



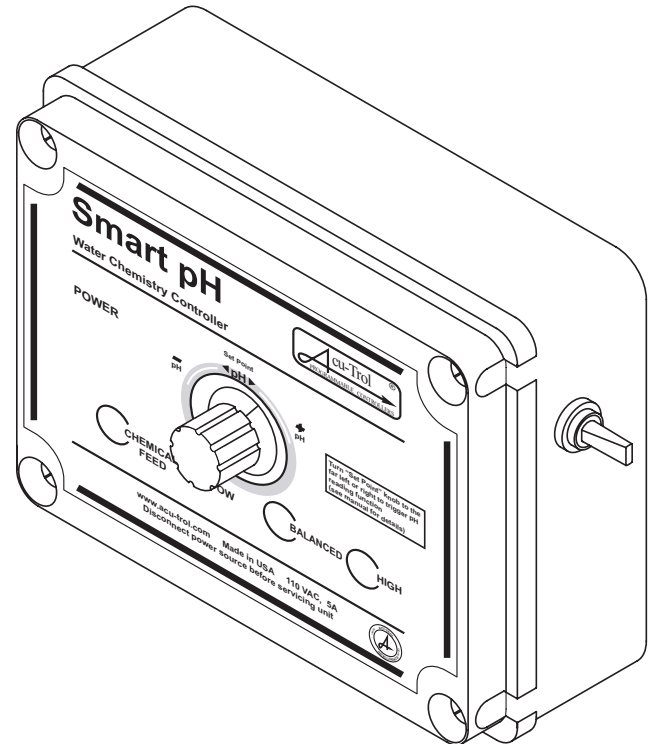
# Pentair Water

Pool and Spa™



# SMART pH™

## INSTALLATION GUIDE



**11830 Kemper Road  
Auburn, CA 95603  
1-800-273-4667 • 530-823-9898  
Fax: 530-823-9899  
www.acu-trol.com  
www.pentairwater.com**



## 1.1 IMPORTANT SAFETY INFORMATION

**PLEASE READ THIS USER MANUAL** completely before installing or operating the equipment. The Smart pH™ is a Class 1 product for protection against electric shock and a Type 1 product with regards to disconnection of the control circuits.

Observe the following safety precautions:

- ☑ Do not permit anyone untrained or under the age of 18 to use this product.
- ☑ Unit must be properly connected to earth ground.
- ☑ Never apply power when front panel is not secured in the closed position.
- ☑ Never service unit with power applied, always turn OFF main circuit breaker to unit and all equipment when servicing.
- ☑ Touching the controller's internal parts could result in injury and or damage to the controller. In case of a malfunction, only a qualified technician should repair the controller.
- ☑ Risk of Electric Shock. Connect only to a grounding type receptacle protected by a ground-fault circuit interrupter (GFCI).
- ☑ Do not bury cord. Route cord to eliminate abuse from heater exhaust, lawn mowers, hedge trimmers, and other equipment.
- ☑ Be careful not to damage any of the insulation on wires or the power cord. Should the cord be damaged return it to your dealer for a replacement. Continued use could result in fire or electric shock.
- ☑ To reduce the risk of electric shock, do not use an extension cord to connect unit to electric supply; provide a properly located GFCI.
- ☑ Never remove or install any cables between the circuit cards when power is applied, damage to the components may occur.



### WARNING

CHEMICAL BURN HAZARD - Make sure pumps are OFF before drilling into pipes. Securely fasten all electrical, water and chemical lines. Locate chemical feed pumps and chemical storage tanks in a safe and secure area. Never turn chemical feed pumps ON when any valves are closed. The feed lines can blow off and spray full strength chemicals causing damage to property and cause serious injury or death.

## WARRANTY

Acu-Trol, Inc. warrants the Smart pH™ to be free from defects in manufacturing and workmanship for a period of ONE (1) YEAR from the date of manufacture for the electronic module. All sensors and flow cells have a ONE (1) YEAR from the date of manufacture. Other equipment is covered by the individual manufacturer's own warranty. During the warranty period, any defective parts will be repaired or replaced when necessary by Acu-Trol, Inc.

This warranty does not cover: (a) the buyers' labor or any servicing fees related to replacement of the Product; (b) damage resulting from the use of this Product in other than its normal manner; (c) damage from misuse, accident or neglect; (d) damage from improper testing, operation, or installation; (e) not operating the Product on a dedicated (separate) circuit or under conditions other than those recommended or at voltages or amperages other than the voltage or amperage indicated on the Product; and (f) acts of Mother Nature (i.e. lightning, electrical storms, floods, etc.). In addition, attempting to service or modify the Product will render this Warranty Void. Defective parts should be returned immediately to the local Acu-Trol dealer, any parts returned to the factory require a return of material authorization code to subsequently generate an RMA (Return Material Authorization form). An Acu-Trol Technician will analyze the returned part and determine the cause of failure and process accordingly.

WARRANTY CARD MUST BE COMPLETED AND RETURNED AT ONCE TO BE KEPT ON FILE

## 1.4 SMART pH™ OVERVIEW

**SUMMARY:** The Smart pH is a microprocessor based, modular automation system capable of continuous local monitoring and control of the pH water chemistry for pool and spa applications. The Smart pH will maintain the pH levels (**either** increasing pH using base or decreasing pH using acid) of your water system automatically. The Smart pH will **only increase or decrease the pH**. The Smart pH is recommended for use with a chlorine generator or an erosion type feeder. You can also use the Smart pH when hand feeding liquid chlorine (base) or muratic acid as the chlorine will increase the pH and the acid will decrease the pH. The Smart pH can also control CO<sub>2</sub> gas systems with the same efficiency as an acid feed controller. (For specific information on installation refer to documentation supplied with CO<sub>2</sub> chemical feeder).

**RELAY:** The Smart pH has one relay module to control the pH levels.

**SENSORS:** The Smart pH can measure inputs from one pH sensor.

**VOLTAGE:** The Smart pH can only work on an input voltage of 110 VAC.

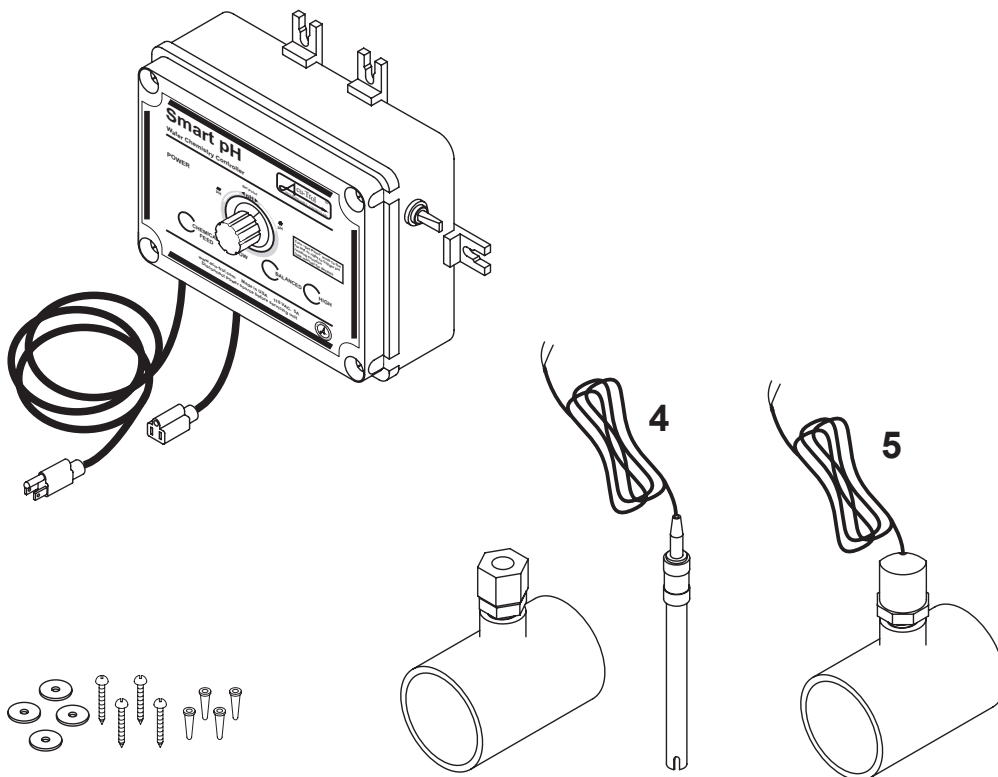
## CHAPTER 2, INSTALLATION

### 2.1 PREPARATION

**Receipt Inspection:** Upon receiving the controller from shipping, check the carton carefully. Report any damaged items directly to the shipping company. Examine the package content list below and verify that all items are present. Please contact your local Acu-Trol dealer if any items are missing or have been damaged. Use care when unpacking equipment to avoid damage or loss of small parts.

### 2.2 PACKAGE CONTENTS

1. Smart pH Controller
2. Mounting Hardware
3. pH Sensor "T" Assembly
4. pH Sensor
5. Flow Switch Assembly



## INSTALLATION SUMMARY

1. Identify new and existing equipment to be connected.
2. All controlled equipment must be 110 VAC (see Section 2.5.2)
3. Mount the Smart pH away from direct sunlight and on a flat vertical surface.
4. Connect the supply voltage with main breaker off (must be a separate dedicated circuit GFCI).

### ▲ CAUTION

Keep the Smart pH out of direct sunlight or inside a room if possible.

## MOUNTING THE SMART pH™

Select a location for mounting the Smart pH that will meet the following recommendations.

1. At least ten (10) feet from open water.
2. Close enough for the supplied power cord (6') to reach the supply voltage. The controller will not operate properly without a solid earth ground connection.
3. Supply power must be routed to the Smart pH in accordance with all national, state, and local codes.
4. Keep the Smart pH out of direct sunlight and inside a room if possible, a shade screen should be used for outdoor installations.
5. The installation surface must be solid and vertical. Do not mount the controller in a horizontal position.
6. Maintain adequate clearance for opening the enclosure.
7. The environment should be free of chemical fumes and excessive heat.
8. Mount as far as possible from sources of electrical interference.
9. Hold the controller against the mounting surface with a closed lid and mark the location of the mounting brackets on the wall. Prepare holes as necessary and secure controller using hardware provided.
10. Make sure the controller box is not distorted by an uneven mounting surface.

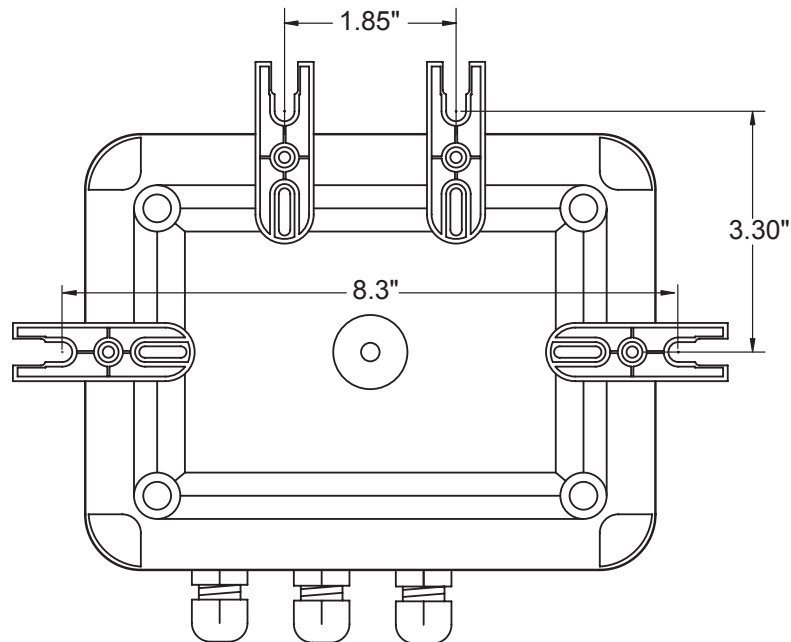


Figure 1. Mounting Dimensions

### WARNING

Proper and safe operation requires an earth ground connection. All electrical work must be performed by a licensed electrician and must conform to all national, state, and local codes.

# ELECTRICAL SPECIFICATIONS

The following electrical specifications tabled below must not be exceeded.

ITEM	DESCRIPTION	LIMIT
Input Voltage	Maximum Input AC Voltage	125 VAC
Input Current	Maximum Input Current	5 AMPS (AC)
Input current	Maximum Current for Single Relay	5 AMPS (AC)
Temperature	Minimum/Maximum Operating Temperature	30° - 110° F
Standby Current	Current with Relay OFF, LED ON Current with Relay OFF, LED OFF	50 mA (AC) Typical 30 mA (AC) Typical
Sensor Range	pH	4.22 - 9.78

## CONNECTING THE 110VAC POWER SUPPLY

For cord connected installations wait to plug the cord in as the last step in the installation. For hard-wired installations make sure the circuit breaker is off and turn it on as the last step in the installation. **Acu-Trol recommends having a licensed electrician perform the installation to ensure all national, state, and local codes are met.**

## RELAY BOARD CONTROL VOLTAGE SETTING

The relay comes set from the factory for 110 VAC control voltage. Changing the jumper on the relay will allow for different control voltages of 24V or for a Dry Contact Switch (see Fig. 2)

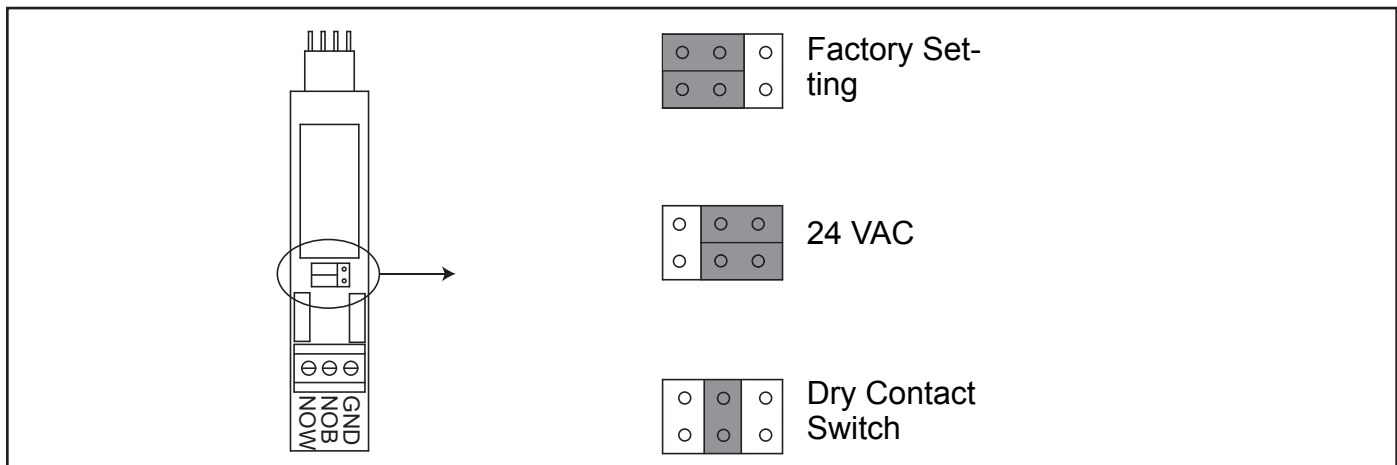


Figure 2. Relay Jumper Settings

## CHEMICAL FEED PUMP LOCATION

If the feed pump has not been previously installed, follow the instructions included with the chemical feed pump. Some chemical feed pumps include a power cord and are ready to plug in. If a "pigtail" has been ordered with the Smart pH, simply plug the pump power cord into the "pigtail". If a "pigtail" is not installed the power cord from the pump will need to be modified. The list below provides overall installation recommendations:

1. Mount at least 10 feet from open water.
2. Install the pump below the level of the Smart pH and away from any other equipment or systems.
3. Install close enough to the Smart pH for the feed pump power cords to reach.
4. If a plug is already on the pump, simply plug in the pump to the Smart pH "pigtail". If pigtailed are not installed, you will need to hardwire the pump to the Smart pH relay board.
5. Route the supply power wires to the Smart pH through the lower fitting and attach to the appropriate relay terminals on the relay circuit board (see Section 5, "Wiring Diagram"). If the wire ends were striped and not ferruled make sure that no frays of wire are out of the connector as this may lead to a short.
6. PVC conduit can also be used (in accordance with all national, state, and local codes).
7. When installing metal conduit into the controller, a ground LUG should be used (in accordance with all national, state, and local codes) to connect the conduit to the relay board ground.

# PLUMBING INSTALLATION

Install the flow sensor and the pH sensor using the following steps:

1. Turn off all power to the system, close all isolation valves and then release any air from the system by turning the release valve on top of the system filter.
2. The flow sensor and pH sensor "T"s must be installed **after the filter but, before the chemical injector**. **Install the flow sensor before the pH sensor.** The flow sensor "T" has an arrow on it. The arrow indicates water flow direction.
3. Remove the protective cap from the pH sensor. Using the "T" with the sensor adapter, install the sensor into the adapter. Push the sensor into the adapter until it hits the bottom of the "T" (see Fig 5). Tighten the sensor adapter (hand tighten only).
4. Allow for sufficient drying time of the PVC glue (minimum recommendation of 24 hrs).
5. Close the air release valve on top of the filter. Open any isolation valves and check the system for leaks.

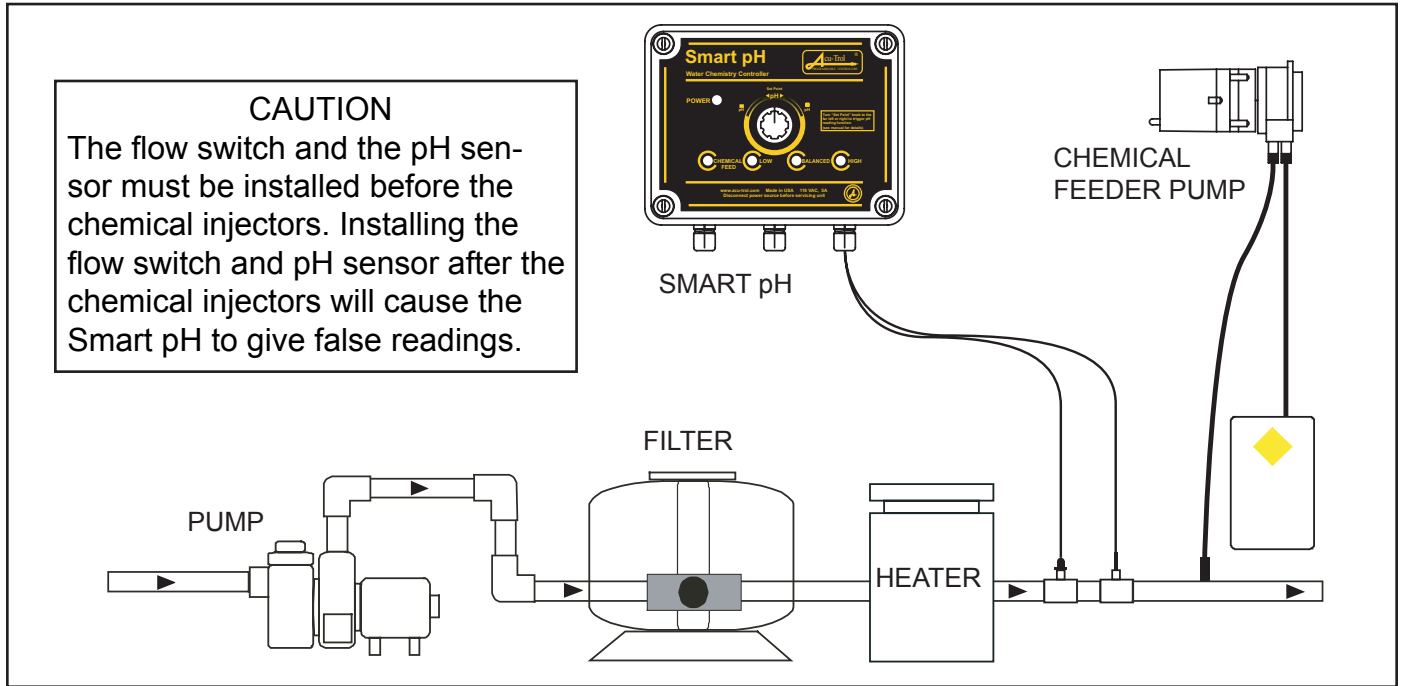


Figure 3. Plumbing Installation Diagram

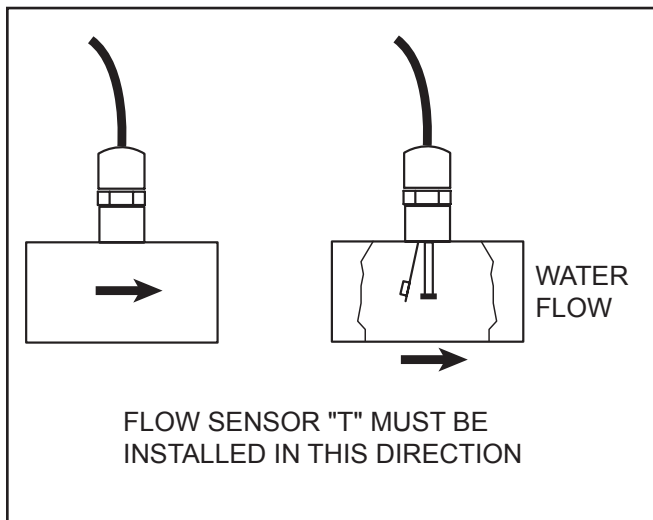


Figure 4. Flow Sensor Installation

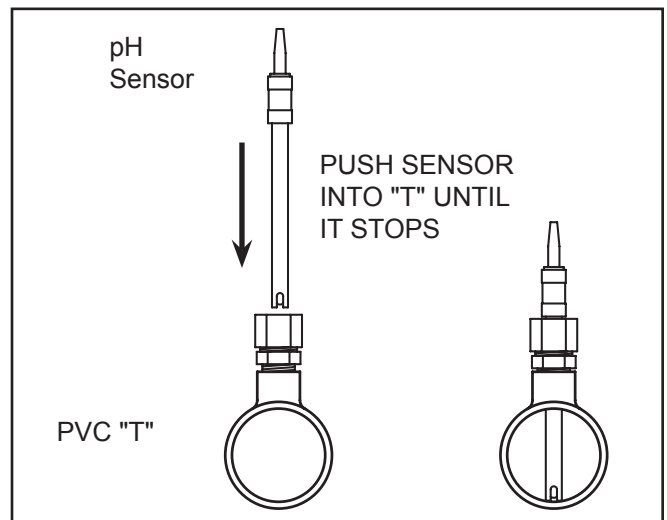


Figure 5. pH Sensor Installation

# SENSOR WIRING

## pH SENSOR

Open front panel by removing the top two screws completely and unscrewing the lower two screws about half way. The front cover will now fold down like a shelf for easy access to the wiring connections and dipswitches. Route the sensor wires through the small strain relief into the Smart pH and to the appropriate connectors (green terminal bar) in the Smart pH (see Fig. 6).

The polarity (+ and -) of the pH sensor must be observed. The pH sensor wire (+) is clear, and the pH sensor wire (-) is green. Leave excess wire outside the controller enclosure. Do not stuff excess wire inside the controller as this may cause excess strain on sensor and relay connections. Do not cut the sensor wire. If the cable is longer than needed, it should be coiled neatly and attached under the controller enclosure.

### WARNING

Sensors are shipped with a protective cap covering the electrode tip to protect the sensing element. Sensors should be kept in the protective cap until ready for installation, if the cotton in the protective cap becomes dry, wet it with tap water. During shipment, air bubbles may have entered the electrode, carefully shake the electrode downward (like a thermometer) to dispel the air from the sensing elements inside the electrode. Before using the sensor, remove the cap.

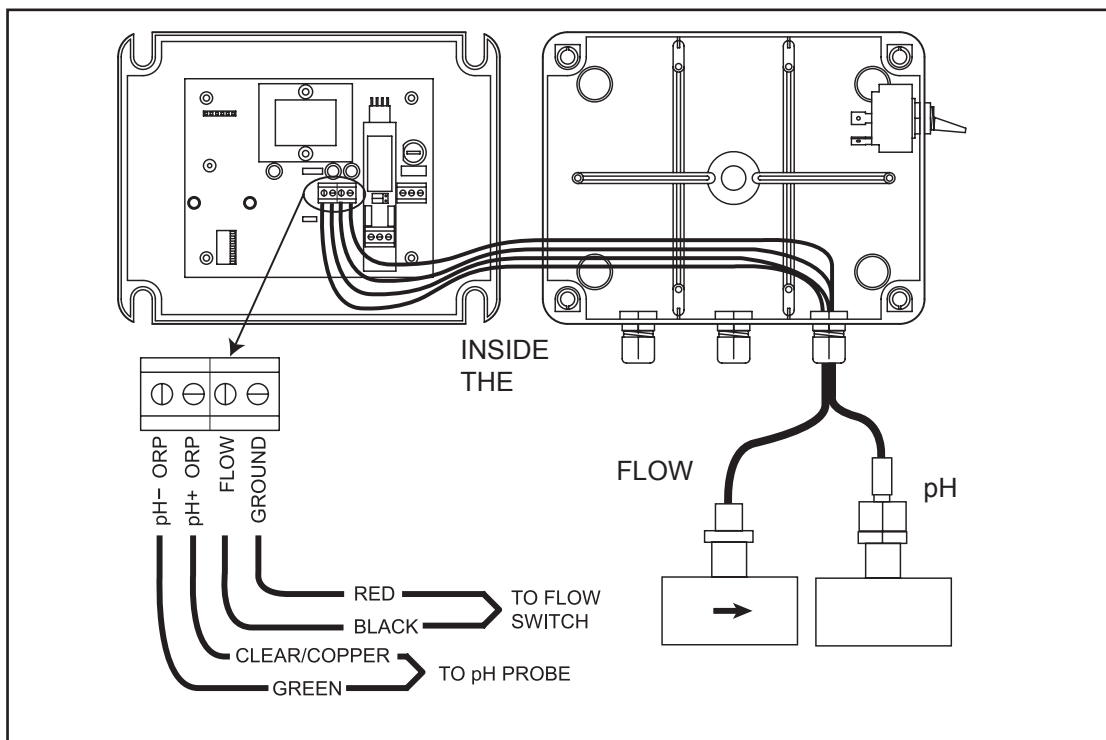


Figure 6. Smart pH Sensor and Flow Switch Wiring

## FLOW SENSOR

The flow sensor is used to indicate that there is flow and that it is OK to feed chemicals. The Smart pH will not allow chemicals to feed if the water flow is not on and detected.

Route the sensor wires through the small strain relief into the Smart pH and to the appropriate connectors (green terminal bar) in the Smart pH (see Fig. 5).

Do not stuff excess wire inside the controller as this may cause excess strain on sensor and relay connections.

Do not cut the sensor wires.

If the cable is longer than needed, it should be coiled neatly and attached under the controller enclosure.



## 2.9 SETTING THE DIP SWITCHES

1. Set the switches on the DIP Switch as to your requirements. (See fig 7.)

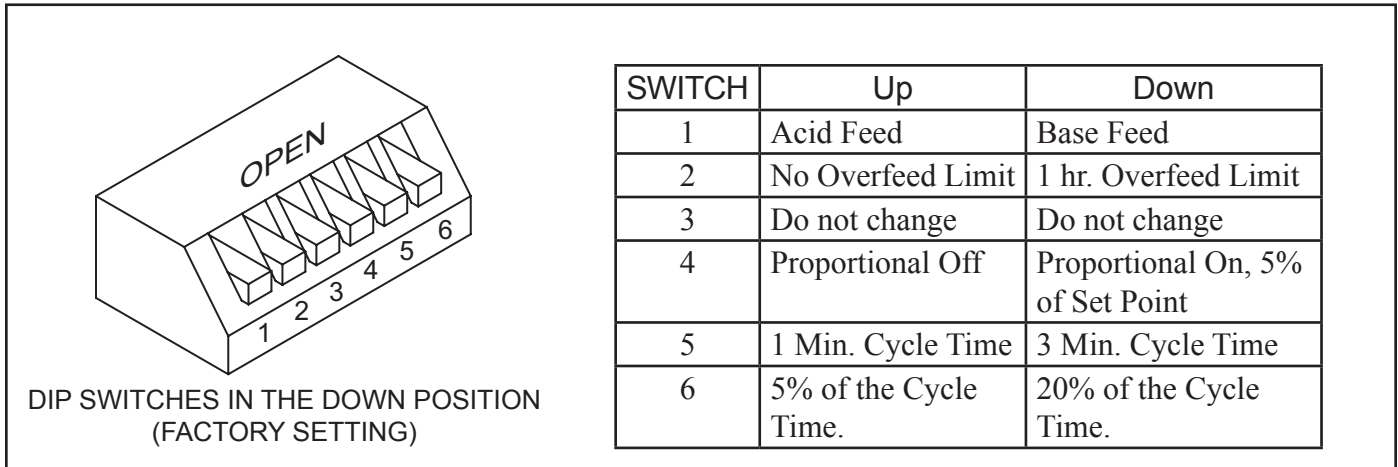


Figure 7. DIP Switch Settings

### Descriptions:

- Acid Feed: DIP Switch 1 (up) will turn on the chemical feeder when the "High" LED side is on.  
OR  
Base Feed: DIP Switch 1 (down) will turn on the chemical feeder when the "Low" LED side is on.
- Overfeed: The unit will enter overfeed mode when the feed time has exceeded the setting of DIP Switch 2. When in overfeed mode, the Low, Neutral, and High LED's will flash.
- Proportional: DIP Switch 4 will set a variable time length calculated to turn the chemical feeders on and off so that the pH level does not overshoot.
- Cycle Time: Use DIP Switch 5 to have a one (1) minute cycle time (up) or a three (3) minute cycle time. The On Time + Off Time = Cycle Time.
- On time: Dip Switch 6 determines whether the chemical feeder can be on for 5% of the On Time or whether it is 20% of the On Time (This can help the unit from overfeeding on small bodies of water or spas).

## FINISHING AND TESTING

Once the controller system has been installed with applicable sensors and modules, allow the Smart pH system to acclimate to the body of water for 24 hours.

1. After all wire connections are complete, close the panel and tighten the enclosure screws.
2. Turn on the main breaker and turn on the Smart pH.
3. Verify that the controller is active and that LED's are working.

## OPERATIONS

### SMART PH™ BASIC OPERATION

- When the pH level is .2 or greater above the set point the HIGH LED will be on.  
When the pH level is .2 or greater below the set point the LOW LED will be on  
When the pH level is .05 to .2 above the set point the HIGH LED and the BALANCED LED will be on.  
When the pH level is between +/- .05 from the set point the BALANCED LED will be on.  
When the pH level is .05 to .2 below the set point the LOW LED and BALANCED LED will be on.

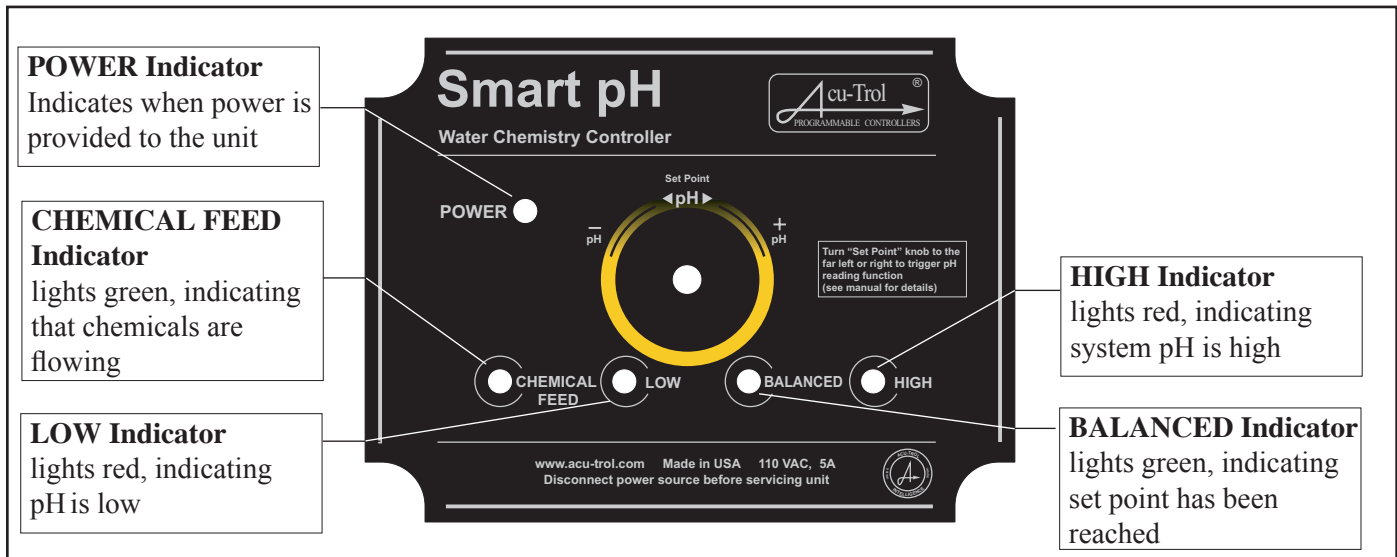


Figure 6. Smart pH Basic Operation

## STARTUP

### SETTING pH

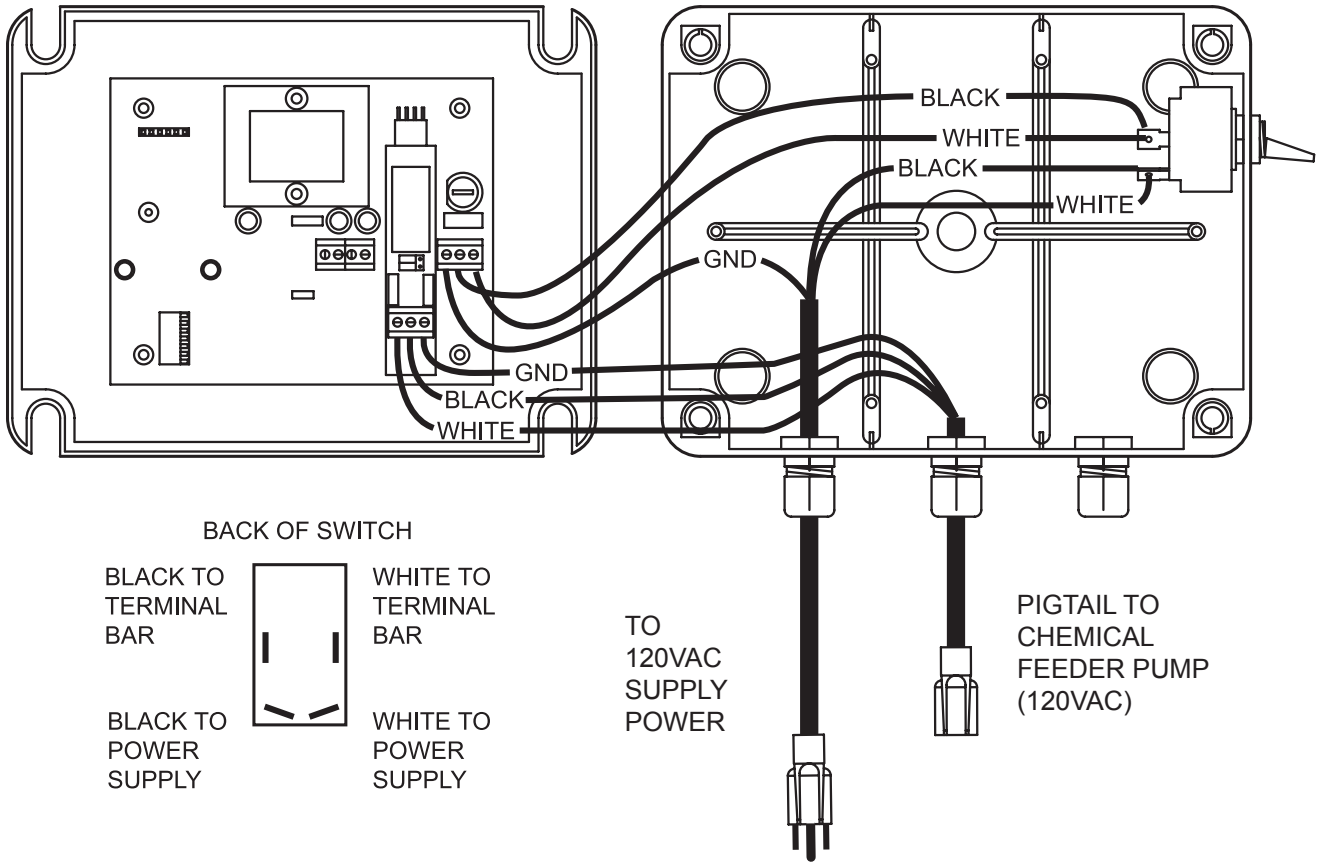
Measure the pH using a standard test kit. If not already done, close up the front cover of the Smart pH. When the knob (potentiometer) is turned all the way to the right or left the units Low, Balanced, and High LED's will begin to flash simultaneously. Count the number of flashes on each LED. This will be the reading of the pH probe being monitored. For example, for a pH reading of 6.23 the Low LED will flash 6 times, the Neutral LED will flash 2 times and the High LED will flash 3 times. The LED's will all go off for approximately 2 seconds and then restart again until the knob is moved back into the set point range. Chemical feeding will stop when the Smart pH detects there is no flow. **See Chapter 6, "Setup Check Out Sheets" for help with start up.** The Smart pH is not an absolute measuring device. If the pH of the system is too high turn the knob to the left and monitor over some period of time. If the pH is too low turn the knob to the right and then monitor over time. Monitor the pH readings by using the hand check method and adjust the Smart pH to achieve the desired reading. Normally the probes should read +/- .5 of the hand check, if out of this range the probe may need to be cleaned (See "Cleaning Probe", Section 4.2).

## TROUBLESHOOTING

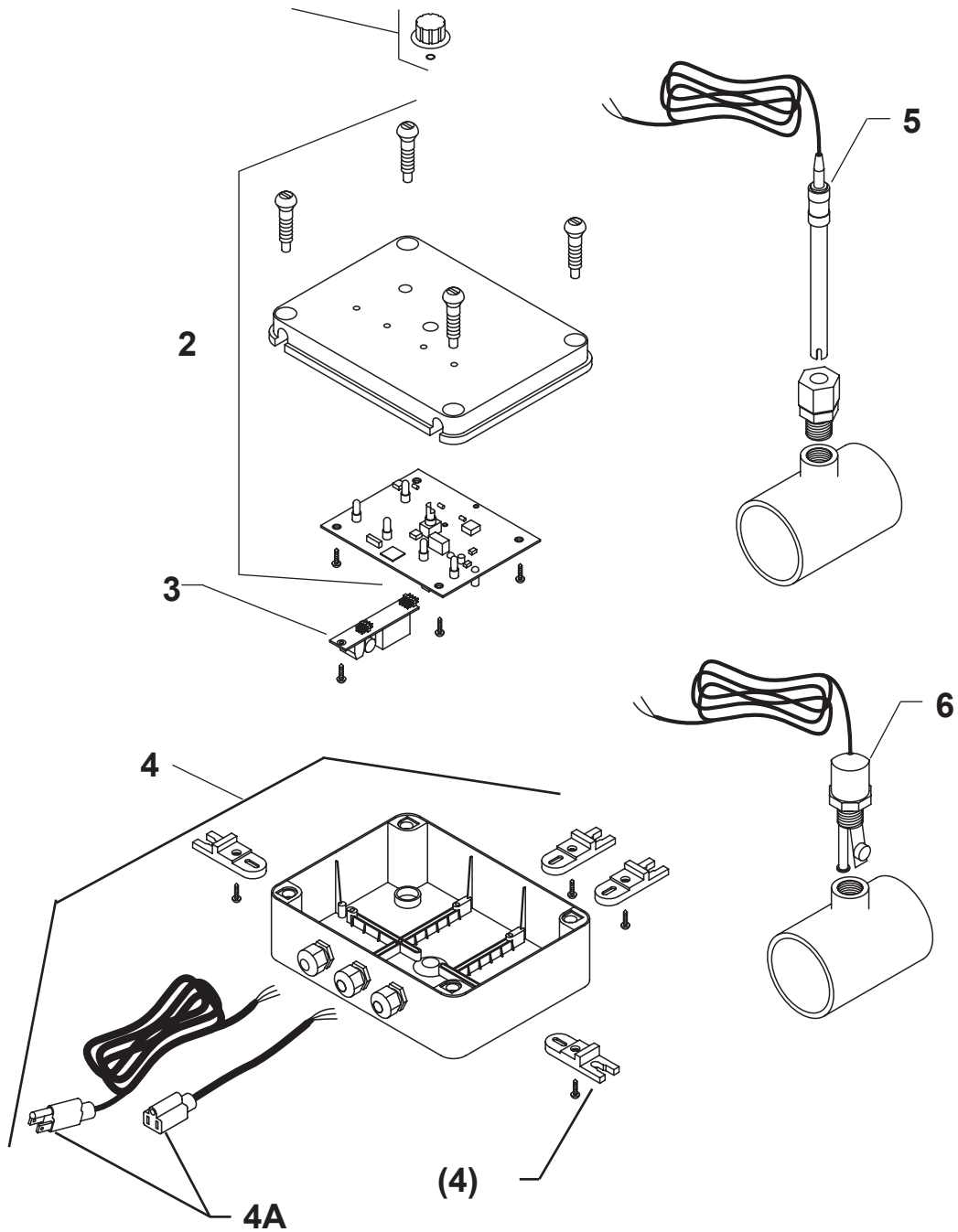
PART	PROBLEM	SOLUTION #1	SOLUTION #2
pH Levels	High pH won't come down even after turning control down	Check chemical tank and make sure it is not empty	Check power connection between the Smart pH and the chemical controller
pH Sensor	Reading never matching hand check	Clean sensor, check ground on input power	Check total alkalinity
pH Sensor	Readings never matching hand check	Short (+) (-) on sensor, pH = 7.0. Remove sensor	Sensor may need to be cleaned
Flow Switch	Not working	Check continuity when flow is present	
LED's Flashing	Overfeed alarm ON	1 hour or none only	Make sure feeder is working properly

# DIAGRAMS

## 120VAC SUPPLY POWER WIRING



# EXPLODED VIEW



## PARTS LIST

Dia. #	Description	Part #
1	Knob with O-Ring.....	754000030
2	Top Half Replacement, Complete .....	714000030
3	Relay Module .....	714000050
4	Bottom Half Replacement, Complete .....	714000040
4A	Cables, (1) Power Cable, 6' and (1) Pigtail, blue, 6" .....	754000020
4B	Mounting Feet (4) with Screws (4) .....	715000000
5	Sensor, pH .....	744000020
6	Sensor, Flow Switch.....	744000030

