

OWNER'S MANUAL

 **Polaris Watermatic**

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C660 ORP/pH Controller, 120V

 **Polaris**

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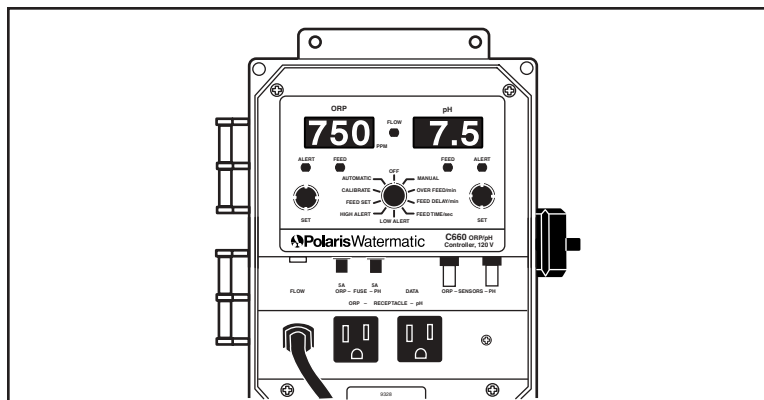
## I. Introduction

**For your protection, read all instructions carefully before installing or operating this automatic controller.**

The Polaris Watermatic® C660 ORP/pH Controller is designed to automatically monitor and maintain both the sanitizer level and the pH balance in swimming pools, spas, or any circulating water system that requires water chemistry management. The C660 Controller is designed for easy installation and simple operation. It may be used with liquid feed pumps, granular feeders, tablet erosion feeders, and ozone generators. **It is not warranted or recommended for use with chlorine gas systems.**

During the filtration cycle of the pool or spa, the sanitizer level and pH balance are maintained by a constant measurement of the ORP (Oxidation-Reduction-Potential) and pH balance of the water. Measurements are displayed on the controller's ORP and pH digital readouts (see drawing below). If the sanitizer level (ORP) falls below a predetermined set point, the controller will activate the chemical feeder until the preset point is reached. The pH is maintained in a similar manner. The C660 has two standard power receptacles for the ORP and pH outputs.

Various safety features prevent the feeding systems from activating if the sanitizer or pH balance are outside of the controller's range. These and additional features and options are described in further detail in the Pre-installation section of this manual.



## II. Specifications

<b>pH Control Range:</b>	7.0 to 8.0
<b>ORP Control Range:</b>	400 mV to 900 mV
<b>Input Power:</b>	120 VAC 60 Hz, 3-wire grounded power cord. GFCI source required
<b>Controller Power:</b>	Less than .5 amp internally fused
<b>Output Power:</b>	120 VAC 60 Hz, 5 amp fused, two 3-wire grounded power receptacles
<b>Display:</b>	Digital readouts
<b>Operating Temperature:</b>	40 - 120° F
<b>Sensors:</b>	pH: glass combination with 10' cable ORP: platinum combination with 10' cable

### Selectable features:

- Desired ORP/pH settings
- Manual operation
- pH and PPM calibration
- ORP and pH timed or continuous feed
- Adjustable alerts on ORP and pH
- Maximum feed time option
- Safety interlock between pH and ORP
- Front face lockouts
- Acid/Base feed

**Note:** When automating a body of water, size feeders so desired levels can be attained in short operating cycles. If the feeders are unable to keep up with demand within a short time frame, automation becomes ineffective.

### **III. Components**

The C660 ORP/pH controller box contains:

- ORP/pH Controller
- Flow Cell with Flow Switch with parts bag (part# 9-700)
- ORP Sensor (part# 3-250)
- pH Sensor (part# 3-260)

### **IV. Features**

#### **A. Flow Cell**

This system includes a flow cell designed for easy installation with the Watermatic controller. The flow cell has an integrated flow switch/flow indicator that requires at least 0.3 GPM to work properly. When the flow exceeds the minimum flow rate, the black piston in the flow switch chamber moves to the top, closes the reed switch and sends a signal to the controller to allow its operation. The flow light must be illuminated for the controller to operate.

#### **B. Flow Switch**

The flow switch lead plugs into the RCA jack on the base of the module. If the flow switch is unplugged, an internal jumper closes the circuit and allows the controller to continue to operate. When using peristaltic pumps, the flow switch eliminates the pumping of chemicals while the filter system is off.

Flow cell installation and operating instructions are in the Installation section.

#### **C. PPM Readout**

The controller is factory set with no ppm (parts per million) readout. If OFF is not displayed in the digital window, turn the ORP Set Knob until OFF appears in the window.

## **D. Timed Feed and Delay Cycles**

For most controller applications, the continuous feed mode is appropriate. However, if you are using the controller in one of the following situations, you will need to change the feed settings to allow for a timed-feed cycle followed by a delay cycle. Please refer to the Appendix for more information if your application uses:

- a Watermatic G1000, G1000A or G7500 feeder.
- a peristaltic pump to feed the sanitizer or pH and you are experiencing overfeeding.
- an erosion feeder with a spa or small body of water and you are experiencing spiking.
- the ORP sensor located downstream from the introduction of the sanitizer (the pH sensor should always be located upstream from the introduction of the pH balance).

## V. Pre-installation

A selector knob located on the face of the unit allows users to easily choose certain adjustable operational features.

### A. Default Settings

The default positions noted below only occur during the initial startup. After start-up, the controller will retain the last setting chosen by the user. Controller settings are discussed in detail on the following pages.

	<u>ORP</u>	<u>pH</u>
Feed Set	650	7.5
High Alert	900	8.0
Low Alert	100	7.0
Feed Time	4.8	0.6
Feed Delay	10	5
Overfeed	OFF	OFF

### B. Selector Knob Settings

Disconnect the controller from its power source prior to working on the back of the panel.

1. The OFF setting turns off the controller feature without turning off the power to the board.
2. The AUTOMATIC setting is the normal operation mode. It and displays the current status of the ORP and pH levels, as well as PPM if activated.
3. The CALIBRATION setting enables use of the pH Set Knob which allows the digital pH reading to be set to a test kit or a known buffer. The pH sensor should be recalibrated every four to eight weeks.

**Note:** When calibrating to a test kit, always take the water sample from the sample port at the bottom of the flow cell.

4. The FEED SET setting allows the operator to set the ORP and pH settings to a desired level by using the appropriate Set Knob. The feed set range is:

ORP: 400 to 900

pH: 7.0 to 8.0

5. The HIGH ALERT setting allows the operator to set the ORP and pH levels to the highest possible level without sounding an alarm.

ORP: 650 to 900

pH: 7.5 to 8.4

The high alerts can also be turned off.

6. The LOW ALERT setting allows the operator to set the ORP and pH levels to the lowest possible level without sounding an alarm.

ORP: 100 to 640

pH: 6.8 to 7.4

The low alerts can also be turned off.

**Note:** The reading must be above or below the alert level for ten minutes before the controller initiates the alarm and shuts down the respective side of the controller. The system must be brought into range for one minute for the controller to restart.

7. The feed time feature allows the operator to set the feeder's operational duration for specific applications. See Appendix for more information. It adjusts the system from the continuous feed mode to a timed-feed cycle that must then be followed by a delay cycle.

The FEED TIME setting adjusts the feed time from continuous (CONT) to .6, 1.2, 1.8, 2.4, 3.0, 4.8, 6.0, 7.2, 8.4, 10, 15, 20, 30, 60, 120, 180, 240, 300, 600 or 900 seconds for the ORP and pH levels.

8. The feed delay feature is a preset interval between possible feed times that must be used with the feed time feature.

The FEED DELAY setting adjusts the delay time from 1 to 99 minutes. It is only active when the FEED TIME setting is used. When continuous feed is selected, the feed delay will be off.

9. The OVERFEED setting is a safety feature that allows the operator to set a maximum allowable feed time for the sanitizer or pH under normal conditions. It can be set from 0 to 99 minutes on either ORP or pH, but is only operable when feed time is in continuous mode.



When the maximum feed time is reached, the system shuts down and moves into Service Mode (the display flashes). To reset, remedy the malfunction and turn the controller off, then on.

10. The MANUAL setting allows the operator to manually control the feeders. In this mode, when a set knob is turned, the feeder will progress through one feed cycle. If the continuous mode is selected, a slight turn of the desired set knob will start the respective feeder for 30 seconds. To stop the feeder prior to the 30 second feed time, the selector knob can be turned to the OFF position.

### **C. DIP Switches**

The controller has six dip switches located on the back of the module for settings normally established during the installation process. The dip switches control:

- Interlocking ORP and pH
- Acid/Base
- Lockout features
- Reset/test features

A summary of the dip switches is included in the Appendix.

### **D. DIP Switch Settings**

All dip switches are shipped preset to the OFF position.

#### **1. Sanitizer Feed Dependent on pH Being Within Range— pH Switch #1**

The controller is preset at the factory to allow the ORP to feed regardless of the pH level.

Activating this switch will override this feature and allow the feeding of the sanitizer, only if the pH reading is within the controller range (above or below the pH limits sets by the operator). Since the ORP reading is dependent on the pH (i.e. as the pH rises, the ORP lowers), this setting avoids oversanitizing as a result of a high pH level. If the pH is out of range, the sanitizer will not feed but the pH alert light will illuminate.

2. **ORP and pH Simultaneous Feeding—pH Switch #2**

The controller is preset at the factory to allow simultaneous feeding of pH and ORP.

When turned on, this switch will not allow ORP and pH to feed at the same time. In some installations, the sanitizer and the pH are introduced into the filtration system in close proximity to each other. Simultaneous feeding of acid for pH control and liquid chlorine to sanitize can cause chlorine gas bubbles in the return lines. This option prevents the sanitizer from feeding until the pH feed cycle is complete.

**Note:** If the system happens to run out of acid to feed, the pH feeder will continue to run and the sanitizer feeder will not be activated.

3. **Acid/Base Feed**

The controller is preset at the factory to feed acid. When feeding base, turn off pH switch #3.

pH Dip Switch #3

OFF = Acid Feed

ON = Base Feed

4. **Lockout Features**

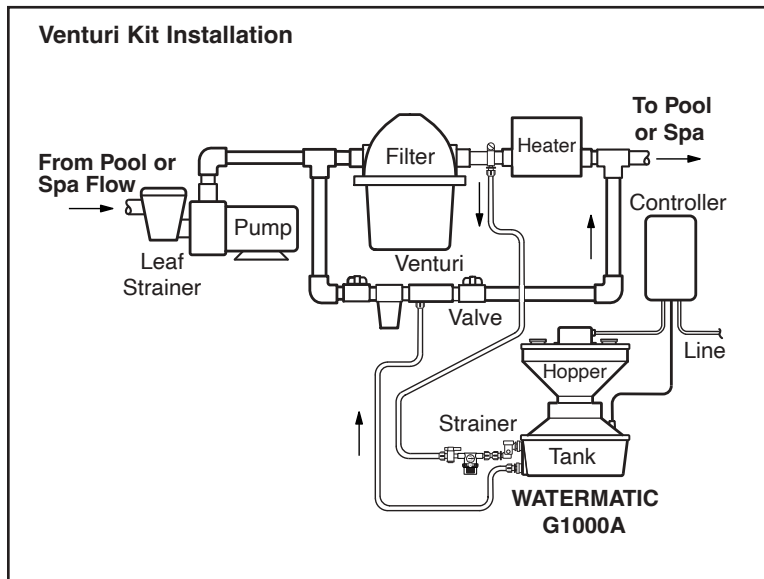
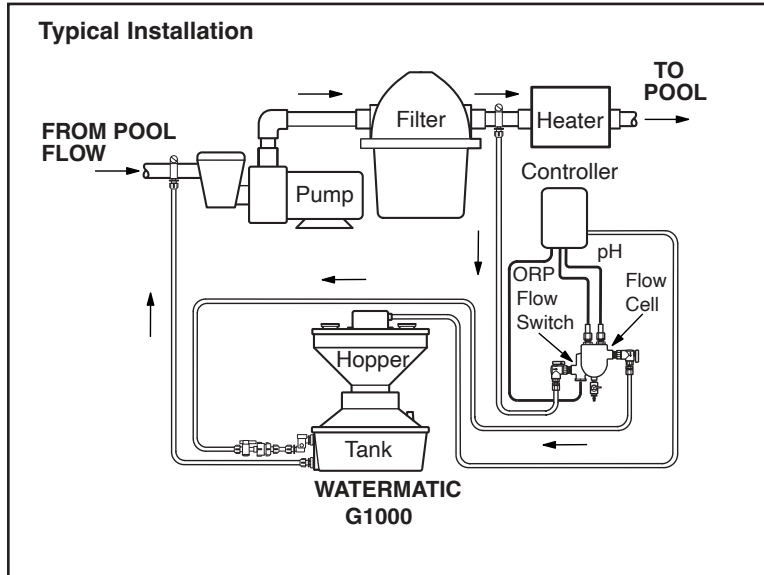
This feature allows the user to set the operating parameters on the front of the board, and lock in the settings. With this switch enabled, CALIBRATE, AUTOMATIC and OFF are the only functioning settings. To reset the operating parameters, turn this dip switch to OFF.

5. **Test/Reset Features**

Must remain OFF at all times.



**THESE FEEDERS SHOULD NOT BE USED BELOW WATER LEVEL.**



## A. Feeding Systems

Install the chemical pump and erosion feed systems as shown in one of the figures on the previous pages. If your model differs from these systems, refer to the installation manual provided with it for the appropriate installation methods. The controller may need to be set for the particular feeder system used.

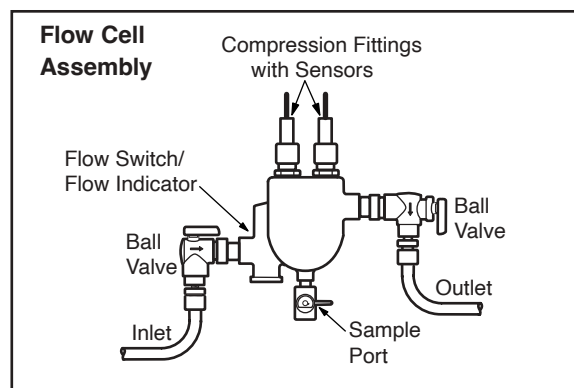
## B. Site Assessment and Controller Installation

Before installing the controller, it is important to do a site assessment to consider where and how you will mount the unit. The controller should be mounted on a wall or other surface within eight feet of the feeder, at least ten feet away from the edge of the water, in close proximity to the time clock, and within six feet of the GFCI power source.

Once the best site selected, obtain all necessary mounting screws or anchors (no mounting screws are provided with the controller). Securely mount the controller on the wall or panel.

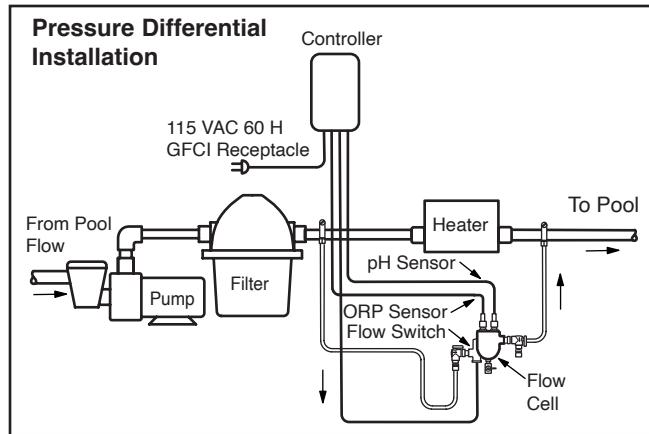
## C. Flow Cell / Flow Switch Assembly

Locate the flow cell within eight feet of the controller, mounted on a vertical surface as shown. The flow cell must be plumbed so the pressure difference between the inlet (flow switch side) and the outlet is sufficient to ensure flow through the flow cell. If the 3/8" tubing provided is being used, a minimum pressure differential of 3 PSI and 0.3 GPM is required to activate the flow switch. It is also desirable to have filtered water pass over the sensors to minimize cleaning.

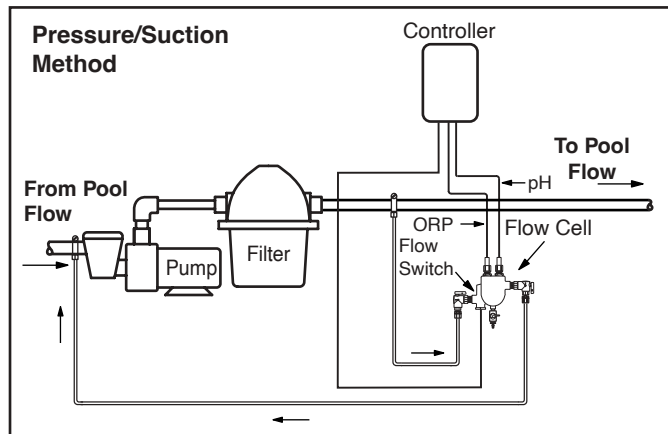


There are three suggested methods to install the flow cell.

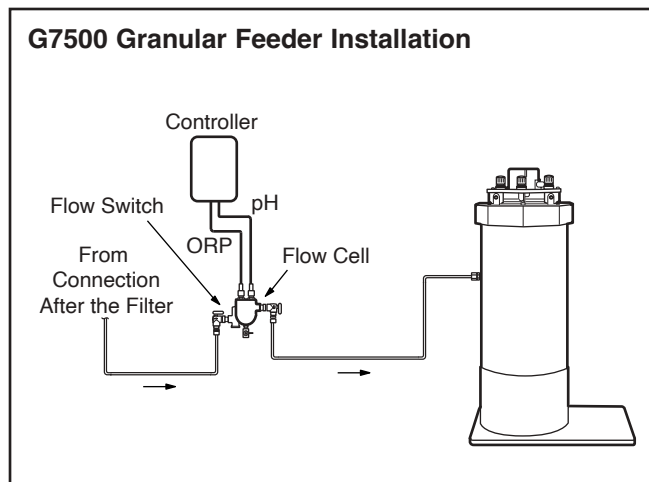
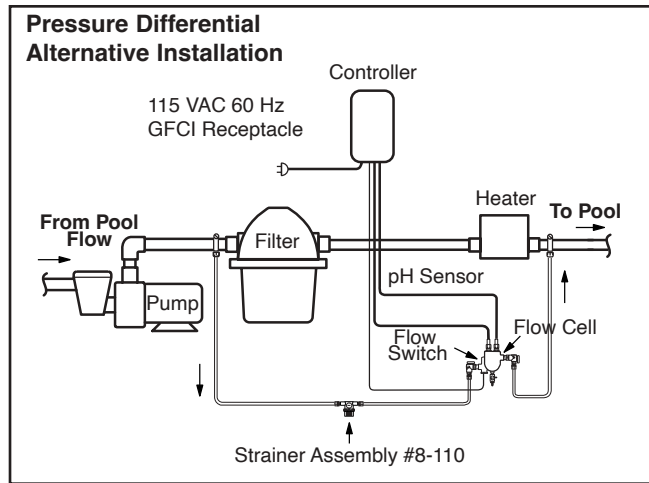
1. Plumb the inlet to the flow cell after the filter and the outlet of the flow cell after the heater using the saddle clamps provided. See Pressure Differential Installation diagram. Fittings for 1/4" NPT taps are also included.



2. Plumb from after the filter to before the pump. This ensures excellent flow but the flow must be adjusted so the sensors are not subjected to a suction environment. See Pressure Suction Installation diagram. Open the sample port (see Flow Cell Assembly drawing) to verify that water is flowing freely from it.



- Plumb from before the filter to after the heater, using an inline filter to minimize the possibility of debris coming into contact with the sensors. See Pressure Differential Alternative Installation diagram.

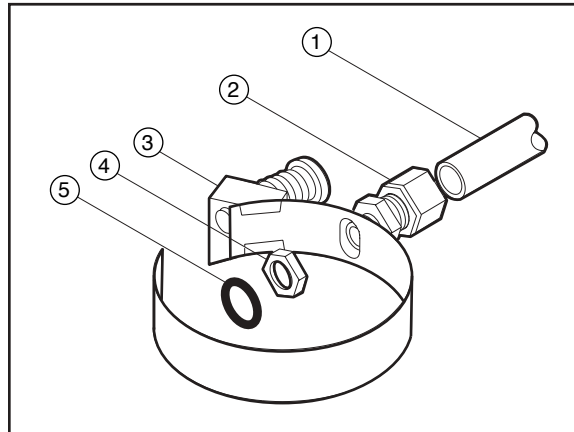


Be aware that solar systems and other factors can alter pressure differentials in a system, adversely impacting flow through the flow cell.

The flow cell comes fully assembled. It is setup to use the 3/8" tubing provided; however, other sized tubing or 1/2" hard plumbing can be used. To use an alternative tubing, remove the 90° on/off valves and plumb according to the application.

1. **If using a saddle clamp**, drill a 7/16" hole in the pipe on the pressure side of the pump. Insert the 1/8" Jaco fitting (#2) through the clamp (#3) and place the nylon jam nut (#4) onto the Jaco fitting. Slide the pipe seal washer (#5) onto the end of the Jaco fitting. Insert the completed assembly into the hole in the pipe and tighten the clamp. Test for leaks.

If the pipe is larger than 2" in diameter, two clamps joined together will be required per each hole.



**If using a pipe tap**, drill a 7/16" hole and tap a 1/4" NPT hole. Apply RTV silicone, teflon stick or teflon paste to the threads on the Jaco fitting and screw securely into the pipe. Test for leaks.

2. Cut the tubing (#1) to the appropriate length. Slightly loosen the Jaco fitting in the pipe and insert the tubing into it. Take the free end of the tubing and insert it into the Jaco fitting on the flow switch side of the flow cell.
3. Complete these steps for the return side of the flow cell using the appropriate remaining parts. Take the free end of the tubing and insert it into the Jaco fitting on the outlet side of the flow cell.



### Operating Tips:

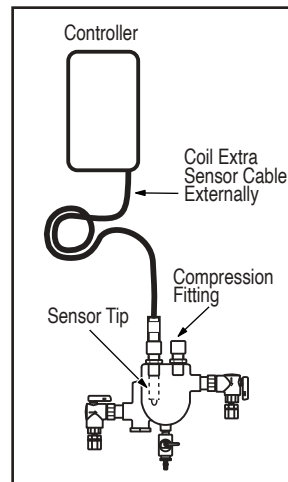
It is imperative that the system has proper flow past the sensors when the pool filtration system is running. **A flow switch must be used with any system using peristaltic pumps.**

### D. Sensor Installation

Carefully unpack the ORP and pH sensors, and remove the protective caps from the sensor tips. Store the protective caps inside the controller enclosure for future use when winterizing or reshipping.

Attach the pH sensor BNC connector and the ORP sensor BNC connector to the controller (see Panel Features diagram). Slide the pH and ORP sensors inside the compression fittings on the flow cell assembly so that the sensor tips are below the water line in the pipe. Tighten the nuts of the fittings until they are finger tight. **DO NOT USE A WRENCH.**

Make sure the controller power switch is off. Plug the power cords from the pH and ORP feeders into the controller. Plug the power cord from the controller into the GFCI receptacle.



**It is recommended that the controller be used with a flow switch to ensure that feeding does not occur when the main filter/circulation pump is not running.**

### E. Start-up Operation

Do not add chemicals to the feeders until all of the following start-up operations have been completed.

1. Using a DPD test kit, manually adjust and balance the pool to acceptable ranges. Automation should be used to maintain chemical levels, not to balance a pool that is far out of acceptable ranges.

2. With the controller selector knob (#2 on Panel Features diagram) in the OFF position turn the filter pump on and check for leaks in the system and flow through the flow cell.

**Note:** If the controller is connected to the flow switch on the flow cell and there is adequate flow, the green flow light will be illuminated. However, if the flow switch is not attached, the flow light will be illuminated since there is a jumper in the flow cell connection to allow the controller to be used without a flow switch. It is recommended that a flow switch always be used.

3. Turn the selection knob to the MANUAL mode. A slight turn of each set knob will activate the respective feeder. If the controller has not been programmed, it will be in the continuous mode and each feeder will activate for 30 seconds. If the feeders do not activate, find and correct the problem.

You are now ready to set the following functions:

- Feed set
- High and low alerts
- Feed times and delays (If not in continuous mode)
- Overfeed (If in continuous mode and desire this feature)

Do an initial calibration of the pH reading. Always calibrate using water from the sample port of the flow cell, unless using preset buffer solution. It may take up to 24 hours before the sensors acclimate to the system so recalibrate 24 hours after the first calibration.

The pH sensor can drift slightly over time and calibration will offset this drift. The pH sensor should be calibrated every four to six weeks.

## F. pH Level Settings

1. Turn the selector knob to the FEED SET mode, then adjust the pH set knob until the desired pH level appears in the display. Acceptable levels are 7.2 to 7.8.
2. Adjust the pH feed system for a feed rate that is not too low or too high. Be aware of the lag time between the beginning of the chemical feed cycle and the sensor detection of the chemical levels after circulation through the pool or spa.

A low feed rate can either cause the feeder to lag or the feeding to be extended. A high feed rate can result in too much pH being added.

To check the feed rate, use a test kit to test the pH balance of the water immediately after a pH feed cycle ends. If the pH is high (above the preset point of the pH set point), the feed rate is too high. If overfeeding persists, timed feed may be required.

**Note:** If feeding liquid (muriatic) acid, dilute the acid in the water to avoid overshooting the set point. The smaller the body of water, the greater the need to dilute the acid.

3. The green pH feed light will activate only when the controller is activating the pH feeding system. In constant feed, the feed light will flash while feeding. The feed light will not activate when the pH alert light is on (pH is below or above the alert settings). If using timed feed, the feed light will flash during the feed cycle and be constant during the delay cycle.

To verify the feed mode, acid or base, set the desired pH above the pH indicated on the digital display. The feed light should come on if the controller is set for acid feed. If the controller is set for base feed, the feed light will come on when the desired pH is set below the pH indicated on the display. The unit is normally set for the acid feed mode.

## G. Sanitizer Settings

This controller displays direct ORP readings and the control is based on this reading, not the ppm (parts per million). While ORP indicates the effectiveness of the sanitizer, it does not directly correlate to a ppm reading. Use a DPD test kit to measure the free chlorine. If you need more sanitizer than that indicated by the ORP display, set the desired level above that point. If you require less sanitizer, set the desired level below that point.

**Note:** The ORP reading is not linear. An adjustment from 700 to 750 mv could increase the sanitizer level by several ppm.

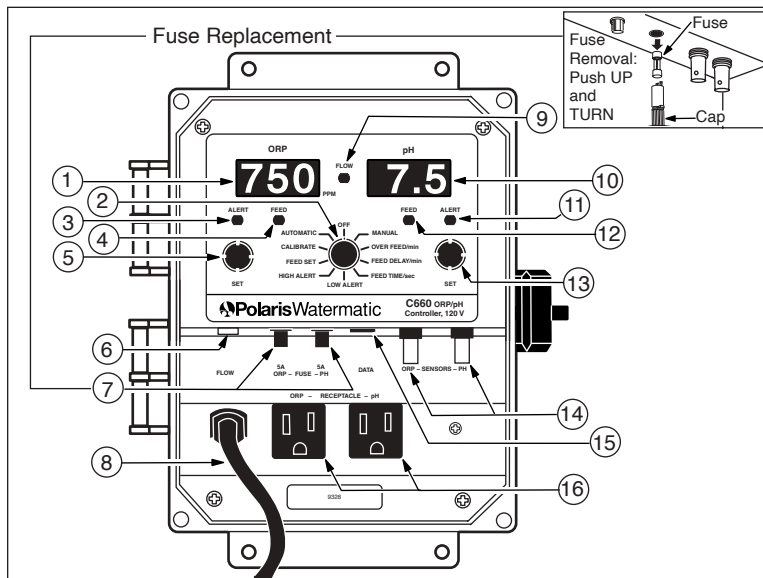
1. Verify that the selector knob is in the FEED SET mode, adjust the set knob until the desired ORP level appears in

the ORP display. The World Health Organization suggests maintaining an ORP at or above 650 mv. This is a good starting point.

2. Allow the system to operate for 24 hours. With the filtration system running, retest the sanitizer level and adjust the ORP set knob if necessary.
3. The feed rate of the sanitizer should be adjusted in the same manner as the pH feeder.
4. The yellow ORP feed light will activate only when the controller is operating the ORP system. In constant feed, the feed light will flash when feeding. If using timed feed/delay, the feed light will flash during the feed cycle and remain on constantly during the delay cycle.

## VII. Panel Features

#	DESCRIPTION	FUNCTION
1	ORP Digital Display	Indicates sanitizer level
2	Selector Knob	Selects controller mode
3	ORP Alert Light	Indicates the ORP level is out of range
4	ORP Feed Light	ORP sanitizer feeder is activated (or in delay)
5	ORP Set Knob	Sets the desired sanitizer mode
6	Flow Switch Connection	Connects flow switch to controller
7	Fuses	Continuous feed = 5 amp, Timed feed/delay = 1.5 slow-blo
8	Power Cord	3-wire grounded power cord with plug
9	Flow Light	Indicates sufficient flow/pressure to operate the controller
10	pH Digital Display	Indicated pH level
11	pH Alert Light	Indicates that pH is out of range
12	pH Feed Light	Indicates the pH feeder is activated (or in delay)
13	pH Set Knob	Sets the desired pH level of the water
14	ORP and pH Sensor Connectors	BNC jacks
15	Data port	Optional accessory connection
16	5 amp ORP/pH Outlets	3-wire grounded power receptacles



## VIII. Operation

### A. Starting the Controller

Prior to starting the system, balance the water chemistry to approximate the desired levels.

When the selector knob is turned to AUTOMATIC, the green flow light and the ORP and pH digital displays will come on. Once initiated, the controller has a 15-second delay to avoid unnecessary feeding. During the delay, bars will show in the digital readout.

**If the system does not have sufficient flow or pressure, the flow light will be off. The controller will not feed.**

### B. Automatic Presets

When the controller is initially powered up, the ORP setting will be 650mV and the pH setting will be 7.5.

### C. Feed Light Activation

1. The ORP feed light (#4 on Panel Features) will flash to indicate when sanitizer is being dispensed. The pH feed light (#12) will flash to indicate when pH is being dispensed.
2. When the system is feeding, the digital display may register an inaccurate sanitizer/pH level because the system is still circulating a dose of sanitizer/pH.
3. The system can be set for timed feed and delay cycles. Once the feeder has dispensed a dose of sanitizer or pH, the feeder is unable to dispense again for a set period of time. This delay allows the sanitizer/pH to be circulated through the pool or spa and returned through the filtration system where the sensors can test the sanitizer/pH level. After the delay period, another dose of sanitizer/pH will be dispensed if needed.

### D. Out-of-range Alert

1. The ORP alert light will flash when the ORP has been out-of-range for **ten consecutive minutes**. Once the alert light comes on, the controller will stop activating the feeder.
2. The pH alert light will flash when the pH has been out-of-

range for **ten consecutive minutes**. Once the alert light comes on, the controller will stop activating the feeder.

3. Once the out-of-range condition has been corrected, the controller will reactivate automatically. After a one-minute delay, it will activate the feeders, if necessary.

### **E. Manual Feed**

1. The MANUAL FEED setting can be used to manually dispense sanitizer/pH.
2. The MANUAL FEED setting cannot be used while the feed light is on.

### **F. Winterizing**

If the system is subject to extended shutdowns or is located in colder climates, it is important to winterize the system.

1. Turn off the main power to the controller.
2. Loosen the compression fitting nuts and gently remove the sensors from the flow cell assembly. **The sensor tips must be stored in a protective cap or bottle filled with a liquid solution of one teaspoon salt and three teaspoons water.** Mix the solution thoroughly and make sure the solution completely covers the tip of the sensors. **STORE THE SENSORS IN A WARM PLACE – DO NOT EXPOSE SENSORS TO FREEZING TEMPERATURES.**
3. Drain the water from the flow cell/flow switch assembly.

## IX. Maintenance

### A. Cleaning the Sensor Tips

1. It is important to keep the sensor tips clean to assure accurate readings. When the sensor tips become dirty, the sensors can read a lower than actual sanitizer/pH level and can cause too much sanitizer/pH to be dispensed.

**Note:** A sensor tip coated with calcium scale will not look visibly dirty.

2. As a general rule, the sensor tips should be cleaned every two to four weeks for commercial pools and spas, and once each month for residential. Cleaning frequency, however, can vary from one body of water to another.

To determine the appropriate frequency for your pool or spa, note reading prior to cleaning. After cleaning the sensor, allow a stabilizing period of approximately ten minutes. If the reading is identical to the reading prior to cleaning, the sensor was not dirty and the time between sensor cleanings can be increased.

3. To clean the sensor tip, turn off the controller. Loosen the compression fitting nut and gently remove the sensor from the flow cell assembly. Swirl the tip for five seconds in muriatic acid (diluted 5 to 1) or white vinegar, and rinse it in water. **Do not touch, wipe or brush the end of the sensor.** For commercial pools and spas, every third cleaning, swirl the sensor tip in a solution of liquid soap and water. Rinse with water.
4. Gently replace the sensor in the flow cell assembly and turn on the controller.
5. Allow the controller to operate for a few minutes to get an accurate reading. Adjust the set knobs if necessary.

### B. Checking the ORP Sensor

1. The ORP sensor should be checked every six months or anytime the feeder oversanitizes the water.
2. Clean the sensor tip as noted above.



3. Place the sensor in a clean glass of tap water. This should give a reading of between 200 and 400 mV. Adding a pinch of Dichlor or Trichlor should cause the ORP level to jump to between 750 and 800 mV. If Dichlor or Trichlor are not available and a sanitizer with a high pH such as calcium hypochlorite or liquid chlorine (sodium hypochlorite) is used, the ORP level may only rise to between 650 and 750 mV.
4. If the sensor does not respond as indicated, the sensor should be replaced.

### **C. Checking the pH Sensor**

1. The pH sensor should be checked every six months or anytime the pH goes out of range.
2. Place the sensor in a clean glass of tap water. Add a small amount of acid to the glass. The pH reading should drop to the lowest red light. Then place the sensor in any solution with a pH above 7.5. The pH reading should move up.
3. If the sensor does not respond as indicated, the sensor should be replaced.

## X. Troubleshooting

PROBLEM	POSSIBLE CAUSE	SOLUTION
SANITIZER LEVEL TOO LOW	Set knob set too low	Adjust knob clockwise until the proper sanitizer level is reached and stabilized
	pH level too low (less than 7.2)	Check pH level with a test kit and adjust as required
	Chemical feeder empty	Refill chemical feeder
	Controller malfunction	Replace controller module
	Sensor failure	Replace sensor
SANITIZER LEVEL TOO HIGH	Sensor dirty	Clean according to the maintenance instructions
	Set knob set too high	Test the sanitizer with a test kit and adjust the ORP knob counterclockwise until the proper sanitizer level is reached
	pH too high (above 7.8)	Check pH level with a test kit and adjust as necessary
pH LEVEL TOO LOW	Set knob set too low	Adjust pH set knob
	pH calibrate knob improperly adjusted	Adjust pH calibrate knob
	Chemical feed rate too high	Lower feed rate
	Chemical feeder empty (if using base)	Refill chemical feeder
	Controller malfunction	Replace controller module
	Sensor failure	Replace sensor
pH LEVEL TOO HIGH	Sensor dirty	Clean according to the maintenance instructions
	pH sensor calibration improperly adjusted	Adjust pH sensor calibration
	pH set knob set too high	Adjust knob counterclockwise
	Chemical feeder empty (if using acid)	Refill chemical feeder
	Feed pump malfunction	Repair feeder pump
	Chemical feed rate too low	Increase feed rate
RED pH ALERT LIGHT ON	pH level is below 7.0 or above 8.2	Manually adjust pH in the pool
DISPLAY LIGHTS OFF	No power supply	Check circuit breaker
FEEDER DOES NOT OPERATE	Bad fuse	Replace fuse

## **XI. Guidelines for Using ORP for Water Maintenance**

- Q. Why should I maintain a pH level between 7.2 and 7.8?
- A. pH levels below 7.0 can cause eye irritation, metal corrosion, etching of plaster, stains, damage to vinyl liners, and loss of sanitizer. In addition to eye irritation, pH levels above 8.0 can cause cloudy water, scale formation and loss of sanitizer efficiency (low ORP).
- Q. How do I increase the pH level?
- A. Small amounts of basic (alkaline) chemicals such as pH Plus or pH Up can be added.
- Q. How do I lower the pH level?
- A. Small amounts of liquid acid (muriatic) or dry acid (sodium bisulfate) such as pH Minus or pH Down can be added.
- Q. How does 650 mV relate to the ppm of chlorine?
- A. Pure water, without conditioner, at a pH level of 7.5 corresponds to approximately 1.5 ppm of chlorine. Actual pool or spa water usually takes at least 1-2 ppm of chlorine to generate 650 mV ORP, although the Total Dissolved Solids and pH can affect the activity of the chlorine and thus change the level of ORP.
- Q. Does an ORP of 650 mV stop algae?
- A. No. Because algae is a living organism that adapts genetically to a constant level of sanitizer, the periodic addition of an algicide or shocking may be necessary. Please note that the addition of some chemicals can change the ORP readings for up to several days.
- Q. What causes a low ORP?
- A. A low sanitizer level, a pH level above 8.0, a conditioner level above 200 ppm or a TDS (Total Dissolved Solids) above 3,000 ppm can all cause a low ORP.

- Q. How do I make sure the ORP sensor is working properly?
- A. Watch the sensor reading when adding sanitizer. If it does not respond properly, follow the recommended sensor tip cleaning procedures detailed in the Maintenance section. If cleaning does not solve the problem, check the sensor as outlined in Maintenance.
- Q. How should the ORP sensor respond to adding acid?
- A. Adding acid decreases the pH level thus increasing the ORP.
- Q. How should the ORP sensor respond to adding base?
- A. Adding base increases the pH level thus decreasing the ORP.
- Q. How should the ORP sensor respond to adding sanitizer?
- A. Depending upon the type of sanitizer used, the ORP should increase. A sanitizer high in base, such as liquid chlorine (sodium hypochlorite) or a dry chlorine powder (calcium hypochlorite), however, can cause the pH level to rise and the ORP to decrease. The pH level must be in the ideal range to maintain the proper ORP level.
- Q. Can ORP be used with ozone?
- A. Even though ozone is an excellent oxidizer, it has a very short lifetime. Therefore, a chlorine or bromine residual will still be needed in order to maintain the proper ORP level. When using ozone, the ozone must be introduced into the system downstream from the sensors.
- Q. Can ORP be used with UV or metal ions?
- A. Only if the proper chlorine or bromine residual is maintained.

## **XII. WARRANTY**

### **Polaris Watermatic C660 ORP/pH Controller**

This limited warranty is extended to the original consumer purchaser of this Polaris Watermatic C660 Controller manufactured by Polaris Pool Systems, Inc., 2620 Commerce Way, Vista, CA 92083-8438, USA.

Polaris Pool Systems warrants the Watermatic Controller it manufactures, including all parts and components thereof, to be free of defects in material and workmanship. For questions regarding your Polaris Watermatic Controller, please feel free to call or write us. Be sure to provide the serial number of your unit.

The warranty commences on the date of installation of the controller and shall remain in effect for a period of one (1) year, but in no event shall it be in effect for more than two (2) years from the date of manufacture of the controller as established by the serial number.

This limited warranty does not apply if the failure is caused or contributed by any of the following: improper handling, improper storage, abuse, unsuitable application of the unit, lack of reasonable and necessary maintenance, winter freezing or repairs made or attempted by other than Polaris Pool Systems or one of its authorized service centers. Polaris will repair or replace, at its option, a unit or part proved to be defective within the warranty period and under the conditions of the warranty.

Unless local repair is authorized, the consumer must deliver or ship the unit or the warranty parts, freight prepaid to the nearest Polaris Authorized Service Center or return it freight prepaid (after proper authorization) to the plant of manufacture.

Authorization to return a unit to the plant of manufacture must be obtained from the Polaris Customer Service Department. For your convenience, please check with your dealer for the local procedure before exercising this warranty. If further directions or instructions should be required, contact the Customer Service Department at 1-800-VAC-SWEEP (USA and Canada only) or 760-599-9600. Be sure to insure your shipments against loss or damage during transit.

Polaris is not responsible for the cost of removal of the unit, damages due to removal, any other expenses incurred in

shipping the unit or parts to or from the factory or its authorized service centers, the installation of the repaired or replacement unit. The consumer must bear these expenses.

This warranty does not cover repair or replacement of a unit except at our factory or a Polaris Authorized Service Center.

THIS LIMITED WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, AND ALL SUCH OTHER WARRANTIES ARE DISCLAIMED EXCEPT TO THE EXTENT ANY IMPLIED WARRANTY MAY BE IMPOSED BY STATE CONSUMER LAW. ANY SUCH IMPLIED WARRANTY IMPOSED BY STATE CONSUMER LAW IS LIMITED IN DURATION TO ONE (1) YEAR FROM DATE OF PURCHASE.

IN NO EVENT SHALL POLARIS POOL SYSTEMS BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES OF ANY NATURE OR KIND OR FOR DAMAGES TO PERSONS OR PROPERTY, INCLUDING ANY DAMAGE RESULTING FROM THE USE OF THE POLARIS WATERMATIC CONTROLLER.

Some states do not allow limitations on how long an implied warranty lasts, or the exclusion or limitation of incidental or consequential damages, so the above limitations may not apply to you.

This limited warranty is valid only in the United States of America and Canada, and it does not apply to Polaris Watermatic Controllers sold or installed in any other country.

## **XIII. Appendix**

For most controller applications, the continuous feed mode is appropriate. However, if you are using the controller in one of the following situations, the settings will need to be changed to allow for a timed-feed cycle followed by a delay.

The feed settings will need to be adjusted if your application uses:

- a peristaltic pump to feed the sanitizer or pH and you are experiencing overfeeding.
- an erosion feeder with a spa or small body of water and you are experiencing spiking
- the ORP sensor located downstream from the introduction of the sanitizer (the pH sensor should always be located upstream from the introduction of the pH balance).
- a Watermatic G1000, G1000A or G7500 feeder.

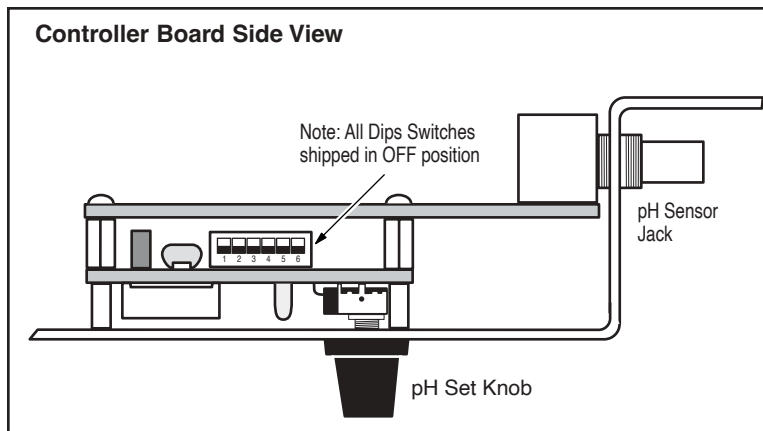
The feed and delay time options are detailed on the following pages.

Once the appropriate feed and delay cycle times have been set, allow the system to run for a few days. Then adjust the feed cycle longer if the water is undersanitized or shorter if the water is oversanitized. The delay cycle can also be shortened if the feeder cannot keep up with the demand.

The ORP and pH sides of the controller can be modified independently. For example, the pH side can be left in continuous mode while the ORP side is set for a timed feed, and vice versa. This versatility means you can choose the optimal settings for your controller application.

## A. Summary of Dip Switch Settings

<u>Switches</u>	<u>Description</u>
1	ON = No ORP feed if the pH is out of range OFF = ORP feed regardless of the pH
2	ON = No ORP feed while the pH is feeding OFF = ORP and pH can feed simultaneously
3	OFF = ACID Feed ON = BASE Feed
4	OFF = Lockout Disabled - Any changes possible ON = Lockout Enable - Calibration only
5	Mfg Test/Reset = Remain in OFF position
6	Mfg Test/Reset = Remain in OFF position





## **B. Peristaltic Pump is Overfeeding Sanitizer or pH**

When using a peristaltic pump which feeds slowly, or in pools with equipment located at a distance, the sanitizer or pH chemical may overfeed due to the delay in the circulation of the chemicals. This situation can be avoided by employing the timed feed/delay mode.

For example, a starting point can be:

5 minute Feed Time, 5 minute Delay

If this selection does not control the situation, increase the feed time. If spiking continues to occur, shorten the feed time. When using acid in small bodies of water, the acid must be diluted.

## **C. Erosion Feeder on a Spa or Small Body of Water is Causing Spiking**

When using the controller with an erosion feeder system, which continues to dissolve sanitizer while in the off mode, it is better to have a very short feed cycle followed by a delay that allows the sanitizer to circulate past the sensors. This is especially important in spas or small bodies of water.

For example, a starting point can be:

10 second Feed Time, 5 minute Delay

## **D. ORP Sensor Located After Sanitizer Introduction**

If the controller is used in an installation where the sensor is located downstream of the introduction of the sanitizer, there is a potential for the sensor readings to be inaccurate. Since this installation is generally associated with sanitizer tablets, which dissolve slowly, it is better to have a long feed cycle followed by a delay that allows the sanitizer to circulate past the sensor. This will ensure proper readings from the sensor.

For example, a starting point can be:

10 minute Feed Time, 5 minute Delay

### **E. Watermatic G1000, G1000A or G7500 Feeder**

These feeders can only operate with a short feed cycle followed by a delay; continuous or long feed cycles damage the feeders.

#### **For pools:**

Sanitizer: 4.8 second Feed Time, 10 minute Delay

pH: 0.6 second Feed Time, 5 minute Delay

#### **For spas:**

Sanitizer: 0.6 second Feed Time, 5 minute Delay

pH: 0.6 second Feed Time, 5 minute Delay

**Note:** In all cases, the two-ounce cone must be used.



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