



**roman  
fountains**<sup>®</sup>

*America's Fountain Company!*<sup>SM</sup>

# *Operations and Maintenance*

## Section 1

## THANK YOU

Thank you for purchasing your fountain equipment from Roman Fountains. We appreciate your business and invite you to contact us whenever you require assistance.

ROMAN FOUNTAINS  
P.O. BOX 10190  
Albuquerque, NM 87184  
Phone: (800) 794-1801  
FAX: (505) 343-8086  
<http://www.romanfountains.com>

**Please be prepared to provide:**

- Date of purchase
- Invoice number(s)
- Name of original purchaser
- Model number(s)
- Any other identifying number(s)
- A brief description of the problem

### **ELECTRICAL SAFETY**

*This water feature utilizes high voltage electrical equipment and is therefore potentially dangerous to operating and maintenance personnel if proper procedures are not followed.*

*Only persons qualified and authorized should be allowed to operate or maintain this electrical equipment. Failure to follow procedures can result in injury, fatal shock, or significant damage to equipment.*

*GFCI breakers should be tested at regular intervals.*

**This guide describes how fountain systems work. It outlines the basic procedures for operation and maintenance. The Wiring diagrams and Piping drawings included with this manual help fill out the picture of what this fountain is about and how it works.**

**For more detailed information on your equipment, refer to Section 3 of the *Operations and Maintenance* document.**

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## **READ THIS FIRST**

### **QUICK START PROCEDURES**

#### **EQUIPMENT INSTALLATION**

Complete piping, conduits, and wiring per approved shop/installation drawings.

#### **CLEAN AND FLUSH**

***This Step Is Critical -- Fountain supply and suction lines must be clean before pumping equipment is operated. Failure to do this can damage the pumps.***

Before vault/skid installation, flush and pressure-check all suction and discharge water lines to the basin. After vault/skid installation, thoroughly clean all fountain basin(s) and thoroughly flush all piping to remove remaining construction debris.

#### **FILTRATION**

If equipped with a sand filter, fill sand filter tank to the required level with specified sand media.

***Note: Cartridge filters already have a cartridge element installed at the factory.***

***Note: Chemical feeders do not need to be filled at this time. They can be filled and adjusted after the fountain initial startup is complete.***

#### **CHECK FOR LEAKS**

Close all of the pumping equipment valves and fill the basin to the specified water level. Watch the water level. If it drops, find and fix the leaks.

Slowly open all valves on the pumping equipment that connect to the basin and fill (prime) the system. Allow the level to stabilize and check for leaks on the pumping equipment (during shipment and installation, union connections can come loose).

If the pump is above water level and does not automatically fill the pump volute, remove the strainer basket cover and fill the pump with water. **CRITICAL- DO NOT START THE PUMPS DRY.**

#### **POWER UP**

Verify that incoming power is the same as the control panel label (inside door). Turn ON the control power breaker. Verify that the water level is correct and push the reset button for the Water Level Controller (this will clear the red light). Turn the panel switches briefly to the MANual (H) position and verify the operation of the fill valve and motor/lighting contactors. Put the Fill Valve switch in AUTO.

In vault installations, vacuum the debris from the sump and turn ON the sump breaker (consult wiring diagram in panel). Fill sump with water and confirm that the sump pump drains the sump and shuts OFF. Check the operation of the ventilation fan (vent fan should run continuously).

Turn ON the pump breakers and “bump” the pump **briefly** with the panel switches in the MANual position. **CHECK THE ROTATION** of 3-Phase pumps. ***Reverse rotation may damage the pump.***

Run the pumps in MANual position for a few minutes and check for leaks. Also, watch the basin water level and, if the level drops, make sure the Fill System automatically refills the fountain.

#### **ADJUST THE FOUNTAIN**

Adjust the fountain display to the desired effect by adjusting the valves on the discharge lines to the fountain. ***NEVER ADJUST FLOW USING THE VALVES ON THE SUCTION LINES - THIS WILL DAMAGE THE PUMP.*** Suction isolation valves should be fully open when the system is operating.

## INTRODUCTION

While the mechanical systems in a fountain are easily understood, the electrical system is a mystery for some people. All fountains have pumps, typically some type of filtration, water effects, lights, a collection of fittings, and an electrical system. This guide will help tie all of the pieces, mechanical and electrical, together so you can maintain your fountain.

All of the electrical systems in your fountain are designed to run automatically (AUTO). Several conditions (i.e., time clock, water level) must be met before each of the systems can run. For instance, on some systems before the pump is allowed to run, the time clock must be on, the water level OK, and the selector switch on the control panel must be in AUTO. The following are descriptions of the different type of devices used for these conditions.

**Electronic Time Clock** – has a small contact that is not used to power pumps and lights directly, instead the contact provides power to other conditions. See the [TIME CLOCK](#) section.

**Mechanical Time Clock** - used in the simplest of fountain systems. It has high-current (30A) contacts that are used to switch the power directly to the pump or lights.

**Three-Position Selector Switch (HOA)** - used to put systems into AUTOMATIC, MANUAL, and OFF modes. In AUTO mode, the system requires all of the other conditions before the system will run. In MAN mode, the system will operate without any other condition and should be used for maintenance only.

**Water Level Control System** - When the system is equipped with an electronic water level control, the pumps and fountain lights will only operate when the Water Level is above Low Level Cutoff. See the [ELECTRONIC WATER LEVEL CONTROL](#) section.

**Wind Control System** - used to turn off or reduce the height of water effects in high wind conditions. See the [WIND CONTROL](#) section.

**Automatic Backwash Valve** - mounted to the top of a sand filter. It automates the backwash function by changing the valve position from “filter mode” to “backwash mode” and back again. To make this change the filter pump must be stopped. A single contact, mounted on the backwash valve controller, tells the filter pump when to run. See [FILTRATION](#) section.

**Pressure Switch** - used to monitor the discharge pressure of a pump. If the pump cannot deliver adequate pressure, the pressure switch will not let the pump run. The pressure switch has a contact that closes when the pressure reaches the set point of the switch. Normally this switch is wired to a timer in the control panel that lets the pump start and build pressure.

**Photo Cell** - used to turn on the fountain lights. Typically this is connected to a contact that is switched on when the display pump is running. That way if the pump is running and it is dark, the lights are on.

***Since every fountain is slightly different, the following page is a checklist of the requirements for your fountain systems.***

## YOUR EQUIPMENT

### SUBMERSIBLE PUMP SYSTEM

- Time Clock
- Selector Switch

### FILTER PUMP SYSTEM

Your Filter Pump requires the checked devices to operate in AUTO.

- |  |  |
|--|--|
| <input type="checkbox"/> Time Clock      | <input type="checkbox"/> Wind Control        |
| <input type="checkbox"/> Level Control   | <input type="checkbox"/> Auto-Backwash Valve |
| <input type="checkbox"/> Selector Switch | <input type="checkbox"/> Pressure Switch     |

Your Filter Pump has the checked devices that require maintenance.

- |  |   |
|--|---|
| <input type="checkbox"/> Basket Strainer                 | <input type="checkbox"/> Cartridge Filter |
| <input type="checkbox"/> Bromine/Chlorine Erosion Feeder | <input type="checkbox"/> Skimmer          |
| <input type="checkbox"/> Sand Filter                     |   |

### DISPLAY PUMP SYSTEM

Your Display Pump requires the checked devices to operate in AUTO.

- |  |  |
|--|--|
| <input type="checkbox"/> Time Clock      | <input type="checkbox"/> Wind Control    |
| <input type="checkbox"/> Level Control   | <input type="checkbox"/> Pressure Switch |
| <input type="checkbox"/> Selector Switch |  |

Your Display Pump has the checked devices that require maintenance.

- |  |                                  |
|--|----------------------------------|
| <input type="checkbox"/> Basket Strainer | <input type="checkbox"/> Skimmer |
|--|----------------------------------|

### FOUNTAIN LIGHTING SYSTEM

Your Fountain Lighting requires the following devices to operate in AUTO.

- |  |  |
|--|--|
| <input type="checkbox"/> Time Clock    | <input type="checkbox"/> Photocell       |
| <input type="checkbox"/> Level Control | <input type="checkbox"/> Selector Switch |

### WATER LEVEL CONTROL

Your Fountain uses the following Water Level Control method.

- |  |  |
|--|--|
| <input type="checkbox"/> One-Function-Mechanical (single level mechanical float)         | <input type="checkbox"/> Three-Function Electronic Level Control with Low-Level Protection |
| <input type="checkbox"/> Two-Function Electronic Level Control with Low-Level Protection |  |

### WIND CONTROL

Your Fountain uses the following to adjust the Fountain Display during Windy Conditions

- |   |   |
|---|---|
| <input type="checkbox"/> Turns off the pump | <input type="checkbox"/> Opens a diverter valve |
| <input type="checkbox"/> Engages VFD        |   |

### WATER TREATMENT

Your system has the following Water Treatment equipment.

- |  |   |
|--|---|
| <input type="checkbox"/> Chlorine/Bromine Erosion Feeder | <input type="checkbox"/> Silver Ion                       |
| <input type="checkbox"/> Ozone Generator                 | <input type="checkbox"/> Automated Water Treatment System |

## START-UP

- Fill fountain basins with water.
- Verify that all valves are completely OPEN except for the **Display Adjustment Valves**. If not previously adjusted, these valves should be initially set at 50% OPEN.
- Start filter pump to verify that it is pumping water by checking the **Filter Pressure Gauge**. Filter pressure should increase by at least 5 PSI when pump is started.
- Start main pump and verify that it is pumping water by checking the **Discharge Pressure Gauge**. Pressure should increase by at least 5 PSI when pump is started.
- Set the time clock programming for the appropriate operating times.
- Observe fountain operation for at least ten minutes to verify proper operation
- Before leaving the fountain, verify that any sump pumps and vent fans, if so equipped, are operational and that all selector switches are in their AUTO positions.

## SHUT-DOWN

- Turn all pump and lighting circuit breakers OFF. Do not turn off any circuit breaker that powers a protective device such as a sump pump or vent fan.
- Before leaving the fountain, verify that the sump pump, if so equipped, is operational.
- If the fountain is to be out of service for an extended period of time, we recommend that the fountain basins be drained, the nozzles removed, and that all open pipes be plugged or otherwise sealed to prevent debris from getting into the piping system. In addition, verify that no chemicals have been left in skimmers or chemical feeders.

## WINTERIZATION

- Drain all fountain basins completely and store drain plugs and standpipes in a safe location
- Drain all equipment and piping within the equipment space
- Turn OFF the ventilation system for equipment room unless system is thermostat protected
- Do not turn OFF the power to sump pumps (if so equipped)
- Install plumbers' plugs to seal all open piping connections in fountain pool floors.

***WARNING! Do not add automotive anti-freeze to fountain, it is poisonous.***

## GENERAL MAINTENANCE

Each fountain has its own characteristics and features that will determine its general maintenance requirements. Many variables can effect the maintenance requirement including the operating time, season, surrounding plants, people traffic, quality of the water supply, etc. You will need to determine the maintenance procedures and the required maintenance schedules based upon the experience you gain from living with the fountain in the coming year. The following are some general guidelines to get you started.

### Daily

- Clean all the trash and debris from the fountain basins
- If your system has a vault that is equipped with a sump pump, the float should be checked for freedom of movement and moved to check the operation of the pump. The sump pump is not a continuous duty pump. Pumping too much will wear it out faster.
- Check any skimmer baskets for debris
- Test water for chemical balance with a DPD test kit
- Check the water level in the reservoir(s).

### Weekly

- Inspect and clean all the suction strainers and backwash the sand filter
- Clean the Water Level Probes.

### Monthly

- Test all GFCI breakers.

### Yearly

- Lubricate pump bearings (as required)
- Inspect all equipment for wear and loose bolts
- Drain the water from the system and refill with fresh water. When this is done, the water quality levels will have to be manually balanced.

## FILTRATION & WATER TREATMENT EQUIPMENT

Airborne debris tends to accumulate in fountains. This debris is often drawn into the suction lines and skimmers in the fountain basin by the pumps. The filtration devices in your system are there to prevent damage to the pumps and to help clean the water before it returns to the basin. Each filter system has a pressure gauge that indicates the operating pressure at the filter. **If the pressure increases 8-10 psi over the “clean” operating pressure, it is time to clean the filter.**

**Basket Strainer** - a pot with a removable lid and a basket that collects debris. A basket strainer is normally used on the suction side of a pump. The pump must be OFF to clean a basket strainer. To clean, you must first isolate it from the water in the rest of the system by closing valves on either side of the strainer. Remove the strainer lid, lift out basket, clean it, inspect the o-ring, replace the lid, and open the valves. An air pocket may form in the basket strainer; if so, loosen the lid slightly until water squirts out and then tighten the lid.

**Cartridge Filter** - has a removable lid and a filter element that collects the debris. The element is disposable and filters much finer particles than do basket strainers. The pump must be OFF to clean a cartridge filter. As with the basket strainer, you need to isolate the filter from the water in the piping by closing the valves on either side of the filter.

**Sand Filter** –a tank full of sand that when water is forced through the sand, the debris is trapped in the sand. By forcing water through the sand from the other direction, the sand is loosened up and the debris is flushed out. The multi-port valve on top of the sand filter switches the flow from the pump from one end of the sand bed to the other. On most sand filters, you must turn OFF the pump to change from “filter” mode to “backwash” mode. When you restart the filter pump in “backwash” mode, the sight glass on the side of the multi-port valve will fill with cloudy water. When the water runs clear, you have successfully backwashed the filter. Turn off the pump and switch back to “filter” mode. **Do not leave the filter in “backwash” mode for more than 3 minutes**, as it will quickly drain the fountain.

**Automatic Backwash Sand Filter** - uses a motorized valve to automatically change from “filter” mode to “backwash” mode. The backwash cycle is typically controlled with an electronic time clock that periodically puts the system into the backwash mode. Most auto-backwash valves have a contact that is used to turn off the filter pump while the valve is changing modes so that backwashing can be performed several times a day without human intervention. As with any filter system, the fountain debris characteristics determine the backwash frequency and, therefore, the programming of the clock.

**Skimmers** - used to remove floating debris and are installed in the wall of a fountain at water level. They are used in addition to floor-mounted suction for the filter pump. Valves regulate how much water is drawn from either the floor suction or skimmers. Adjust the valves so the skimmers draw as much as possible without creating a whirlpool (which draws air into the pump that will damage it). Skimmers have removable baskets that must be kept clean.

**Chemical Erosion Feeders** - feed a constant amount of chlorine or bromine into the fountain. The feeder is a sealed tank containing chlorine or bromine tablets. A small valve on the feeder adjusts the amount of water that is allowed to flow across the tablets. This concentrated chlorine mixture is then fed into the discharge of the filter. Since the concentrated chemical is very corrosive, all the piping just downstream of the feeder should be PVC.

**Automatic Chemical Treatment systems** - use an electronic controller that measures the chemical properties of the water and adds chlorine or bromine as required. A relay in the controller turns on a valve that feeds water to the erosion feeder or turns on a pump that injects liquid chemical into the filter stream.

## MECHANICAL WATER LEVEL CONTROL

A Mechanical Float Valve is connected directly to a 50psi water supply line. Several different housings are offered but they all work the same. (Figure 1)

- The float valve opens when the water level drops, causing the float to drop (LOW).
- The float valve closes the valve when the water level rises (OK).

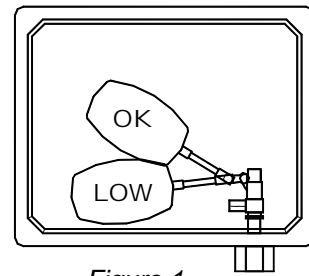


Figure 1

## ELECTRONIC WATER LEVEL CONTROL

Roman Fountains builds a complete electronic level control and low-water equipment protection system. It normally consists of:

- Water Level Control (WLC) board - Industry standard electronic board
- 3-position Fill Valve Selector Switch (HOA) that allows the Fill Valve to be operated automatically (AUTO), turned on (MAN) to manually fill the fountain (ignoring the probes), or switched off (OFF) during maintenance. (Figure 2)
- Red illuminated Reset pushbutton that indicates an extremely low-level water condition – Low Level Cutoff (LLCO). When pressed, the pushbutton resets the LLCO condition and restarts the pump and lights. (Figure 2)
- Float switch or resistive type level measurement sensors
- Copper fill manifold with a solenoid valve and isolation ball valves
- Field interface terminal blocks that allow convenient connection of field wiring.

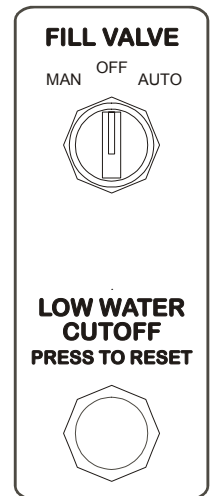


Figure 2

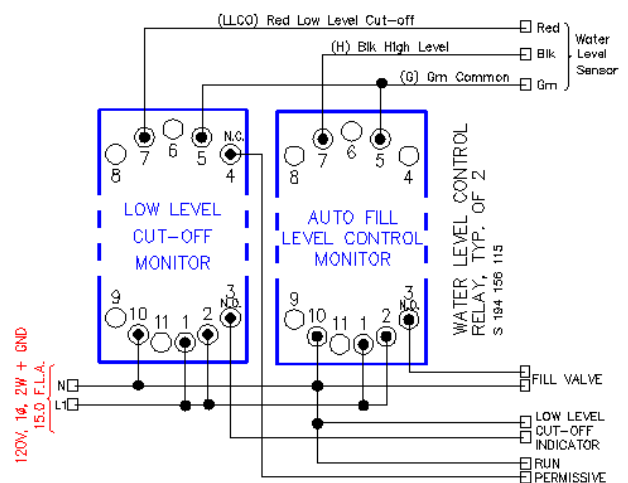
## WATER LEVEL CONTROLLER (WLC)

The Water Level Control (WLC) Relays (Figure 3) create a low voltage (24V) signal for the basin mounted water level sensors.

The WLC monitors the water level by measuring continuity between the sensor common (G “Gm” terminal block) on the board and the water level sensor inputs (H “Blk” terminal block, LLCO “Red” terminal block).

Loss of continuity between the G and H connections turns ON the fill relay, which turns on the fill valve.

Loss of continuity between the G and the LLCO connection turns ON the LLCO relay, which turns off the pumps and/or lights.



**Water Level Sensors-Float Style**

The **Float** style sensor has a plastic float riding on a brass tube that contains magnetically activated switches. Roman Fountains has several float sensor housings that are conduit or wall mounted. All of the housings use the same float sensor.

- As the float drops, the **HIGH** switch is opened, turning on the “fill relay” on the WLC.
- If the float continues to drop and reaches the bottom switch (LLCO), the WLC **LLCO** relay turns OFF.
- As the water level rises, the bottom switch in the sensor closes, but the board will not reset the LLCO condition until the float reaches the high switch and the reset pushbutton on the control panel is pressed.
- When the float reaches the high switch, the fill relay turns OFF automatically which turns off the fill valve.

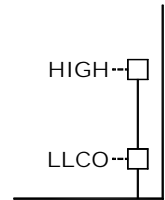


Figure 4

**Water Level Sensors-Resistance Style**

The **Resistance Style Probe** performs in the same fashion as it does with the float style probe. It uses the fountain water to create a conductive path between the WLC sensor common (G) and the WLC inputs (**H**, **LLCO**).

- The Sensor Common probe is placed lowest in the water. As the water level drops, the **HIGH** and **LLCO** probes are uncovered, opening the electrical path back to the WLC.
- As the water level rises, continuity returns for each of the inputs, but as with the float style probe, the **LLCO** relay will not reset unless the **Reset** pushbutton (on the control panel) is pressed.

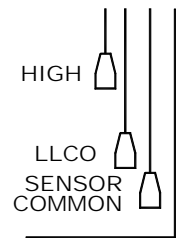


Figure 5

**Electronic Three-Function Water Level Control & Low Level Protection**

In fountains where there is a significant water level drop when the pumps are turned on, Roman Fountains offers a **three-function** water level control system (Figure 6). This type of system monitors the water level when the pumps are turned OFF (static level) and adds water to the basin if losses occur.

- The **Three-Function WLC** system uses a standard sensor system plus an additional level sensor mounted at the static level.
- An additional relay in the panel monitors the display pumps. When the pumps are running, the relay switches the level sensor signals from the static sensor to the operational sensor.

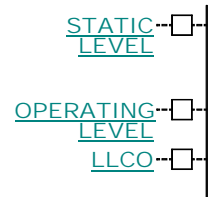


Figure 6

**Fill Manifold**

The Roman Fountains fill manifold (RMS Series) is designed to operate at a maximum of 50psi. (Figure 7)

- The **Manual Bypass Fill Valve** is used to fill the fountain quickly.
- The water level controller that is located in the main control panel controls the **Solenoid Valve**. It has a knob on top that can be used to adjust the maximum flow of the solenoid valve when it is turned ON.
- The **Isolation Valves** shut the water OFF to the solenoid valve to allow for servicing.
- A **Hose Bib** is provided as a convenience to the service personnel for washing down the vault or equipment area.

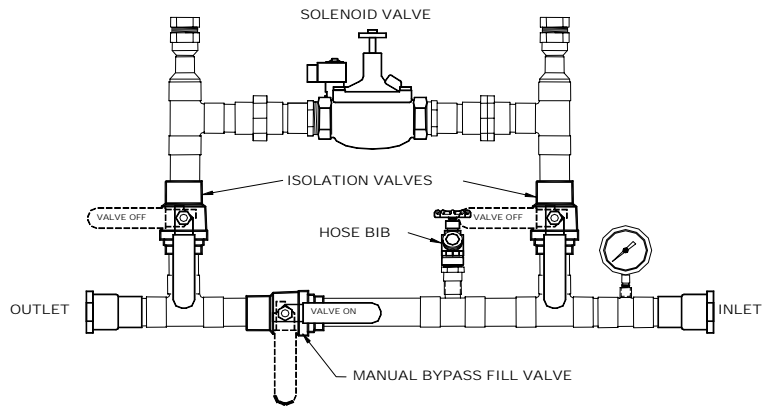


Figure 7

**Trouble Shooting Electronic Water Level Controls**

Some of the time, the problems experienced with electronic water level controls are due to poor wiring connections. Any time wiring connections are made around a fountain, the connections should be sealed with silicone or the junction box potted with an approved re-enterable potting compound (3M 4442 High Gel). Since water level control sensors circuits are low voltage (24v), a poor connection can cause all kinds of headaches.

**TESTING THE LEVEL PROBES**

Once you have established that your connections are clean and dry, test the signals from the level probe(s). Use a digital multimeter set to test continuity.

**FLOAT SENSOR TESTING**

- Disconnect the probe wires from the terminal blocks in the panel.
- Check the continuity between the wires as indicated on the chart below.

Float Position	Continuity Between
Highest	GR ► BL; RD
Down 1/4"	GR ► RD
Lowest	No Continuity
Ignore the white wire –it is not used (except w/(3) float system)	

**RESISTIVE SENSOR TESTING**

Since the resistive sensors are making their electrical connection through the water, they need to be clean.

- Use a thin strip of sand paper or emery cloth rolled around the probes to scrub them clean.
- **There is no effective way to field check the resistive probes.**
- The WLC applies a voltage (24V) to the probes and uses very sensitive circuits enclosed within the relays to measure the resistance (which is very high).
- Sometimes the resistance of the water is too high for the resistive probes to be used. Roman Fountains has a set of float probes that can be substituted for the resistive probes that allow the same degree of adjustment as the resistive probes.

**TESTING THE WLC RELAYS**

How the Relays work is described in the earlier paragraphs. Basically, the **G** (“Grn” terminal block) connection is common. Each of the other sensor inputs (**H** [“Blk” terminal block], **LLCO** [“Red” terminal block]) needs to have continuity with **G** for each to be satisfied (Note: This should be done at the terminal blocks).

To test the WLC Relays:

- Make wire jumper connections to each of the terminal block inputs and “**Grn**” terminal block.
- Using jumper clips, connect the **H** [“Blk” terminal block] and **LLCO** [“Red” terminal block] to the **G** [“Grn” terminal block] pigtail.
- Remove the connection to the sensor inputs (in the order of the table below) and observe the reaction of the **WLC** relays.

Sensor Input	WLC Relay Reaction
<b>H</b>	Fill Relay turns ON (Red LED is lit; <u>Auto-Fill</u> relay)
<b>LLCO</b>	LLCO relay turns ON (Red LED is lit; <u>Low Level Cut-Off</u> relay)

- Reconnect the sensor inputs (in the order of the table below) and observe the reaction of the **WLC** relays.

Sensor Input	WLC Board Reaction
<b>LLCO</b>	LLCO relay turns OFF (Red LED is <i>off</i> ; Run Permissive resumes)
<b>H</b>	Fill relay turns OFF (red LED is <i>off</i> )

**MECHANICAL PROBLEMS WITH THE ELECTRONIC WATER LEVEL CONTROL**

Check the following:

- Is the float stuck?  
*A small piece of floating debris will keep the float from moving.*
- Are the vent holes in the Probe Housing clear?  
*If the water can't get in or out, the float does not move.*
- Is the Fill Valve Selector switch in Manual?
- Is there debris inside the solenoid valve?
- Is the Manual Bypass Valve on the Fill Manifold OPEN?
- Are the Isolation Valves for the solenoid valve OPEN?

## WIND CONTROL SYSTEMS

Wind Control is used to prevent the water in the fountain from blowing somewhere you don't want it to go. A wind speed sensor mounted near the fountain sends a signal to a controller that converts the signal to wind speed in MPH. The Wind Controller allows you to set the wind speed alarm levels (set-points) in the controller, which are used to control the fountain equipment. When the wind reaches the wind set-point, the amount of water being sprayed into the air is reduced.

When the system goes into a wind alarm, a timer is started. The timer delays the rapid cycling of the pump system if the wind is gusting. If the wind goes over the set-point while the timer is running, the timer starts over. The wind must stay below the set-point for the duration of the timer.

There are two types of Wind Control Systems.

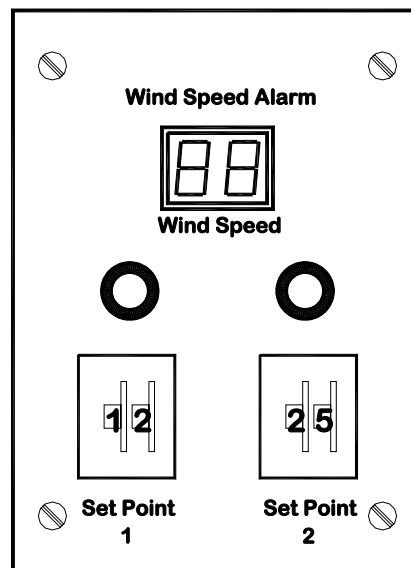
### One-Stage Wind Control

This system gives you a single set-point. When the wind reaches the Low Wind Set-Point, the display pumps are turned OFF for up to 10 minutes.

### Two-Stage Wind Control

This system gives you two wind set-points. When the wind reaches the Low Wind Set-Point, the fountain effects are reduced. Opening a valve that diverts a portion of the display water back to the basin typically does this. The timer for this can be set up to 10 minutes.

When the wind reaches the High Wind Set-Point, the display pumps are turned OFF. The timer for this is set at 10 minutes.



## TIME CLOCK

SEE SECTION 3 FOUNTAIN EQUIPMENT FOR INFORMATION ABOUT THE TIME CLOCK CONTROLLER.

## WATER TREATMENT

**Algae** are one of the most common and perplexing problems in maintaining a fountain. This plant growth, requiring sunlight for photosynthesis, usually appears in fountain pools in two forms: the free-floating type (usually green) which floats in the water and the clinging type (usually black), which grows on the sides and bottom of the pool.

The best method of controlling algae is by continuously providing regular chemical treatment to maintain the necessary chemical concentration levels. These chemicals are available through your local swimming pool service suppliers. They can advise on the appropriate amounts and types of approved chemicals. To minimize the chemical consumption, a copper and silver ion system may be used.

Once algae appear in the water, it can easily be killed and removed from the pool water. An alga that attaches or roots itself to the wall and floor of the pool is difficult to remove. The pool must be drained and direct contact with a straight solution of chlorine is the only practical way of removal. The clinging type may appear as black spots or as a brownish or greenish, mossy layer. The brown or green algae can often be removed by super-chlorination or shocking the pool. However, it is better to maintain proper chlorine treatment and minimize the possibility of algae growth.

Algae will grow best in direct sunlight and warm, shallow, dirty pools where the water chemistry including pH, alkalinity, hardness, cyanuric acid, algicide, disinfectants and softening agents are not kept at the prescribed levels.

Some other factors that will influence the water chemistry are wind, the level of people participation, relative humidity and temperature, water lost to splash and evaporation, pool finish, access to the pool and water, and the effectiveness of the filter system. If not controlled properly, algae can spread rapidly.

### **All of the following needs to be monitored to keep algae in check:**

**pH** -- is an indication of the acid alkaline balance of the pool water. The pH of the pool water should be constantly maintained between 7.4 and 7.6. These are figures on an arbitrary scale ranging from 0 - 14. The number 7 indicates a neutral condition. Higher numbers indicate increasing alkaline conditions. Lower numbers indicate increasing acid conditions. pH is easily measured using available test kits.

An excessive acid condition can cause piping and equipment corrosion, damage to the pools interior finish, and rapid dissipation of sterilizing agents. An excessive alkaline condition can prevent sterilizing agents from working and cause scale formation (deposits of calcium salts) on equipment and pool finishes. pH can be increased by adding sodium carbonate (soda ash) and decreased by adding muriatic acid.

**Total Alkalinity** -- is the total amount of certain alkaline chemicals in the water. Total alkalinity should be maintained between 70ppm and 100ppm (parts of alkaline chemicals per million parts of water as measured by available test kits). Control within this range provides better pH stabilization and ensures the most effective usefulness of pool water chemicals.

Total alkalinity can be increased by adding bicarbonate of soda (baking soda) and decreased by adding muriatic acid. The fountain filtration system should always be operating when these chemicals are added to the pool water.

**Algicide, Disinfectant or Sterilizing Agent** -- A sterilizing agent is used to kill some bacteria and to check the growth of algae. The sterilizing agent most frequently used is chlorine that is available in a variety of different types. We recommend the use of bromine. It is available in tablet form and has the added advantage of greater stability and usually does not affect the pool pH. However, it may require the use of pool water conditioner (cyanuric acid). Chlorine may also be used. Normally, the addition of bromine or chlorine to the pool is a manual operation. Bromine is most effective when added to the pool at night or early morning.

***!!WARNING!! Do not add bromine or chlorine and acid to the pool at the same time, since they will combine and form a very toxic gas. Keep treatments a few hours apart for safety.***

## Water Treatment Terms

**Bromine or Chlorine Residual** - free chlorine that remains in the water to prevent the growth of algae and bacteria. Once bromine or chlorine is added to the pool, a certain amount is destroyed in the process of killing algae and bacteria. Additional amounts are dissipated by low pH, sunlight and the water effects themselves, and some chlorine reacts with debris to form ineffective chlorine compounds called chloramines. The residual is the amount of bromine or chlorine that remains in the pool after the above occurs. It should be maintained at 1 to 3ppm at all times. Regular treatments should easily maintain the desired level, minimizing the frequency of shock treatments.

**Super-chlorination or Super-bromination** - the addition of an extra dose of an algicide, usually 3 to 5 times the normal dose. It is used occasionally as a "shock" treatment to destroy any algae or bacteria that survive regular chlorine treatments. It may be required as often as once a week for very warm water temperatures and may not be required at all for colder water temperatures. Oxidizing by the use of oxidizing agents may be substituted for this procedure.

**Algicides** - generally used as super-chlorinators to kill algae once they bloom in the pool. Proper water treatment, as described above, should prevent the need of algicides. However, they may be used as a supplement to the regular maintenance program, or kept available for emergencies should algae develop in the pool. Once again, the algicide should be added at a rate of 3 to 5 times the normal chlorinating dose.

**Water Hardness** - will also affect the appearance of your fountain. The water supply must be maintained at 150ppm of total hardness. Low levels (< 90ppm) are more corrosive than high levels (7300ppm).

The pool should be drained and refilled with fresh water whenever evaporation has caused the concentration of hardness to become excessive (>300ppm). The fountain water effects increase the evaporation rate, which in time will increase the hardness concentration. Although regular chemical treatment will reduce the frequency of this requirement, the hardness concentration should be checked periodically. The draining and refilling operation may be required as often as once every two months in some cases. This will result in savings on chemical costs. Unfiltered and untreated pools should be drained and refilled weekly. Calcium deposits on pool walls will usually indicate a high hardness concentration.

**Alum** - used to remove iron from the water in areas where the available water supply has a high iron content and is not filtered using commercial filters. Reaction between the iron and chlorine can stain the basin's surface, unless the iron is removed immediately after filling the pool by adding alum to the pool with the filter off, followed by a super-chlorination treatment. The precipitate is then vacuumed directly to the filter waste line, rather than through the filter as in the normal backwash operation, to prevent clogging of the filter media.

**Anti-Foam Products** - used to combat soap or detergent added to the fountain usually as an act of vandalism. The following information may prove helpful in eliminating this nuisance.

First, it is important to note that soap, detergent, and materials of similar nature do not appear to have a harmful effect on fountain equipment. They can, however, interfere with the proper operation of diatomaceous earth filters due to clogging of the filter element or other possible adverse effects. In this event, the pool should be drained and refilled as soon as possible after soaping occurs. Most fountain installations utilize permanent media filters, which continue to operate effectively when soaps, detergents, or defoamers are present in the pool.

The main problems caused as a result of soaping are overflowing of the suds from the pool, and partial shrouding of water effects, especially those having low heights. Also, illumination from fountain lights may be effectively reduced with very little light output realized above the pool surface. Prolonged fountain operation with foam present could conceivably cause pump damage.

Two remedies have been found to be effective against soaping. One remedy is to completely drain and refill the pool with fresh water. This is an ultimate answer and is effective once soaping occurs.

The second remedy is to use an anti-foam product, generally before soaping occurs, however, it may be used afterwards as well. In either case, the anti-foam product counteracts the sudsing effect and permits continued fountain operation without the necessity for draining and refilling the pool. When used in advance, it can reduce the effects of soaping, or may eliminate these effects entirely.

Many types of anti-foam products or defoamers are available. Silicone base defoamers, which are non-toxic, are recommended. Defoamers of a petroleum base nature should not be used.

The following silicone base anti-foam products have been used successfully for fountain applications. Other similar products may also be available.

SAG-470 - manufactured and distributed by Union Carbide Silicone Division of Union Carbide Corporation (www.unioncarbide.com)

NALCO 71-D5 - manufactured by Nalco Chemical Company of Chicago, Illinois (www.nalco.com)

DOW-CORNING ANTI-FOAM "A" and ANTI-FOAM "B" - manufactured by Dow-Corning Company of Midland, Michigan (www.dowcorning.com)

Contact local representatives of these respective companies for complete application information and details of availability.

Concentration and frequency of application of these anti-foam products vary depending on pool size, water volume, and the concentration of soap or detergent injected into the water. Generally, an initial treatment is required for advance protection with additional amounts being required as evidence of soaping becomes apparent. Keep in mind that evaporation and changes in water chemical compositions also affect the demand for anti-foam products. Heavy concentration may cause the water in the pool to take on a slight milky cast.

We make no specific recommendation in this respect, other than to suggest these particular manufacturers and types of products. The best advice is to follow the manufacturer's recommendations, and try an experimentation period to achieve the right balance for your fountain.

We hope the above information will be of benefit to our customers in arriving at satisfactory maintenance and control programs.

### **Important Chemical Notes**

- Always have circulating system in operation when adding chemicals unless instructions advise otherwise.
- All dosage is approximate and will vary for different chemical manufacturers.
- Follow the instructions on the chemical container.
- Never add acid and chlorine at the same time. They will form a toxic gas.
- All chemicals are dangerous.
- Handle and store in accordance with the manufacturer's instructions.
- Treating dirty water is a waste of chemical and should be avoided. Water should be filtered first.
- Test the water using a Test Kit
- Your test kit should at least be capable of monitoring chlorine or bromine residual and pH levels.
- Follow the directions on your test kit. Test the water approximately every other day -- more frequently in warmer weather and less frequently in colder weather. Never add chlorine to the water before testing. Never rely on previous tests or visual inspection of the pool water. Use the test kit.
- All chemicals are added in proportion to the total gallons of water in the pool(s) (capacity). Estimate your pool capacity by determining the dimensions (in feet) of the pool(s) and following the formulas below.
  - Rectangular:  $L \times W \times \text{Depth} \times 7.5 = \text{Pool Capacity in gallons}$
  - Round:  $\text{Diameter}^2/4 \times \text{Depth} \times 23.5 = \text{Pool Capacity in gallons}$
  - Oval:  $(L \times W)/4 \times \text{Depth} \times 23.5 = \text{Pool Capacity in gallons}$
  - Free Forms: Divide the pool into combinations of the above shapes and add to determine total volume

***NOTE: If pool(s) has sloping sides, multiply number of gallons by .85 to estimate.***

### Testing Do's and Don'ts

- Rinse test vials with pool water before and after test. Never add chemicals before never add chemicals before.
- Test for acid only when chlorine level is <1.0 ppm. Never rely on previous tests or visual inspections. Use the kit.
- Fill both pH and chlorine vials simultaneously. Do not read results in sunlight
- Be certain only the prescribed drops are added to vials. After adding test chemicals, do not discard tested water into fountain
- Read test results immediately against a light background
- Replace test chemicals once a year
- Re-test for residual chlorine at least 30 minutes after administering chemical

### Cleaning Tools

The following is a list of maintenance tools to be considered for plaster, tile, gunite, or painted finish pools with cartridge or sand filters.

- **Filter System** (portable or fixed) - either cartridge, silica sand, or diatomaceous earth. This is the heart of the cleaning system responsible for filtering out particles. Other equipment aiding the fixed filter:
- **Skimmer** - the purpose is to draw dirt, leaves, oils, debris and floating algae from the water surface back to the filter for removal. It will also serve as a vacuum point. This fitting can double as a vacuum fitting.
- **Main Suction** - draw suspended particles and particles fallen to the pool floor back to the filter for removal.
- **Vacuum Fittings** - outlets where a vacuum hose can be hooked up. These should be plugged when not vacuuming.
- **Wall Brush** - a sturdy constructed brush with durable nylon bristles at least 18" long.
- **Skimmer Net** - a sturdy constructed net / screen used to remove debris from the water surface (sometimes referred to as a leaf skimmer).
- **Vacuum Head** - a sturdy constructed vacuum head with enough flexibility to conform to the contours of the pool walls and floors.
- **Vacuum Hose** - A sturdy constructed flexible floating hose long enough to reach from the skimmer and vacuum fitting to the farthest point of the pool. Once the longest length is determined, add 5' to 10' to that length.
- **Telescopic Pole** - a sturdy constructed 8' - 15' telescopic pole will be required. All the above cleaning tools can be attached to this pole. Quick tool snap adapters should be used to attach pole to cleaning tools. Be sure that the pole fastener is coordinated with the cleaning tool.
- **Pool Water Test Kit** - this is one of the most essential tools in your maintenance equipment package. The test kit will measure various chemical levels in the pool water. It is your window that provides feedback on the effectiveness of your maintenance program. *NOTE: It is essential to monitor at least Bromine or Chlorine and acid levels.*
- **Pumice Stone** - heavy oil or high calcium stains can be removed in most substances by the use of a soft pumice stone. Be certain stone is thoroughly saturated with water when using. Sometimes it may be necessary to use a hard pumice stone. Use extreme caution, as you can damage the pool wall or floor surfaces. You should consult the manufacturer of your pool surface before using pumice stone.
- **Wire Brush** - with small stainless steel brush. Extreme caution is essential when using, as excessive pressure will damage pool surface. You should consult the manufacturer of your pool surface before using a wire brush.

***NOTE: We advise you to keep an accurate log of your maintenance activities including chemical levels, frequency of procedures, etc. This will help you estimate your future maintenance programs.***

## Pool Cleaning Procedures

- Test the water every two days or as needed
- Brush the pool walls every seven days or as needed
- Skim the water surface every two days or as needed
- Brush the pool floor every seven days or as needed
- Clean the wall at pool level every seven days or as needed
- Check and clean basket strainer in skimmer every two days or as needed
- Skim the pool bottom every two days or as needed
- Vacuum the pool every seven days or as needed
- Start the pump
- Remove basket strainer from skimmer or remove plug from vacuum fitting
- Slowly close off all other suction lines to filter pump
- Prime vacuum hose by lowering head into pool slowly (feed hose in water, so that water fills entire hose)
- Attach one end of hose to vacuum with telescopic pole attached and attach remaining end of hose to skimmer or vacuum plug outlet
- Vacuum pool. NEVER REMOVE HEAD FROM WATER OR YOU WILL LOSE PUMP PRIME.
- When finished, detach hose from skimmer or vacuum plug inlet / outlet and remove equipment.
- Reinstall skimmer strainer, adjust suction settings and plug all vacuum plug outlets.  
NOTE: Do not close off all other suction points if the same pump is used for the feature and the filter.  
In this case, slowly throttle down the other suction points to facilitate the vacuum working.
- Add chemicals as needed.