

# HELIOTROPE POOL HM-4000C SOLAR POOL HEAT CONTROLLER FOR VALVE DIVERter CONTROL

## Installation Instructions

### DESCRIPTION

The HM-4000C Helio-Matic is a combination 120 Volt or 240 Volt controller for solar pool heating. The HM-4000C has a 24VAC valve output which controls the water flow direction with a three-way valve.

The HM-4000C is a programmable differential unit (6°ON/3° OFF or 9°ON/6° OFF), and is shipped from the factory preset at 6°ON/3° OFF. To change the differential to 9° ON/6° OFF, locate the jumper J2 on the outer right side of the circuit board and move the cap to the identified position. This is illustrated on the underneath side of the High Voltage wiring cover.

High Limit is adjustable from 60° to 104° and when the set temperature is reached the pumped water flow is directed away from the solar collectors. This adjustment is with the knob on the front panel.

The control normally uses one AS-2-10 and one IS-1.0 sensors. If a threaded sensor is desired in place of the IS-1.0 a BP-25-1/4" threaded brass plug can be utilized in the 1/4" pipe plug located in the filtration pump's strainer housing.

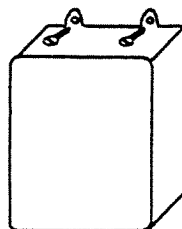
In normal installations, the solar collectors are at an elevation higher than the pool water surface and because of this configuration there is no need for additional collector freeze protection. Should the collector be mounted below the pool water surface, or the pump allowed to run 24 hours per day in freezing weather, there must be provision for collector freeze protection.

The HM-4000C is used to control a 12/24VAC, 0.8 Amp Flo-Verter valve for diverting the filtration pumped flow either to the collectors or bypassing the collectors.

### CONTROL INSTALLATION

Mount the control box with the two mounting tabs at the top of the box.

Outdoor mounting is acceptable because the control is inside a weather-proof housing.



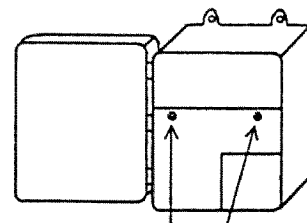
SCREW INTO  
WALL

THE CONTROL MUST BE LOCATED AT LEAST FIVE OR MORE FEET FROM THE POOL.

### POWER WIRING

The controller should be powered at all times. Check the line side (input) of the pump's Time Clock to determine voltage, either 120V or 240V.

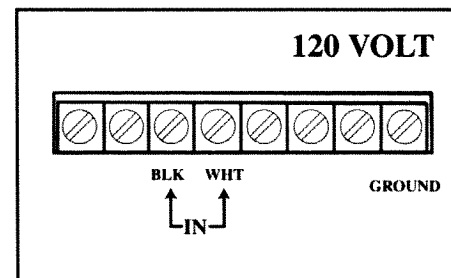
Disconnect the power to the Time Clock. Remove the cover on the High Voltage compartment of the controller by removing the screws.



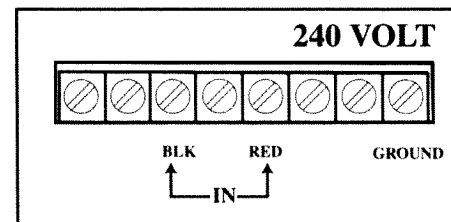
REMOVE SCREWS

The controller should be installed by a qualified electrician and conform to the National Electric Code and prevailing local codes. Depending on whether the supply voltage is 120 V or 240V, wire as shown in the illustration.

**120V** - Connect power-in wiring from the line Side of the Time Clock. Black conductor to terminal #3 and the white (neutral) to terminal #4.



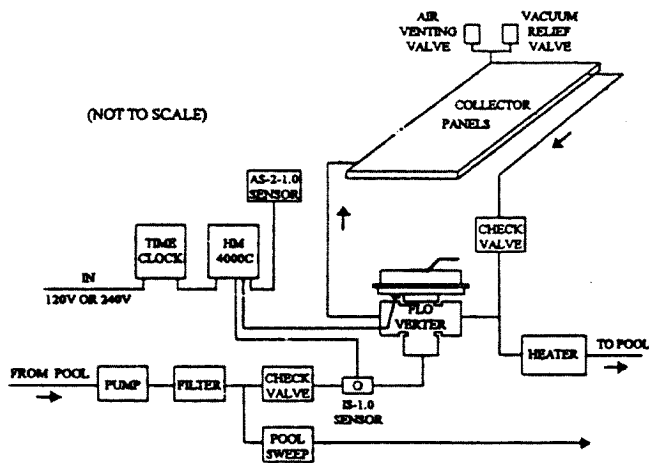
**240V** - Connect power-in wiring from the line side of the Time Clock to terminal #3 and #5.



To reduce the risk of electric shock, connect the "earth ground" terminal to the grounding terminal of the electrical service or supply panel with a continuous green insulated copper wire equivalent in size to the circuit conductors supplying this equipment, but no smaller than No. 12AWG (3.3mm).

## INSTALLATION OF THE FLO-VERTER VALVE

Install Flo-Verter valve in any position except upside down in the pool filtration system as shown in the illustration below:

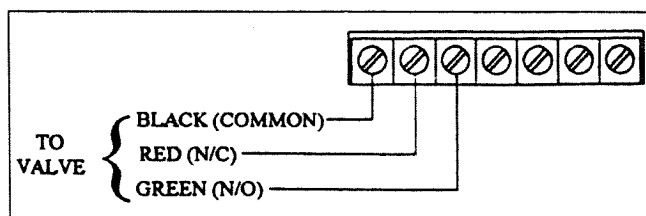


The valve diverter is pre-drilled with a small bypass hole which allows the collector to drain when the pump is off or when collection is not diverted through the collector. Install a check valve as shown in illustration. The check valve prevents water from the solar collectors passing backward through the filter into the pool when the pump is off.

### VALVE ELECTRICAL HOOK-UP

Connect the three wire cable from the valve to the appropriate terminals at the low voltage (Class II) connector which are identified as black, red, and green. (Note: The Flo-Verter valve will operate with either a 12 or 24VAC input.)

Should the valve be installed backwards, or it is desired to reverse the action of the valve, the green and red wires may be reversed. This causes a 180° change in the valve position.



When using a Jandy valve, connect the Jandy black wire to the terminal identified black and the other two wires to the terminals identified red and green. Depending upon how the valve was installed (which port to collector) the flow can be correctly directed by using the

toggle switch on the Jandy actuator.

### SENSORS INSTALLATION

The HM-4000C control normally uses an AS-2-10 "block sensor" and an IS-1.0. The thermal performance of the AS-2-10 tends to simulate the solar collector.

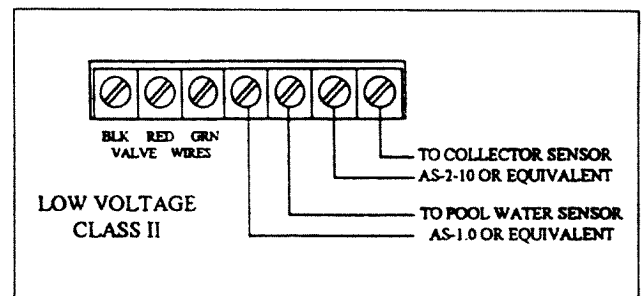
Mount the AS-2-10 sensor in such a position that it "sees" the same amount of sun as the collector array. It is not recommended that the AS-2-10 be in contact with the collector array.

The IS-1.0 sensor is designed to be inserted directly into a 1-1/2" or 2" PVC pipe. Drill a 5/16" hole in the pipe (do not pre-drill a pilot hole) and insert the sensor in place. Tighten down the hose clamp to insure a water tight installation. This sensor inputs pool temperature to the control for differential and high limit function. It should be located as close as possible to the point where water exits from the pool to supply the solar pump for accurate temperature sensing. Should a threaded sensor be desired instead of the IS-1.0, the BP-25-10 is a 1/4" brass plug, and is typically installed into the basket strainer which precedes the filtration pump.

### SENSOR ELECTRICAL HOOK-UP

Hook-up between the control and sensors is accomplished with an 18-24 gauge two conductor hook-up wire. The sensor leads are CLASS 2 wiring and carry 4 VDC. Because the sensor wiring is exposed to the elements it is important to utilize heavy insulated wire for its mechanical protection plus UV-inhibited cable to prevent sun damage and a service call within several years.

If lightning frequently occurs in your area, it is recommended to use a shielded hook-up wire with the shield grounded to the earth ground terminal. Connect the collector sensing wire to the Low Voltage terminals 6 and 7. Connect the pool sensor to terminals 4 and 5.



At the termination of all sensors, weather insulating procedures should be exercised. Wire nuts should be sealed with silicone.

## CONTROL OPERATION TEST

The following "Control Operation Test" will verify the correct operation of the control. These tests may be performed when the control is mounted and wired into the system but with the sensor wires disconnected. The HM-4000C may also be bench tested using a line cord for power attached to High Voltage terminals 3 and 4 for 120V, or terminals 3 and 5 for 240V with the ground connected.

1. Place the switch in the "TEST ON" position. With power applied, the "FLOW THRU COLLECTORS" light will turn on and the valve, if connected, will turn to the solar position. If the valve is not connected, output voltage may be measured on the low voltage connection terminal strip, and 24VAC should be present between black and green terminals.

With switch in "OFF" position, which is the bypass mode, 24VAC should be present between black and red terminals.

2. Place the switch in the "AUTOMATIC OPERATION" position. With the sensor lead-in wires removed from the terminal strip, install a 1K resistor on collector sensor terminals (6 and 7) and a 10K resistor on pool sensor terminals (4 and 5). The control should turn the "FLOW THRU COLLECTORS" indicator light on.

## THERMISTOR SENSOR TEST

All sensors manufactured by Heliotrope Pool are tested to be within  $\pm 0.6^\circ\text{F}$  of a reference test sensor. This means that all sensors manufactured by Heliotrope Pool are compatible with one another. If one sensor was to fail, it would be necessary to replace that failed sensor only. The sensors have a negative temperature coefficient, which means they exhibit a very high resistance at low temperatures and a very low resistance at high temperatures.

To properly perform a sensor check you will need a volt-ohmmeter set to perform resistance (ohms) measurements. Connect the volt-ohmmeter leads

TEMPERATURE vs. RESISTANCE CHART 10K Thermistor @ 25°C		
*F	*C	Ohms Resistance 10K
Open		Infinite
32	0	32,630
41	5	25,380
50	10	19,890
59	15	15,710
68	20	12,490
77	25	10,000
86	30	8,057
95	35	6,531
104	40	5,326
113	45	4,368
122	50	3,601
131	55	2,985
140	60	2,487
149	65	2,082
158	70	1,751
176	80	1,255
194	90	917
212	100	680
Short		0

to the two wire leads coming from the sensor. If the volt-ohmmeter shows an infinite reading (e.g. a "1" in the display on a digital volt-ohmmeter or no deflection on an analog type volt-ohmmeter) this indicates an open circuit. The HM-4000C sensor should read 10,000 Ohms at 77°F.

### Check the following:

1. The sensor lead-in wire to the sensor for a break in the wire. This would be found around sharp metal corners or edges such as roof flashing.
2. The sensor lead-in wire where it connects to the sensor leads for a possible disconnection.

If the volt-ohmmeter indicates a short (i.e. a "0" in the display on a digital volt-ohmmeter or full deflection on an analog type volt-ohmmeter).

### Check the following:

1. A nail or staple through the sensor wire shorting both leads.
2. Insulation that has been scraped off the sensor wires around sharp metal edges such as roof flashing.
3. At the sensor, where it is connected to the sensor lead-in wire to determine if the sensor itself is shorted.

If the volt-ohmmeter indicates a large variation in the resistance reading relative to what you believe is the true temperature referencing the Temperature versus Resistance chart, then a failure of the sensor may have occurred. However, this is not always the case. To further check the suspected faulty sensor you can compare it to another known good sensor placed in exactly the same spot with the same insulation, if any, around the sensors.

If this is not possible, you can disconnect the suspected faulty sensor from the system and compare it at room temperature with a good sensor. Be sure to leave both sensors in the room together for about 30 minutes so they can reach the same temperature. If the suspect sensor shows a large variation from the good sensor, this would confirm a faulty sensor. If not, the sensor is good and the large temperature variation experienced in the system is probably a problem in the plumbing of the system.

### **WHAT TO DO IF KNOB SETTING IS NOT ACCURATE**

An error between the knob setting and the actual water temperature can easily be corrected. With the circulation pump in the on condition, rotate the knob counter-clockwise until the flow through the collectors is stopped. At this point, check the pool water temperature with an accurate thermometer, loosen the set-screw on the knob and relocate the knob pointer to the correct temperature setting. Re-tighten the set-screw.

### **TROUBLESHOOTING THE FLOW-VERTER VALVE**

If the valve fails to operate as indicated by the indicator light "FLOW THRU COLLECTORS" then check the Low Voltage connection terminal at the HM-4000 controller for power. With the switch in the "TEST ON" position the black and green terminals should read 24VAC. With the switch in the "OFF" position the black and red terminals should read 24VAC. If both of these conditions exist either a wiring to the valve failure has occurred or there is a failure with the valve.

Individual motors, microswitches, and shaft with o-rings are available as replacement parts. Also a complete drive assembly is available and can be easily replaced without removing the valve from its plumbing connections.

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