5-Year Limited Solar Warranty

*This Five Year Limited Warranty statement is only applicable to **Solar controls and accessories** sold and installed within the USA and Canada* and supersedes any warranty statements dated prior to November 1, 2010.*

Hayward warrants its Hayward solar products to be free from defects in material or workmanship, under normal use and service for 5 years from date of manufacture, providing it is installed according to the installation instructions and specifications. The datecode stamped on the outside of the product and also coded on the printed circuit board will be the sole determination of manufacturing date.

To obtain warranty service or repair, please contact the place of purchase or the nearest Hayward authorized warranty service center. For more information, please contact the Hayward Technical Service Support Center or visit us on the web at www.haywardnet.com. Hayward will not assume any of the cost incurred in removal or reinstallation of the product. One year outside the USA and Canada.

The express warranty above constitutes the entire warranty of Hayward Pool Products with respect to its solar products and IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING A WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE. IN NO EVENT SHALL HAYWARD BE RESPONSIBLE OR ANY CONSEQUENTIAL OR INCIDENTAL DAMAGES OF ANY NATURE WHATSOEVER.

No wholesaler, agent, dealer, contractor, or other person is authorized to give any warranty on behalf of Hayward. This warranty is void if the product has been altered in any way after leaving the factory.

Charges

Years 1-3:   no charge
Years 4-5   60% of current list price plus $5.00 shipping and handling

Unless a copy of the original purchase invoice is enclosed, the manufacturing datecode on the product will be used to determine the repair charges. Hayward reserves the right to charge a nominal fee to cover inspection, test, and return freight for all controls where no faults or problems are detected. All charges will be COD (COD charge will be included) unless you already have an open account in good standing with Hayward. If the product returned can not be repaired, Hayward will offer and equivalent credit towards the purchase of any new Hayward product. Products that exhibit evidence of abuse, misuse, field damage (water/fire damage, line voltage applied to low voltage terminals, missing parts, etc.) or installed for more than the warranty period are not eligible for warranty repair replacement.

Aqua Solar
GL-235
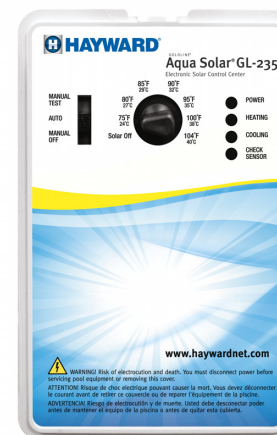
Electronic Solar Control

Operation and Installation Manual

GL-235

Description

The GL-235 is a differential temperature control for solar heating of pools, spas, and hot tubs. It provides differential temperature control with an adjustable, calibrated water temperature high limit. Automatic nocturnal cooling (for pools that overheat in hot climates) and recirculate freeze protection functions can be enabled/disabled via internal jumpers.

Input power can be either 115 or 240 VAC. The output controls a 24VAC automatic valve actuator. For older systems with 12VAC valves, an internal jumper can be moved to select 12VAC output operation. The GL-235 also has a high voltage output for controlling a filter pump or booster pump.

Specifications

Power: 105-130VAC, .5A 50/60Hz.
or
195-250VAC, .3A 50/60Hz

Output: Selectable low voltage 24VAC, 20VA, .85A
or
12VAC, 20VA, 1.7A

SPST-NO isolated contact
115VAC 1HP
240VAC 2HP

Sensors: 2 required (thermistor, 10Kohm @ 25C/77ºF).

Differential: on at 4ºF, off at 1.5ºF

Desired Pool Temp.: 70-104ºF calibrated scale or Solar Off, 75 (24ºC) - 104ºF (40ºC) on some models

Recirculate freeze: On at ≤40ºF (4.5ºC), off at ≥42ºF (5.5ºC), Enabled via jumper

Nocturnal cooling: On when collector 8ºF less than pool and pool hotter than limit, off when collector 3ºF less than pool or pool cooler than high limit. Enabled via jumper

Installation

Mounting
The GL-235 is designed for outdoor use. Mount the box vertically with the knockouts facing downward. For safety, the GL-235 must be a minimum of 5 feet (horizontally) from the pool or spa.

Power input
Turn off power at circuit breaker before wiring. Remove the internal panel to expose the wiring connections. Either 115VAC or 240VAC can be used. Refer to the input wiring diagram (Figure 1) on next page. **WARNING: Applying 240VAC to the 120VAC input terminals will cause permanent damage to the control.**

Grounding
Refer to NEC and local codes for specific grounding requirements. In general, a separate ground conductor must be run to the ground terminal on the pool service panel.

Low Voltage (LV) output: Solar Valve
The GL-235 controls a single valve. In most applications this is the solar valve, which diverts water through the collector panels or through the normal pool loop depending on conditions.

All controls are shipped with the output voltage set to the industry standard 24VAC. To use the GL-235 with older 12VAC valves, move jumper J4, located on the right side of the circuit board.

With the sensor disconnected from the unit, measure the resistance of the sensor using an ohmmeter. At room temperature (25ºC/77ºF) the sensor should measure approximately 10K ohms (10,000 ohms ± 1%). For other resistance measurements at different temperatures, consult the table at back of manual. If the sensor is not returning the correct value, it is defective and will need to be replaced. If the sensor is returning approximately the correct value, reconnect it to the terminals marked "SOLAR SENSOR". If the "CHECK SENSOR" indicator remains on, the unit is defective and needs to be replaced.

If FREEZE PROTECTION is enabled:
When a sensor is disconnected from the unit and freeze protection has been enabled, the GL-235 will recognize this as a freeze condition and activate freeze protection.

Temperature/Resistance/Voltage

All Hayward controls use 10K thermistor sensors. When disconnected from the control the sensor will read 10K ohms at 25ºC/77ºF. Refer to the chart below for the resistance at other temperatures. For a given temperature, the resistance reading should be accurate to ±1%. For a given resistance reading, the temperature reading should be accurate to ±0.5ºF. Voltage measurements should be accurate to ± 2%. Ohm measurements made with sensor disconnected from unit. Voltage measurements made with sensor connected to unit and power applied. Sensor voltages are DC volts.

°F	Ohms	Volts	°F	Ohms	Volts	°F	Ohms	Volts	°F	Ohms	Volts
1	82,719	4.46	41	25,391	3.59	81	9,076	2.38	121	3,679	1.34
2	80,142	4.45	42	24,704	3.56	82	8,861	2.35	122	3,602	1.32
3	77,656	4.43	43	24,037	3.53	83	8,651	2.32	123	3,527	1.30
4	75,255	4.41	44	23,391	3.50	84	8,447	2.29	124	3,454	1.28
5	72,937	4.40	45	22,764	3.47	85	8,249	2.26	125	3,382	1.26
6	70,698	4.38	46	22,156	3.45	86	8,056	2.23	126	3,312	1.24
7	68,535	4.36	47	21,566	3.42	87	7,867	2.20	127	3,244	1.22
8	66,447	4.35	48	20,993	3.39	88	7,684	2.17	128	3,177	1.21
9	64,428	4.33	49	20,438	3.36	89	7,506	2.14	129	3,112	1.19
10	62,479	4.31	50	19,900	3.33	90	7,333	2.12	130	3,049	1.17
11	60,595	4.29	51	19,377	3.30	91	7,164	2.09	131	2,987	1.15
12	58,774	4.27	52	18,870	3.27	92	6,999	2.06	132	2,926	1.13
13	57,014	4.25	53	18,377	3.24	93	6,839	2.03	133	2,867	1.11
14	55,313	4.23	54	17,899	3.21	94	6,683	2.00	134	2,809	1.10
15	53,669	4.21	55	17,435	3.18	95	6,530	1.98	135	2,752	1.08
16	52,078	4.19	56	16,985	3.15	96	6,382	1.95	136	2,697	1.06
17	50,541	4.17	57	16,548	3.12	97	6,238	1.92	137	2,643	1.05
18	49,054	4.15	58	16,123	3.09	98	6,097	1.89	138	2,591	1.03
19	47,616	4.13	59	15,711	3.06	99	5,960	1.87	139	2,539	1.01
20	46,225	4.11	60	15,310	3.02	100	5,827	1.84	140	2,489	1.00
21	44,879	4.09	61	14,921	2.99	101	5,697	1.81	141	2,440	0.98
22	43,577	4.07	62	14,543	2.96	102	5,570	1.79	142	2,392	0.97
23	42,318	4.04	63	14,176	2.93	103	5,446	1.76	143	2,345	0.95
24	41,099	4.02	64	13,820	2.90	104	5,326	1.74	144	2,299	0.93
25	39,919	4.00	65	13,473	2.87	105	5,208	1.71	145	2,254	0.92
26	38,777	3.98	66	13,136	2.84	106	5,094	1.69	146	2,210	0.90
27	37,671	3.95	67	12,809	2.81	107	4,982	1.66	147	2,167	0.89
28	36,601	3.93	68	12,491	2.78	108	4,873	1.64	148	2,125	0.88
29	35,565	3.90	69	12,182	2.75	109	4,767	1.61	149	2,084	0.86
30	34,561	3.88	70	11,882	2.72	110	4,664	1.59	150	2,044	0.85
31	33,590	3.85	71	11,589	2.68	111	4,563	1.57	151	2,005	0.84
32	32,648	3.83	72	11,305	2.65	112	4,464	1.54	152	1,966	0.82
33	31,737	3.80	73	11,029	2.62	113	4,368	1.52	153	1,929	0.81
34	30,853	3.78	74	10,761	2.59	114	4,274	1.50	154	1,892	0.80
35	29,998	3.75	75	10,500	2.56	115	4,183	1.47	155	1,856	0.78
36	29,169	3.72	76	10,246	2.53	116	4,094	1.45	156	1,821	0.77
37	28,365	3.70	77	9,999	2.50	117	4,007	1.43	157	1,787	0.76
38	27,587	3.67	78	9,758	2.47	118	3,922	1.41	158	1,753	0.75
39	26,832	3.64	79	9,525	2.44	119	3,839	1.39	159	1,720	0.73
40	26,100	3.61	80	9,297	2.41	120	3,758	1.37	160	1,688	0.72

Troubleshooting

No Power Indicator
• Check main power circuit breakers.
• Check fuse

Fuse Replacement
The GL-235 is protected by a fuse located on the left side of the main circuit board. Replace the fuse with a 2A, type ATO-2 fuse, readily available in most automotive or electronics stores.

If "Heating" is always on
Disable recirculate freeze protection if enabled. Check that the switch is in the "AUTO" position. Next verify that the control circuitry is operating properly by disconnecting the solar sensor from the terminal block. The "Heating" LED should go off and the "CHECK SENSOR" LED should begin to blink. If "Heating" remains on, there is an internal circuit failure and the GL-235 will have to be returned for repair.

If "Heating" never comes on
Verify that the switch is in the "AUTO" position, the desired pool temperature dial is set higher (hotter) that the actual pool temperature, and the solar sensor is warmer than the pool water. Also check that the switch on the valve actuator is NOT in the "OFF" position. Disconnect the pool sensor from the terminal block and verify that the "CHECK SENSOR" LED turns on. If the "CHECK SENSOR" LED does not turn on, there is an internal failure and the GL-235 will have to be returned for repair. Reconnect the pool sensor and verify that the "Check Sensor" LED turns off. Next, disconnect the "solar" sensor from the terminal block and verify that the "CHECK SENSOR" LED begins to blink. If the "CHECK SENSOR" LED does not begin to blink, there is an internal failure and the GL-235 will have to be returned for repair.

"CHECK SENSOR" indicator on
If the "CHECK SENSOR indicator is on and NOT blinking, there may be a possible open circuit or short circuit with the pool sensor. Using a voltmeter, measure the DC voltage across the terminals of the pool sensor as indicated in figure 5. If the voltage is close to zero volts, the sensor has a short to ground. Remove the sensor from the terminal block and measure the voltage across the pool terminals again. If the voltage is still close to zero volts, there is an internal short and the unit must be returned for repair. If the voltage is close to five volts, the pool sensor itself may be at fault.

With the sensor disconnected from the unit, measure the resistance of the sensor using an ohmmeter. At room temperature (25°C/77°F) the sensor should measure approximately 10K ohms (10,000 ohms ± 1%). For other resistance measurements at different temperatures, consult the table at back of manual. If the sensor is not returning the correct value, it is defective and will need to be replaced. If the sensor is returning approximately the correct value, reconnect it to the terminals marked "POOL SENSOR". If the "CHECK SENSOR" indicator remains on, the unit is defective and needs to be replaced.

"CHECK SENSOR" indicator blinking
If the "CHECK SENSOR indicator is blinking, there may be a possible open circuit or short circuit with the solar sensor. Using a voltmeter, measure the voltage across the terminals of the solar sensor. If the voltage is close to zero volts, the sensor has a short to ground. Remove the sensor from the terminal block and measure the voltage across the solar terminals again. If the voltage is still close to zero volts, there is an internal short and the unit must be returned for repair. If the voltage is close to five volts, the solar sensor itself may be at fault.

The GL-235 provides two different types of connections to the pool/spa actuators. For older actuators with no wire end connector, a 3 position terminal block is used. Connect the wires to the proper terminal block according to the color code shown in Figure 4. If the valve operates opposite to the way it is supposed to, reverse the red and white wires. Be careful not to short the valve output wiring. The GL-235 is fused and shorting the output will require replacing the fuse.

For newer Hayward, Compool and Jandy actuators (with wire end connectors), two 3-pin connectors are supplied. Plug the actuator into one of the two 3 pin connectors as shown in figures 2 or 3. If the valve operates opposite to the way it is supposed to, disconnect and plug into the other connector.

High Voltage (HV) output: Booster Pump
The GL-235 can control a high voltage booster pump in addition to the normal low voltage solar valve. Note the high voltage relay contacts are isolated so that the booster pump can be run on a separate circuit, as required by many local codes. The GL-235 turns on, the valve output will operate first, and then the HV relay will operate 30 seconds later.

High Voltage (HV) output: Timeclock Override
The GL-235 can also be used to override the filter pump timer. This is very important if recirculate freeze protection or nocturnal cooling functions are being used. Also, this function can be used on systems where the system should operate whenever solar heat is available, regardless of the timer settings. The HV relay will operate approximately 30 seconds after the LV relay.

Sensor Mounting and Wiring
Most installations use a PC sensor to measure the pool temperature and another PC sensor to measure the solar temperature. Alternatively, an SC-¼ sensor can be screwed into the pump strainer basket to measure the pool temperature.

Pool Sensor: Drill a 3/8" (or 5/16") hole in the PVC pipe. Remove burrs around the hole. Check that the O-ring is seated on the PC sensor and then insert sensor into pipe. Tighten hose clamp over the sensor to make a seal—DO NOT OVERTIGHTEN.

Solar Sensor: Use a screw or silicon adhesive to attach the sensor near the solar collector array. The sensor does not have to be attached to the collectors. It is only important that the sensor be exposed to the same sunlight as the collectors. Additionally, the underside of the sensing element may be covered with silicon to minimize wind cooling.

Other 10K ohm Hayward sensors may be substituted. Wire should be twisted pair 20AWG. Sensor wiring run outdoors must be rated for outdoor use and ensure that the wire connections are protected from the weather. **Do NOT run sensor wires in the same conduit or multiconductor cable as the valve actuator wires or any 120/240V circuit.** For long runs or runs near other electrical wiring use shielded cable (Belden 8428 for outdoor use). Ground the shields to the GL-35/LV ground screw.
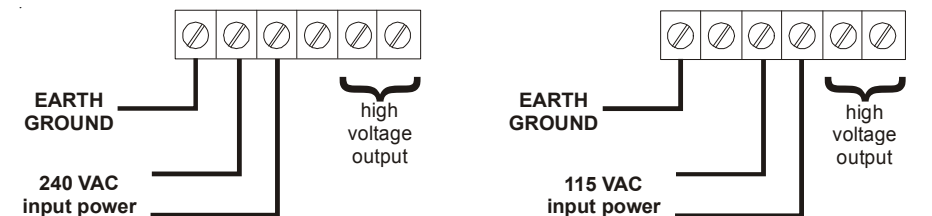
EARTH GROUND   high voltage output
240 VAC input power

EARTH GROUND   high voltage output
115 VAC input power

Figure 1

Freeze Protection
If you are relying on the collectors naturally draining to provide freeze protection, it is very important that you use a **non-positive seal valve or drill a hole (1/8"--1/4") in the diverter of a positive seal valve to allow the collectors to drain.** Alternatively, the GL-235 control can provide recirculate freeze protection. If enabled, when the GL-235 senses a freeze condition at the collector sensor, it will allow circulation of relatively warm water from the pool to the collector panels.

The GL-235 will allow recirculation when the collector temperature falls below 40ºF and will stop circulation when the collector temperature rises above 42ºF. While this type of freeze protection has proven to be adequate in relatively mild climates, it is extremely important that the sensors be properly placed and that the homeowner realize that the system is unprotected in the event of a power failure. Recirculate freeze protection is NOT recommended in climates where freezing temperatures are common or last for extended periods.

Hayward strongly recommends the use of GC-3 freeze snap switches if freeze protection is being utilized. Snap switches should be wired in series with the collector sensor. Placement of the snap switches at the coldest point of the collector array and exposed plumbing will help assure that freeze protection starts early enough to protect the system.

The GL-235 is shipped from the factory with recirculate freeze protection disabled (the jumper is present but installed on one pin only). To activate recirculate freeze protection, install the jumper across both pins marked "RECIRC", located near the top right of the main circuit board.

**If recirculate freeze protection is to be used on a GL-235, either:**
• The filter pump must be set for continuous operation
                or
• The GL235 High Voltage Output must be wired for Timer Override function.

Nocturnal Cooling
The GL-235 has nocturnal cooling logic, which can be enabled/disabled via a jumper on the main circuit board. During nighttime hours, when enabled, the GL-235 will circulate relatively warmer water from the pool to the collector panels, thus cooling the pool over time. The GL-235 will circulate water when the collector temperature <u>AND</u> the pool temperature is hotter than the high limit setting. Circulation will stop when the collector temperature is 3ºF less than the pool temperature <u>OR</u> the pool temperature is cooler than the high limit setting. The GL-235 is shipped from the factory with nocturnal cooling disabled (the jumper is present but installed on one pin only). To activate nocturnal cooling, install the jumper provided onto the two pins marked "COOLING" located near the top right of the main circuit board.
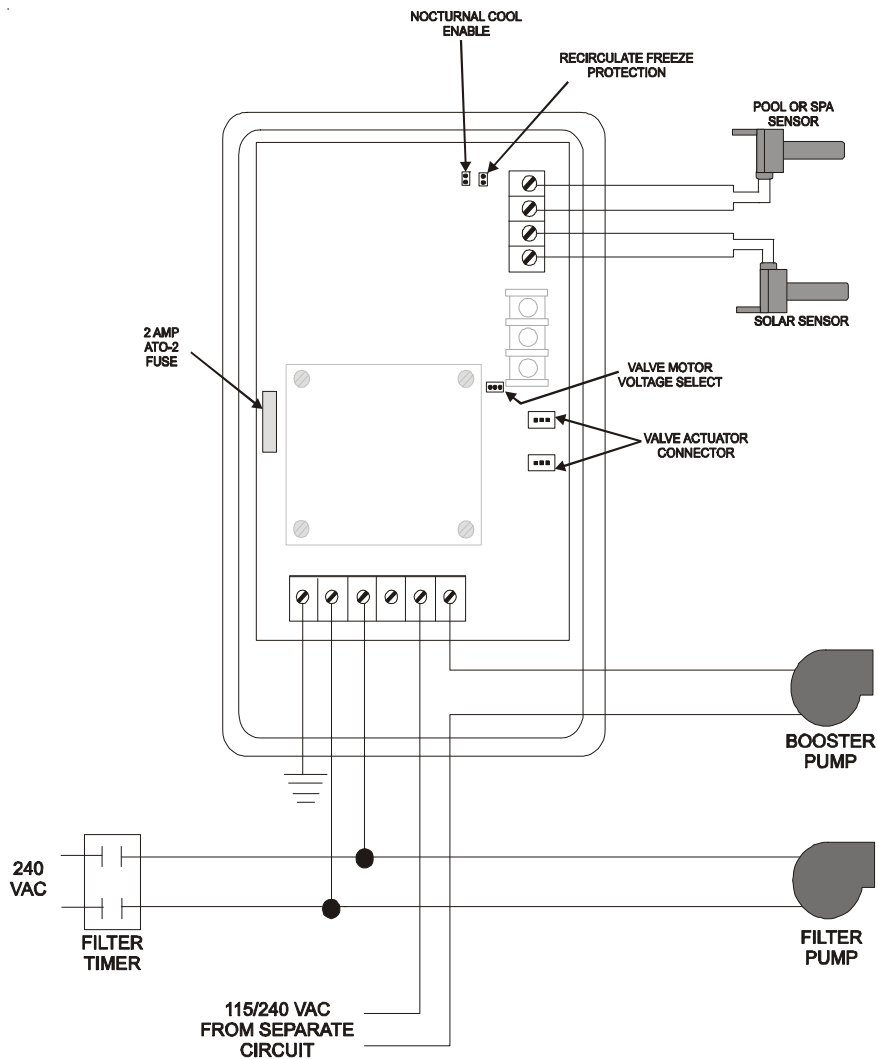
If nocturnal cooling is to be used, either:
• The filter pump must be set for continuous operation
                or
• The GL235 High Voltage Output must be wired for Timer Override function.
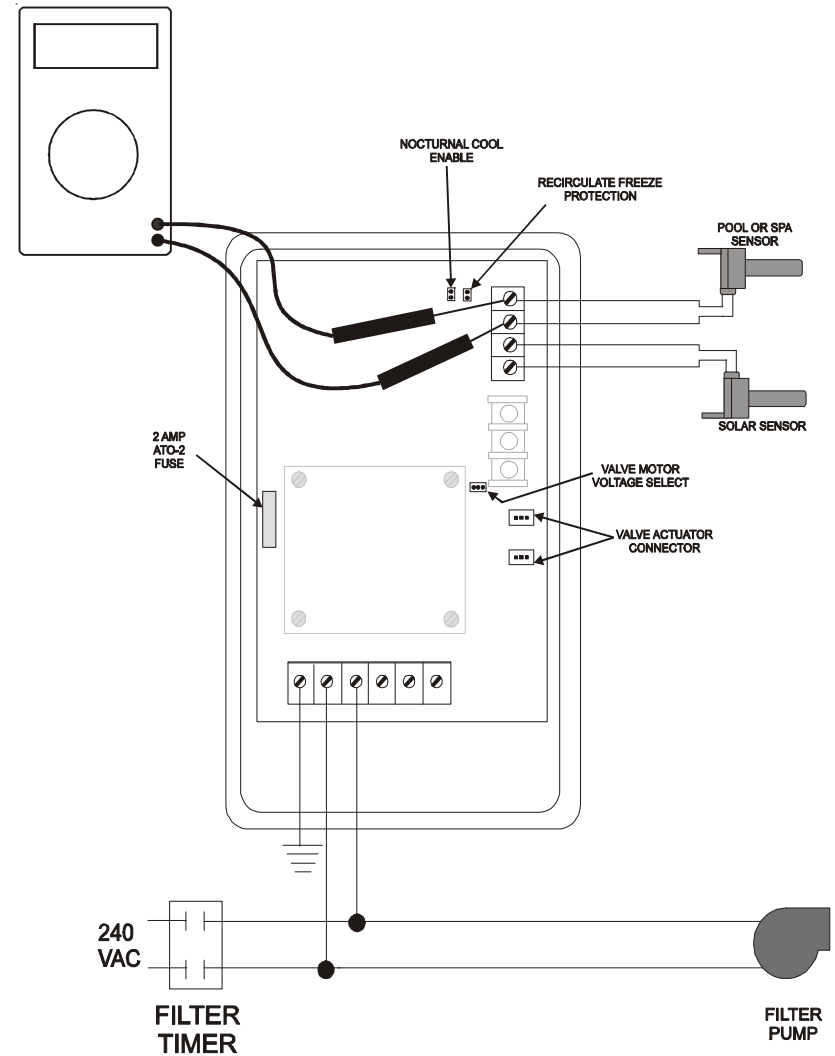
Measuring Voltage of Pool Sensor
(Use the same method to measure the Solar Sensor)

Figure 5
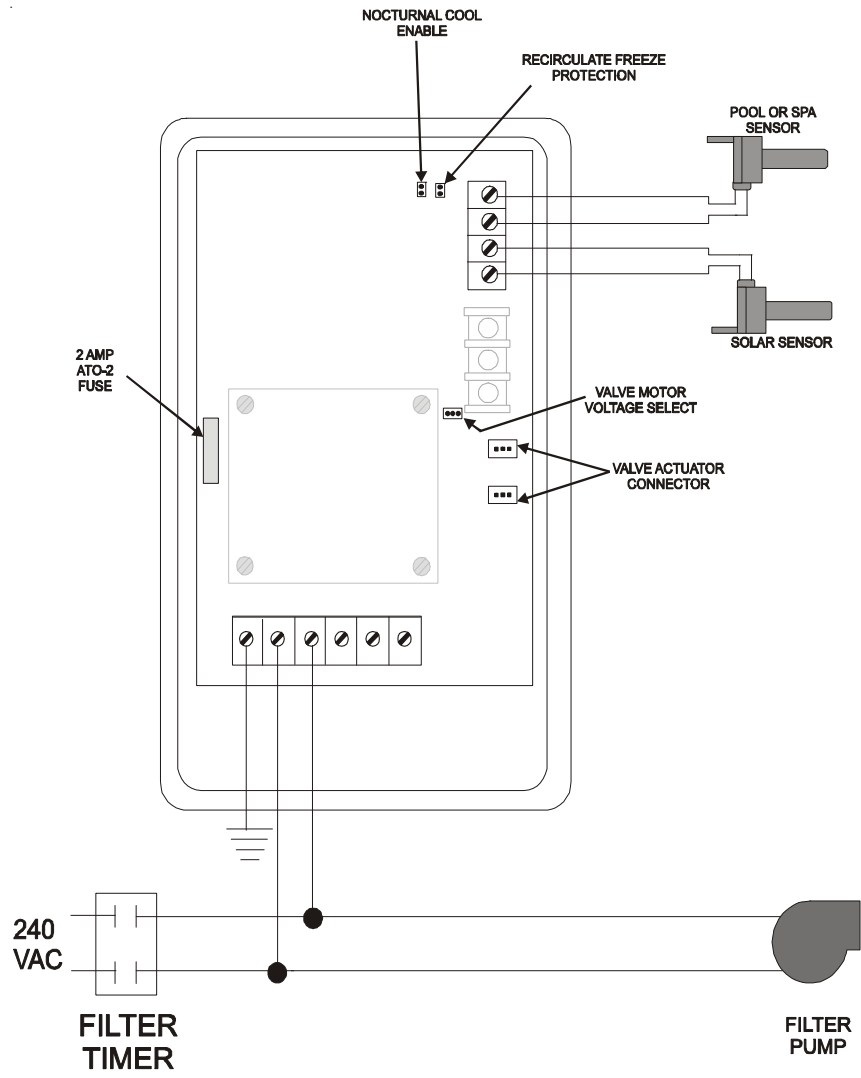
GL-235 high voltage output used for Booster Pump

Figure 4

Operation

For normal operation place the switch in the "AUTO" position and adjust the desired pool/spa temperature setting. The "Power" LED indicator should always be on. (NOTE: During initial power up, the "POWER indicator will blink for approximately 10 seconds while it stabilizes temperature readings). The "Heating" LED indicator will show when the system is collecting solar heat. If the nocturnal cooling function is enabled inside the GL-235, the "Cooling" LED indicator will show when the system is dissipating excess heat.

In the "AUTO" position, the GL-235 will heat the pool or spa (rotate valve to solar loop) when the collector (solar) sensor temperature is higher than the pool/spa sensor temperature by 4ºF or more AND the pool/spa temperature is less than the "Desired Temperature" setting. The GL-235 will stop heating (return valve to pool loop) when the two sensor temperatures get to within 1.5ºF OR the pool/spa sensor is above the "Desired Temperature" setting.

To test the system, move the switch to "MANUAL TEST" and verify that both the "Heating" and "Cooling" indicators light and that the valve(s) are in the solar loop position. Move the switch to "MANUAL OFF" and verify that all indicators except "Power" are off. The valve(s) should be in the normal recirculating loop position. If the valve(s) positions are working in reverse, follow the instructions in section marked **"Low Voltage (LV) : Solar Valve"** to correct. **WARNING: If recirculate freeze protection is being used, do NOT leave the switch in the "MANUAL OFF" position during cold weather**. Also note that the switch does NOT turn power off to the GL-235.

Basic Installation of GL-235

Figure 2
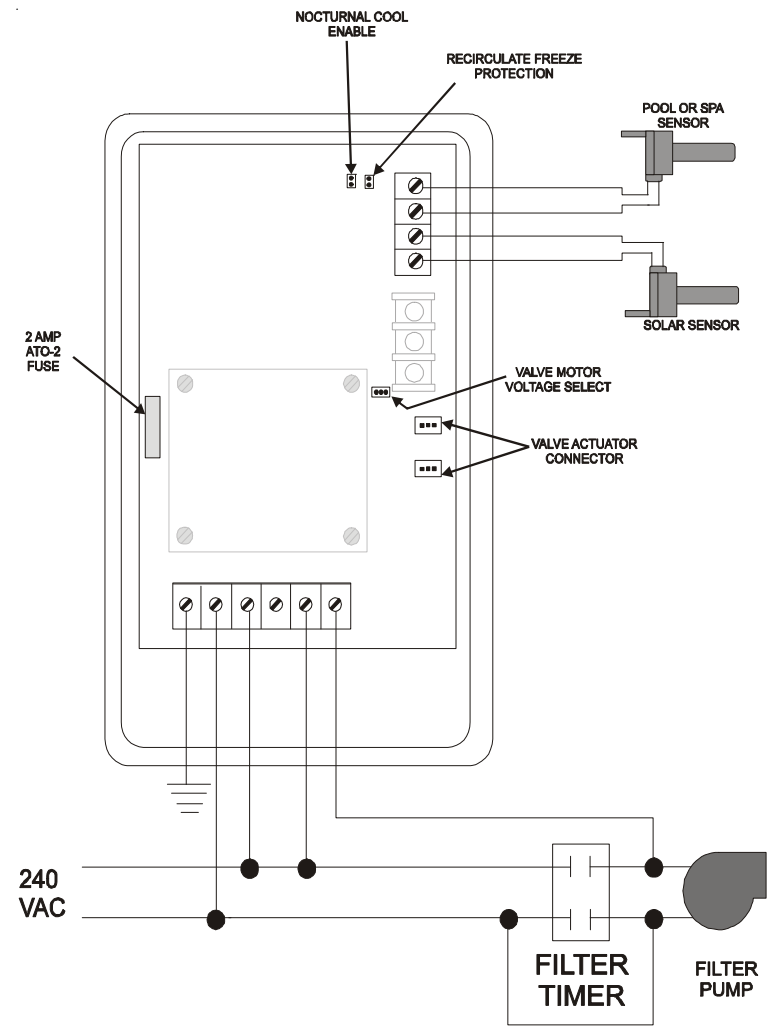
GL-235 high voltage output used for Timer Override

Figure 3