. 3. Defective limit switch circuit in valve operator. 4. Defective valve operator.</p> <p><u>Result B: Valve now rotates in other direction.</u> This indicates that the valve operator is okay.</p> <p>1. Defective GL235 wiring at VOR plug or terminals. 2. Defective solar controller.</p>
<p>VALVE OPERATOR ROTATES SLOWLY</p> <p>(Valve operator creeps and doesn't reach its end stops.)</p>	<p>1. VOR power at the GL235 printed circuit board is reversed causing 12vac to be at the valve operator instead of 24vac. (12vac is used on older VORs) 2. Defective valve operator. 3. GL235 is powered with 110 volts at the 220 volt terminals. Correctly wire the GL235 for 110vac. Caution: Wiring 220vac power to the 120vac power terminals of the GL235 will permanently damage the control and void its warranty. </p>

<p>VALVE OPERATOR ROTATES ONLY WHEN VOR SWITCH IS FLIPPED</p> <p>(Valve operator rotates to stop positions but only when operated from the valve operator switch itself. Turning the GL235 switch to Manual ON or AUTO does not operate the valve. Sensor service light is OFF. Power ON light lit.)</p>	<ol style="list-style-type: none"> 1. The GL235 is wired for 220 vac operation but is supplied with 120 vac.
<p>CHECK SENSOR LIGHT IS ON STEADY</p>	<ol style="list-style-type: none"> 1. Shorted pool water temperature sensor. 2. Open pool water sensor. 3. Cable problem from GL235 to pool water sensor. 4. Loose screw at water sensor terminals in GL235.
<p>CHECK SENSOR LIGHT IS ON AND FLASHING</p>	<ol style="list-style-type: none"> 1. Attic temperature sensor is connected in parallel with PCS3's internal float wires. Connect the temperature sensor in series with PCS3 white wires. 2. Loose screw at GL235 solar sensor terminals. 3. Cable problem from solar sensor terminals in GL235 control to the attic temperature sensor. 4. PCS3 is mounted upside down causing open float condition. Don't laugh, it has happened. 5. Leak detection float inside PCS3 is detecting excess water and has opened the attic temperature circuit. 6. Leak detection float inside PCS3 is defective [open circuit vs. closed circuit switch]. 7. Shorted attic temperature sensor [ohmmeter reads a shorted condition across disconnected sensor wires]. 8. Open attic sensor [ohmmeter reads infinity across disconnected sensor wires].
<p>INSUFFICIENT HEATING (PCS3 does not appear to be heating the pool.)</p>	<ol style="list-style-type: none"> 1. Poor solar weather [No Sunshine]. 2. Pump Timer out of sync with solar energy collection time causing pool to cool too much time. 3. Water flow valves to PCS3 are shut off or restricted. 4. Bypass valve operator does not route water to PCS3. VOR switch is in the wrong "ON" position. 5. Pool Cleaner water flow interfering with the PCS3 water flow. OR, low water flow to PCS3. 6. GL235 is not in "AUTO" mode. 7. GL235 control does not supply power to PCS3. 8. PCS3 water flow and blower power are out of sync with each other resulting in no heat transfer. 9. Defective temperature sensor(s) or Open internal float circuit (prevents auto mode from activating). <p style="text-align: right;"><i>List is continued in next page right column >>>></i></p>

	<ol style="list-style-type: none"> 10. Attic temperature sensor is located in the discharge air stream of the PCS3. 11. Attic sensor not located at the peak of the attic. 12. Defective blower motor on PCS3. 13. No airflow through unit's water coil. Coil is facing the wrong direction inside the attic. 14. Insufficient airflow caused by obstacles, coil too close to wall, etc. 15. PCS3 is located on the floor of a large standup attic. The PCS3 should be located as close to the peak of the attic as is possible. Heat rises in attics. 16. Short circuiting of the PCS3 airflow. The PCS3 is mounted in such a way that air discharged from the face recirculates back into the intake of the coil. Thus the coil does not take in heated air on a regular basis: instead, it recycles the cooler discharged air. 17. Poor location for the PCS3 inside of the attic. 18. Excessive pool water cooling caused by an attached waterfall. It masks performance of PCS3 or offsets the heat gains of the PCS3. Waterfalls on a pool can have a dramatic cooling effect on pool temperature.
<p>PCS3 TURNS ON AT NIGHT; TURNS ON TOO EARLY OR TURNS ON TOO LATE</p> <p>(No attic heat is available for the pool. The attic is cooler than the pool or the same temperature. Or, the attic is warmer than the pool, but the PCS3 does not turn ON)</p>	<ol style="list-style-type: none"> 1. Pool water temperature sensor exposed to cooling winds, rain, etc. giving the GL235 a false indication of cold water temperatures [the attic falsely appears much warmer than the pool causing the PCS3 to turn ON]. Solution: Insulate the pipe around the water temperature sensor and cover with plastic to waterproof. 2. Sun heating water sensor causing it to give a false reading, which fakes out solar control electronics.
<p>SHORT SEASON (The swimming season is not as long as you would like but the PCS3 is heating the pool.)</p>	<ol style="list-style-type: none"> 1. GL235 is not in "AUTO" mode. 2. Heat loss opportunity exceeds heat gain opportunity. I.E. The pool is uncovered and the nights are cold causing excessive heat loss, which is not recovered during the solar day. Solution: Use a pool blanket or cover to eliminate the excessive heat convection losses, which occur directly from the surface of the pool. This will allow the pool to retain the free solar heat and extend the swimming season. This can be an important factor at the front and back ends of the swimming season. 3. Solar heating capacity and pool heat retaining capacity are no longer adequate for the current season's weather. Solution: Use a backup heater located down stream from the PCS3 to further extend the swimming season until the pool has to be winterized [if required].

<p>EXCESSIVE VIBRATION</p>	<ol style="list-style-type: none"> 1. Unbalanced squirrel cage assembly on motor. 2. Loose squirrel cage assembly. 3. Loose motor mounting or cabinet hardware. 4. Mounting requires a foam base for PCS3 to sit on. 5. Rigid mounting of PCS3 to the building structure. 6. Contamination on squirrel cage causing imbalance. 7. Motor bearings are defective. 8. PCS3 mounted using rigid pipes that are not supported properly inside the attic.
<p>HIGH PRESSURE AT FILTER (Total pressure should be less than 22-27 lbs. in the typical installation with a clean filter.)</p>	<ol style="list-style-type: none"> 1. Backwash and clean filter. 2. Check position of valves within support system. Incorrectly positioned valves can restrict water flow and increase pressure with the system. 3. Contact pool servicer. Problem is not in PCS3 system.
<p>POOR CIRCULATION (Pool water gets cloudy.)</p>	<ol style="list-style-type: none"> 1. Clean filter. 2. Check valve positions. 3. Check water flow rate from pump. 4. Check pump sizing. 5. Contact pool servicer. Problem is not in PCS3 system.
<p>HIGH ELECTRIC BILL</p>	<ol style="list-style-type: none"> 1. Check to see how many hours the filter pump is running. 2. Check the condition and size of the filter pump. 3. Slave the filter pump to the GL235 power relay using an external relay as shown online and also use a minimum runtime timer. This will ensure that only the minimum filtration time is achieved since the pump is usually the cause of high electric bills. Place GL235 in AUTO mode. This combination maximizes solar heat collection and minimizes the energy required to accomplish it with the pump. 4. Problem is not the PCS3. It only draws 5.0 amps maximum and its energy use is easily determined within a range of \$7.00 minimum to \$20.00 per month maximum depending upon local electricity rates. At 9¢ per kilowatt-hour and 10 hours per day, the PCS3 will cost an estimated \$18.63 per month or less to operate. 5. Have an energy audit performed. 6. Problem is not in the PCS3 system if it is working.

13. Safety Certification Label

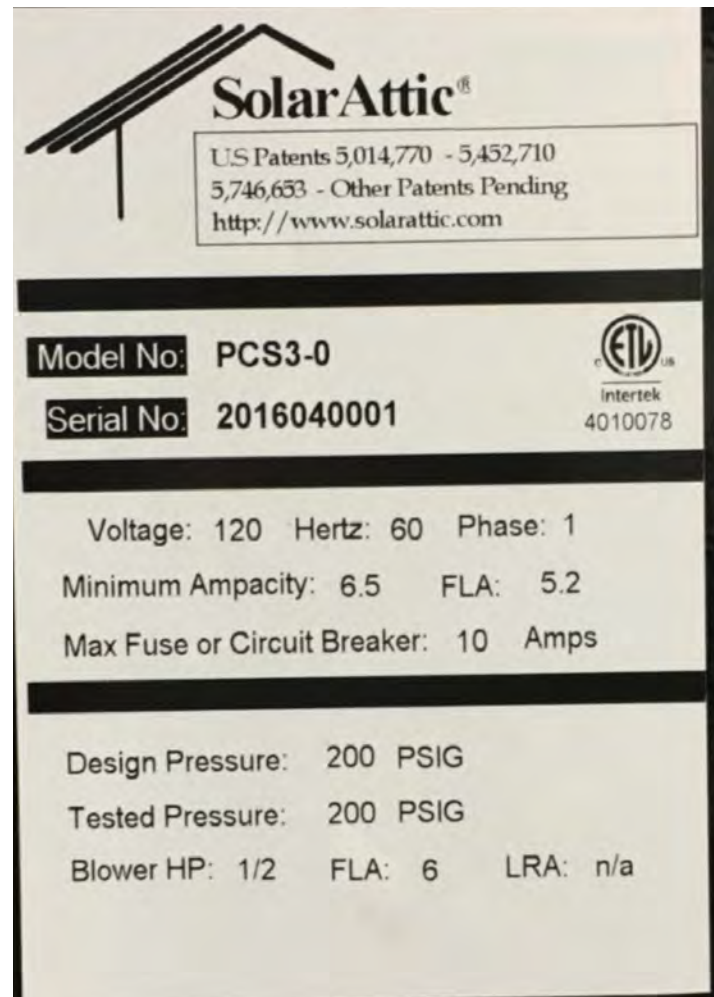


Model & Serial Number

The model number and serial number are printed on the data/safety certification label in the image shown at the right. For example, in the data label shown at the right:

Model: PCS3-0

Serial: 2016040001

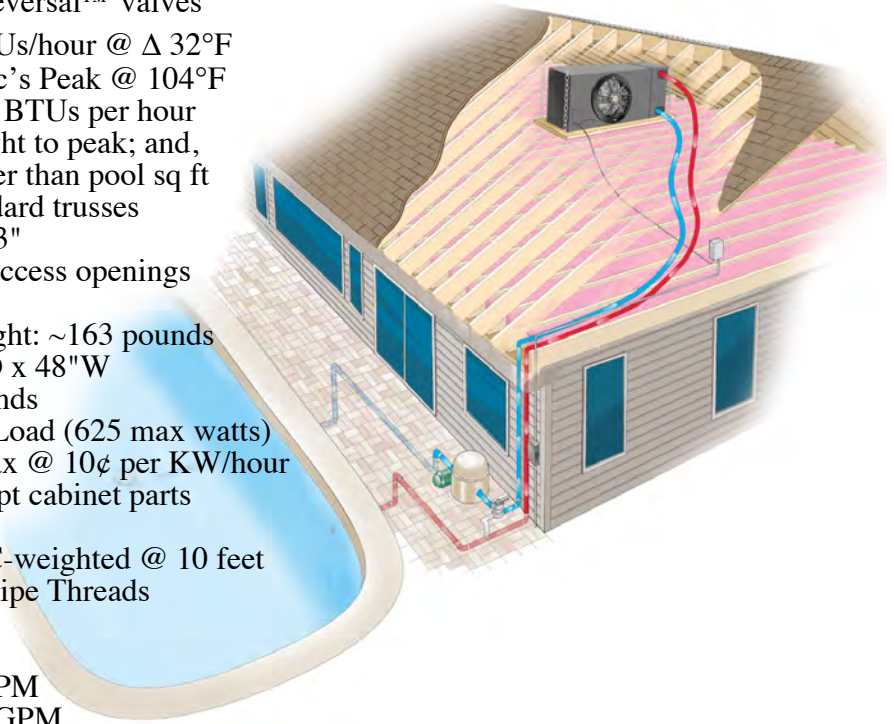


The SolarAttic PCS3 swimming pool heater is proudly manufactured in the USA by Northern Geo LLC at their manufacturing facility in Appleton, Minnesota. On the front panel of the PCS3 [left rear near the top], you will find the current ETL safety certification label. The Northern Geo manufacturing facility is an ETL certified facility and the products they manufacture receive regular ETL safety reviews during each year to maintain product safety certifications. When you buy the PCS3, you can have full confidence that the SolarAttic product is manufactured under the highest safety certification criteria. In addition, all electrical and other components used are also UL Listed.

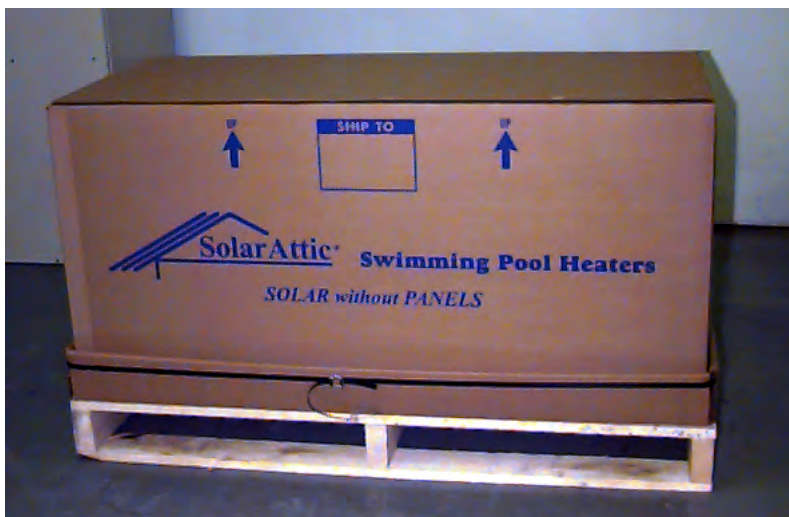
PCS3 Specifications

SOLAR Without PANELS

- Pool Sizes: Up to 1000 square feet or 35,000 gallons
- Up to 70,000 gallons with FlowReversal™ valves
- Nominal BTU Rating: 60,000 BTUs/hour @ $\Delta 32^{\circ}\text{F}$
I.E. Pool water input 72°F & Attic's Peak @ 104°F
- BTU Transfer Range: 20-150,000 BTUs per hour
- Attic space required: 3 ft min height to peak; and, square ft of attic equal to or greater than pool sq ft
- Attic access: Fits through all standard trusses
- Minimum access opening: 17"x 23"
- Can be disassembled for smaller access openings
- Size: 22"H x 14"D x 46"W
- Weight: ~142 pounds Filled Weight: ~163 pounds
- Shipping Crate Size: 28"H x 24"D x 48"W
- Crated Shipping Weight: 221 pounds
- Power: 120 vac 5.2 amps @ Full Load (625 max watts)
- Operating Cost: \$15-19/month max @ 10¢ per KW/hour
- U.L. Listed: All components except cabinet parts
- RPM 1745 Single Speed
- Noise: 62 db A-weighted; 67 db C-weighted @ 10 feet
- Plumbing Connections: 2" Male Pipe Threads
- Pressure Drop: 4-6 PSI typical
- Air Flow Rate: 2600 SCFM
- Water Flow Rate: Range 15-65 GPM
- Optimal Water Flow Rate: 40-50 GPM
- Modes: Manual Off & On
- Automatic Operation Uses Goldline Solar Control
- ETL Safety Certified



SolarAttic and PCS3 are trademarks of Northern Geo LLC, Appleton, Minnesota. PCS3 is manufactured by Northern Geo LLC headquartered in Appleton, Minnesota. FlowReversal information is available at www.flowreversalpool.com. Specifications are subject to change without notice. Box shown below is the PCS3 in its cardboard crate as manufactured and prior to shipping by Northern Geo's MN plant. U.S. Patents 5,014,770; 5,452,710; 5,746,653. Other patents pending.



PCS3 Maximizer

The Third Generation!

- **Uses 30% Less Energy**
- **Noise Free Design**
- **Vibration Free Design**
- **Smaller - Easier To Install**
- **Heats Pools For \$10/Month**
- **Fast 2-3 Year Payback**
- **Solar Without Panels!**

15. Warranty

SolarAttic Limited Warranty-PCS

All Pool Convection System (PCS) pool heaters are warranted to be free from manufacturing defects for a period of thirty-six (36) months from the date of first consumer installation or fifty-four (54) months from the date of shipment from the factory, whichever occurs first. The consumer must complete and return the warranty registration card and provide a receipted bill of sale as proof of warranty period within 30 days from the date of installation. Without registration and proof of purchase date, the warranty begins on the date of shipment from the factory. This Limited Warranty covers parts and labor to correct manufacturing defects only. It does not cover incidental fin damage nor any corrosive damage to heat transfer coils caused by improperly maintained chemical levels in pools. Ph levels outside the 7.2 to 7.6 range voids warranty. Use in Ocean or Sea water pools voids warranty. Use in pools utilizing salt, as a source of chlorine, does not void warranty. All chemical dispensers must be plumbed downstream. Dispensing pool chemicals directly into the pool heater voids warranty. Failure to properly winterize the pool heater in areas with freezing temperatures voids warranty. This warranty does not cover winter freeze damage, normal maintenance, labor charges for removal or installation of parts, transportation charges to the factory or for any other service calls or repairs.

Corrugated fins are used on the heat transfer coils for improved efficiency. They are waffled in appearance and not straight. Fin bending that has been combed with a fin tool does not affect performance and is not considered a manufacturing defect. Our obligation under this warranty is limited to the repair or replacement, at our factory, of any part which, upon our examination, has proven to be defective. Correction of such defects by repair or replacement (at our option) and return freight via lowest common carrier, shall constitute fulfillment of SolarAttic's obligation. This warranty does not apply to those products which, in SolarAttic's judgment, have been altered or repaired outside of our factory or by unauthorized factory representatives, subjected to misuse, negligence, accident, corrosive atmospheres, or operating beyond the limits of our design.

THIS WARRANTY CONSTITUTES THE BUYERS SOLE REMEDY. IT IS GIVEN IN LIEU OF ALL OTHER WARRANTIES. THERE IS NO IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. WHERE CIRCUMSTANCES CAUSE REMEDY EXPRESSED HEREIN TO FAIL OF ITS ESSENTIAL PURPOSE, SOLARATTIC'S LIABILITY SHALL NOT IN ANY EVENT EXCEED THE ORIGINAL PURCHASE PRICE. IN NO EVENT, SHALL SOLARATTIC BE LIABLE FOR CONSEQUENTIAL OR INCIDENTAL DAMAGES, WHETHER THE THEORY BE BREACH OF THIS OR ANY OTHER WARRANTY, NEGLIGENCE, OR STRICTLY TORT. DISPUTES ARISING UNDER THIS AGREEMENT SHALL BE GOVERNED BY APPLICABLE MINNESOTA LAW. THE VENUE FOR ALL DISPUTES IS SWIFT COUNTY, MINNESOTA.



Model Number _____

Serial Number _____

Date of Installation _____

Installer _____

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Made In The U.S.A. With Pride!



Original Appleton, Minnesota Manufacturing Crew in 2003.



SolarAttic
75 West Veum
Appleton, Minnesota 55311
www.solarattic.com

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Version 1.5 ETL - Contents subject to change.