

**RATIO:GUARD®**  
**MODEL P-1**  
**pH INDICATOR/CONTROLLER**

Price \$4.00

**ATTENTION!**

**Your controller must be calibrated** to the electrode before using. See APPENDIX A. for calibration procedures.

**Note:** The first time the controller is turned on it will display **OFF** until a high set point has been entered.

**GETTING TECHNICAL ASSISTANCE**

The H.E. Anderson Company is anxious to assist our customers with installation and use of our products. Our technical people are available each weekday from 8:30 a.m. to 4:30 p.m. central time. You may call us toll free at **1-800-331-9620** from anywhere in the U.S.A. and Canada. If no one is available, we will promptly return your call.

Before you call, we suggest that you review this manual. You may find the answer to your question there. But even if you do not, reviewing the manual will help us to help you.

There is some information you should have available when you call. You should know the model and serial number of your controller. Also, you should note the program version number. We may not need all this information, but having it available at the start can sometimes save a lot of time and trouble for you.

SERIAL \_\_\_\_\_ PROGRAM VERSION \_\_\_\_\_

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# C O N T E N T S

<b>1.0</b>	<b>INTRODUCTION</b>	<b>1</b>
1.1	FEATURES	1
1.1.1	Numeric Display	1
1.1.2	Sealed Enclosure	1
1.1.3	Keypad	2
1.1.4	Memory Backup	2
1.1.5	Easy Insertion Electrode	2
1.1.6	Electrode Mounted Signal Conditioner.	2
1.1.7	Optional Output Latching	
1.1.8	Circuit Protection	2
<b>2.0</b>	<b>INSTALLATION</b>	<b>2</b>
2.1	ELECTRODE INSTALLATION	3
2.2	MOUNTING THE ENCLOSURE	4
2.3	ELECTRICAL CONNECTIONS	4
2.3.1	Electrode Connections	4
2.3.2	Control Relay Connections	4
2.3.3	Power Connections	4
2.3.4	Circuit Protection	4
<b>3</b>	<b>PROGRAMMING &amp; OPERATION</b>	<b>4</b>
3.1	ALARM RELAY LATCHING	4
3.1.1	Programming Alarm Latching	5
3.1.2	Clearing Alarms	5
3.2	CALIBRATION	5
3.3	DISPLAY FUNCTIONS	5
3.3.1	Version Number Display	5
3.3.2	Normal Display	5
3.3.3	Setpoint Display	5
3.4	THE CONTROL FUNCTION	5
3.4.1	Setting the High Alarm Setpoint	5
3.4.2	Setting the Low Alarm Setpoint	6
4	MAINTENANCE	5
<b>5</b>	<b>TESTING &amp; TROUBLESHOOTING</b>	<b>5</b>
5.1	THE PROGRAM VERSION	6

*Contents*

5.2 THE DISPLAY . . . . . 6  
5.3 ERROR CONDITIONS . . . . . 7  
5.4 EXTERNAL ALARM CIRCUIT PROBLEMS . . . . . 7  
5.5 LOSS OF PROGRAMMING . . . . . 7  
5.6 OTHER PROBLEMS . . . . . 7  
6 REPAIR . . . . . 7  
7 FACTORY SERVICE . . . . . 7  
APPENDIX A. Calibration & Care of pH Electrodes. . . . . A-1

**T A B L E S**

SPECIFICATIONS . . . . . 1  
TABLE 1 Terminal Board Connections . . . . . 3

**F I G U R E S**

1. The P-1 Controller. . . . . 1  
2. Installing the Electrode Tee . . . . . 2  
3. The Terminal Board . . . . . 3

## 1 INTRODUCTION

The Model P-1 controller is very easy to install and operate. It requires very little maintenance. The only maintenance required is periodic cleaning and calibrating of the electrode.

This manual covers all aspects of installing and operating this controller. Once your controller is installed and operating, you should not have to refer to the manual unless you have a problem.

This section gives the specifications and describes the features available in your controller. You should also read Section 2 INSTALLATION, Section 3 PROGRAMMING, and Section 4 MAINTENANCE.

It is a good idea to familiarize yourself with Section 5 TESTING AND TROUBLESHOOTING. This will show you how to determine if your controller is operating properly and alert you to possible problems.

APPENDIX A. gives the procedures for cleaning and calibrating your pH electrode. This is something you will need to do regularly, so this is must reading.

### 1.1 FEATURES

This section describes the features of your controller. Some of them will be covered in greater detail under other headings.

#### 1.1.1 Numeric Display

The controller has a large four digit LCD display. This display is used to display pH readings and setpoints. It can also indicate alarm and error conditions.

#### 1.1.2 Sealed Enclosure

The only openings in the enclosure are where wires enter. The panel is totally sealed and the front cover is gasketed.

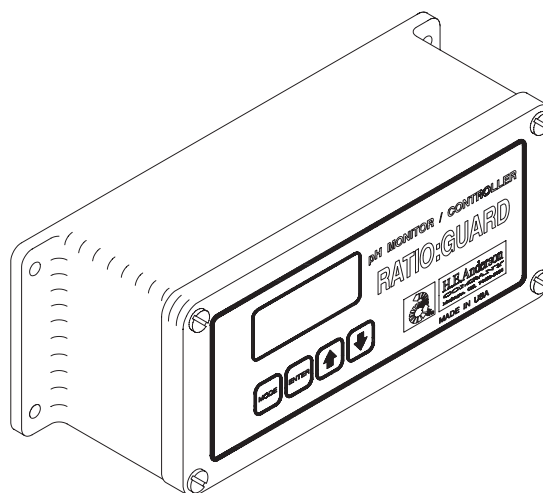


Figure 1  
The P-1 Controller

## SPECIFICATIONS Model P-1

### Range

0–14 pH indication, 1–13 pH control

### Accuracy\*

within 0.05 pH @ 77°F

### Display

0.7 in. LCD numeric

### Control Outputs

10 amp. SPDT contact outputs for both high and low alarms  
Optional output latching

### Enclosure

Water resistant with gasketed cover;  
Sealed front panel

### Power Requirements

120 VAC  
240 VAC (With A suffix on model number)

### Setpoint Memory Retention

Greater than seven days with zero power.

\*If properly calibrated to electrode, using standard buffers.

## Model P-1 pH Control

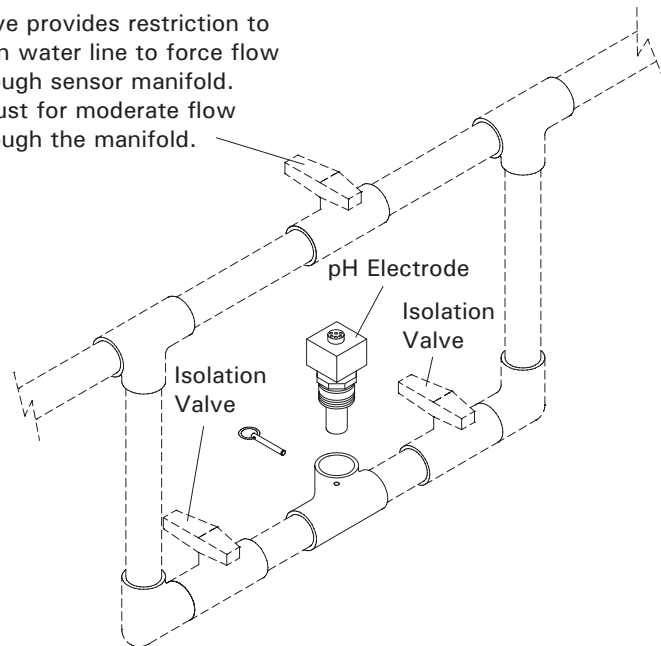
Parts shown with dashed lines are not included with manifold.

Install so electrode inserts from top.

Sensor Tee accepts 2" schedule 80 PVC pipe.

Main water line may be any size.

Valve provides restriction to main water line to force flow through sensor manifold. Adjust for moderate flow through the manifold.



**NOTE: Be certain both isolation valves are open during normal operation. Otherwise the unit will not operate properly.**

Figure 2  
Installing the Electrode Tee

### 1.1.3 Keypad

The four key pad allows easy viewing and setting of setpoints.

### 1.1.4 Memory Backup

The controller memory is backed up by a special supercap device. If power is lost, controller operation will stop, but setpoints will be retained. When power is restored the unit will resume functioning normally.

### 1.1.5 Easy Insertion Electrode

The sensor fitting is design for easy maintenance. The electrode is easily removed for cleaning.

### 1.1.6 Electrode Mounted Signal Conditioner

The pH electrode has a signal conditioner mounted with the electrode. This means that high level digital signals are sent to the controller. This greatly reduces cable related problems and increases accuracy. The controller comes with twenty-five feet of cable. The cable may be extended if necessary, with no effect on performance.

### 1.1.7 Optional Output Latching

The high and low alarm relays may be independently set to latch when an alarm condition occurs.

### 1.1.8 Circuit Protection

The controller includes some protection against external voltage spikes and other problems. However we cannot guarantee protection under all conditions. You should follow the recommendations given in Section 2.3.4 to provide maximum protection of your investment.

## 2 INSTALLATION

You will install the sensors and the control box, as well as any external alarm circuits.

The controller is prewired with twenty-five feet of cable. Select a convenient location which is within reach of electrode location. The location should also be close to a power source.

It should be out of direct sunlight, protected from extreme heat, and be free of vibration.

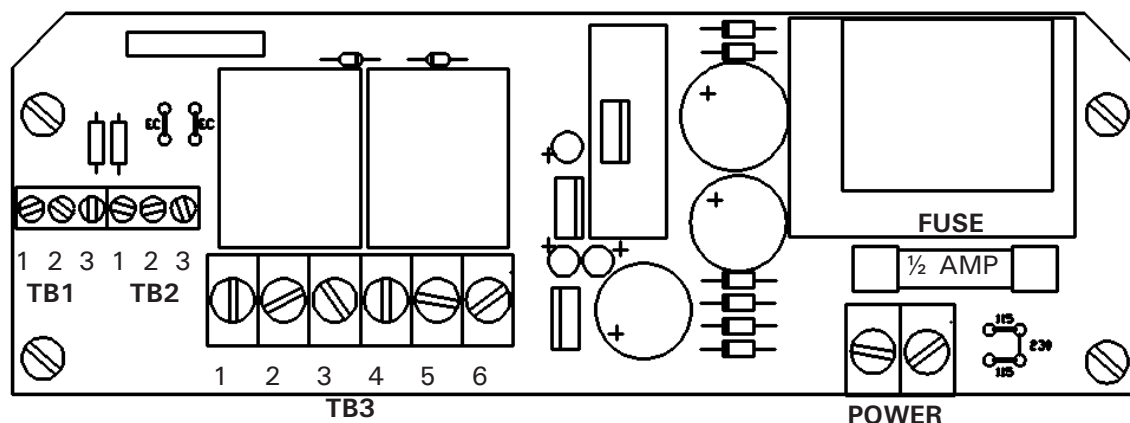


Figure 3  
The Terminal Board

Table 1 – Terminal Board Connections											
Electrode Connections						Relay Connections					
TB1			TB2			TB3					
1	2	3	1	2	3	1	2	3	4	5	6
Gnd (5 V)	pH Signal	+5 VDC	Gnd (12 V)	+12 VDC	-12 VDC	High Alarm Relay			Low Alarm Relay		
Shield	Black	Red	Green	White	Brown	N.C.	N.O.	Common	N.C.	N.O.	Common

The enclosure is water resistant and the unit is well sealed against water spray. However, you should choose a location where it will not be subjected to constant water spray or spray from the bottom.

## 2.1 ELECTRODE INSTALLATION

A recommended installation of the electrode Tee is shown in Figure 2. You can vary installation to suit your needs, but you should remember the following points:

1. The electrode should be installed downstream from the injector and blending tank (if present) so the treated water will be thoroughly mixed.

**Warning: The electrode should never be allowed to dry out. Permanent damage will result.**

2. You should have isolation valves to allow the electrode to be easily removed while leaving the water on.
3. The electrode should be installed in a bypass for maximum convenience.
4. If installed in a bypass, you must have some restriction in the main water line to insure moderate water flow past the sensor. High flow may shorten the life of the electrode.
5. The fittings should be installed so the pH electrode will insert vertically from the top.
6. Be sure to remove the protective cap before inserting the electrode.

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## 2.2 MOUNTING THE ENCLOSURE

Mount the unit securely, using the four holes located in the flanges.

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## 2.3 ELECTRICAL CONNECTIONS

Your controller comes prewired with all sensor connections already made. Normally the only wiring you will do will be to external control or alarm circuits.

You may wish to use conduit for the sensor and power cables. The entrance assemblies may be removed and replaced by conduit connectors if desired. If you do this, you will need to disconnect the cables and reconnect them later.

### 2.3.1 Electrode Connections

The pH electrode cable is prewired. Connection information is given in case you should ever need to replace or rewire the cable. Figure 3. shows the terminal circuit board and sensor terminal blocks. Table 1 details the connections.

### 2.3.2 Control Relay Connections

**WARNING: Be certain all power is off when working with the external circuit connections.**

The control relays are clearly labeled as to alarm function and with common (**C**), normally open (**NO**) and normally closed (**NC**) contacts brought out to the terminal block. Contacts are rated at ten amperes. For ease of wiring, use the smallest wire suitable to the current required by the external circuit.

### 2.3.3 Power Connections

**WARNING: Be certain power is off when working with the power connections.**

The controller comes with a power cord. If you wish to use conduit, remove the power cord and entrance assembly. Refer to Figure 3. when reconnecting power connections.

### 2.3.4 Circuit Protection

We have done our best to design this product to stand up to adverse electrical supplies. The circuit is fused and we have included MOV devices to suppress voltage spikes coming in over the AC line. However, MOV's cannot protect under all conditions and do not last forever. Each time the MOV takes a really big spike it is damaged a little. After enough spikes it will fail.

If you really want to provide the best protection for your controller you should buy a spike suppressor (you can get them at Radio Shack). This is a device that goes between the line cord and wall socket.

This will help. However, if you have a big storm that damages any of your other equipment, you probably should replace your spike suppressor; it may have been damaged by the storm even though it may appear to be okay.

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## 3 PROGRAMMING & OPERATION

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### 3.1 ALARM RELAY LATCHING

As the unit is shipped from the factory, alarms will automatically clear when the alarm condition is corrected. Some people prefer that the alarm relays latch when an alarm condition is detected. They must then be manually cleared after the alarm condition has been corrected. The Model P-1 allows both the high and low alarm relays to be independently programmed to latch when an alarm is detected.

#### 3.1.1 Programming Alarm Latching

You must remove the front panel to program alarm latching. On the circuit board mounted behind the front panel are three sets of jumper pins. The lower two sets should each have a jumper attached to one of the pins.

To program high alarm relay latching, install the middle jumper across both the middle pins. To program low alarm relay latching, install the bottom jumper across both the lower pins.

### 3.1.2 Clearing Alarms

Pressing both the **↑** and **↓** keys will clear the alarms. This is only needed if alarm relay latching has been set.

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## 3.2 CALIBRATION

YOU MUST CALIBRATE YOUR pH CONTROLLER TO THE ELECTRODE BEFORE USING IT! See APPENDIX A. for the calibration procedure.

*NOTE: The pH controller will start out with initial default calibration values, however these values may not give accurate readings. The readings may vary by as more than 0.5 pH from the actual value. It is important to calibrate the unit before using it.*

---

## 3.3 DISPLAY FUNCTIONS

### 3.3.1 Version Number Display

Whenever power is initially applied to the unit it will briefly display the program version number, for example **P1.0.5**. We suggest that you note this number and write it down along with the serial number on the title page of this manual. We may ask you for your program version if you should you call us for assistance.

### 3.3.2 Normal Display

The normal display is the pH value. If there is a high alarm condition the reading will also show a blinking H in the left most position. Conversely, if there is a low alarm it will show a blinking L

### 3.3.3 Setpoint Display

Pressing the **↑** key will show the high setpoint, which is designated by an H in the first position, followed by the value. Like

wise, pressing the **↓** key will show the low setpoint which is designated by L.

---

## 3.4 THE CONTROL FUNCTION

The controller is designed for easy operation. The first time the controller is plugged in the control function will be off. This section tells how to turn control on by entering high and low setpoints.

If the control function is not turned on, the controller will serve as an indicator only. Control is turned on by entering a high setpoint and may be turned off by setting the high setpoint to 0.

### 3.4.1 Setting the High Alarm Setpoint

To set the high alarm setpoint you must first display it by pressing the **↑** key. The setpoint will remain on the display for a short time after releasing the key. While the setpoint is still on the display press both the **MODE** and **ENTER** keys. Hold them until the setpoint display starts to blink. This means you are in the change mode and the value can be changed using the **↑** and **↓** keys. Press either key to move the setpoint to the desired value. If a key is held depressed, the setpoint will change slowly at first, then will speed up. Releasing the key will cause it to revert to slow changing. You may set it to any value between 1.0 and 13.0.

When the setpoint is at the right value, you may press **ENTER** to go back to the regular pH display, or you may simply let the display blink until it automatically goes back to the normal display.

### 3.4.2 Setting the Low Alarm Setpoint

The low setpoint is set exactly as the high setpoint by pressing the **↓** key and then the **MODE** and **ENTER** keys to enter the change mode. You will notice that there is a limit as to how high the setpoint will go. The low setpoint is limited to 0.2 pH units below the high setpoint. This is to insure a minimum differential between high and low setpoints.

## *Model P-1 pH Control*

If the high setpoint is subsequently lowered, the low setpoint will automatically be lowered as necessary to keep this minimum differential.

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## 4 MAINTENANCE

The only maintenance required is periodic cleaning and calibrating, and ultimately replacement, of the pH electrode. APPENDIX A. gives the calibration procedure.

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## 5 TESTING & TROUBLESHOOTING

We have designed your controller to be as trouble free as possible. When your controller is shipped from the factory all sensor cables are wired and the sensors are checked for proper operation. Although this section refers to sensor wiring problems, you should not have to consider these as possible problems unless you have rewired or replaced your sensors.

This section will help you pinpoint problem areas. Once you have located the source of a problem you will be able to easily replace the faulty assembly.

---

### 5.1 THE PROGRAM VERSION

The program version tells which software is installed in your controller. If you should need to call the factory for assistance, we may need to know your program version. The program version is displayed briefly whenever power is initially applied to the controller.

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### 5.2 THE DISPLAY

You can determine some problems from observing the display. In normal operation there should always be something showing on display. If there isn't, something is wrong.

First check to be sure there is power to the controller.

If there is power, you will need to check the fuse. You will need to remove the front panel to check the fuse. It is located behind the shield in the lower right side of the rear circuit board.

***WARNING: Before opening the enclosure and doing anything inside you should remove power from the unit and also remove power from any external control circuits.***

Inspect both the control circuit board (mounted to the cover) and terminal circuit board (mounted to the back of the enclosure) for burned or discolored spots. These are indications of component failures and indicate a serious problem. See sections 7.0 and 8.0 for information on repairs and service.

If the boards appear to be OK, remove the shield and check the fuse.

If it is bad replace it with the same type and rating (½ amp.). Now follow the following procedure to locate the problem. Just let the front panel hang by the cable. Follow proper safety precautions during this procedure.

***WARNING: Use of larger than rated fuses will void the warranty.***

1. Disconnect the sensor at the sensor terminal block.
2. If the problem persists, disconnect the red, white, and brown wires from terminal blocks TB1 and TB2.
3. Apply power for a short time and then disconnect it. If the fuse blew then the problem is with the controller.
4. If the fuse did not blow, connect the wires back one at a time. Apply power briefly after each reconnection. If the fuse blows, the ORP sensor or its cable is faulty and needs to be replaced.

---

### 5.3 ERROR CONDITIONS

You will get the Err indication when:

1. There is no pH electrode installed or the electrode is improperly wired.

*Check wiring carefully.*

2. The pH signal conditioner possibly has failed.

*The controller cannot detect problems with the electrode itself, but it can detect when the signal conditioner, which is mounted within the electrode housing, is not working properly.*

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### 5.4 EXTERNAL ALARM CIRCUIT PROBLEMS

We cannot offer simple solutions for problems with the alarm circuits wired up to our product. You should contact an electrician or other qualified person for these problems.

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### 5.5 LOSS OF PROGRAMMING

Loss of programming is indicated by the display showing control is off. If this happens, your controller will need to be recalibrated.

Loss of programming can only occur if there is an extended period (many days) of no power to the unit or failure if the memory backup system during a no power condition.

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### 5.6 OTHER PROBLEMS

Our technical staff can help with other problems you may experience. We are also happy to answer any questions about our products.

Phone: 800-331-9620 (U.S.A. and Canada)  
918-687-4426.

Our hours are 8:30 a.m. to 4:30 p.m.  
central time, weekdays.

Email: [info@heanderson.com](mailto:info@heanderson.com)

FAX: 918-682-3342

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## 6 REPAIR

Repairs are made by replacement of complete circuit board assemblies or replacement of the complete front panel assembly. This should be done only by an authorized repair person or under the direction of our technical staff.

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## 7 FACTORY SERVICE

Should you require service for your Ratio:Guard® controller, the H.E. Anderson Co. Offers the following factory service options:

1. You may return your entire control or front panel assembly to us, prepaid, for repair. The charge will be a fixed labor charge plus parts and return postage. Charges for units under warranty will be for transportation only. Refer to our Limited Warranty in the back of this manual for details of the warranty. Turn around time in our plant is normally one day.
2. We may be able to speed repair by sending you a factory rebuilt exchange unit; after you receive it you can return the faulty unit. Contact us for details on this service. (This option requires established credit or a credit card number)

Should you need to return your unit to us our shipping address is:

**H.E. Anderson Company**  
**2100 Anderson Drive**  
**Muskogee, Oklahoma 74403 USA**



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## APPENDIX A

### Calibration & Care of pH Electrodes

The controller must be calibrated to the pH electrode to be accurate.

Calibration of pH the electrode is very easy. But you must have both pH 7 and pH 4 (4.01) buffer solutions. A bottle of each of these solutions is included with your controller for initial calibration. These solutions are available from many chemical supply houses, or you may order the solutions from us. There is a list of suppliers at the end of this section. You will also need some distilled (or deionized) water.

Cleaning goes hand in hand with calibration; the electrode should always be cleaned before recalibrating. The flat surfaced electrode used in the Ratio:Guard™ controller was selected for easy cleaning.

Cleaning and calibration should be performed regularly to keep your instrument operating at peak performance. You should clean and recalibrate your electrode every 4-6 weeks or any time you suspect that reading may not be accurate.

All pH electrodes eventually wear out. At some point, when the electrode will not calibrate, it will need to be replaced.

---

#### A.1 CALIBRATING THE ELECTRODE

You will probably want to turn pH control off during the calibration procedure, as it will probably otherwise result in a pH alarm.

You will also need both pH 7 and 4 (4.01) buffer solutions, some tap water, and some distilled or deionized water. **Always use fresh buffer solutions - Never reuse them!** Here is the procedure to calibrate the pH electrode:

1. Close the bypass isolation valves.
2. Carefully remove the electrode from the sensor fitting.
3. Clean the electrode if needed. (Section A.2)
4. Rinse the electrode in tap water, then dip in distilled water.
5. Dip the electrode in the pH 7 buffer.
6. Press the **MODE** and either the **↑** or **↓** key. The display will show CAL. Now, before the display changes, press both the **MODE** and **ENTER** keys. Keep them pressed until the display changes to a blinking **PH 7**.

Now, with the electrode in the pH 7 buffer, press the **ENTER** key; the display will stop blinking. The calibration process takes about 30 seconds.

If calibration is successful the message **good** will briefly appear and then changes to a blinking **PH 4**

7. Rinse the electrode in tap water, then dip in distilled water. This should be done relatively quickly.
8. Dip the electrode in the pH 4 (4.01) buffer.
9. Press the **ENTER** key. The calibration process is repeated for the pH 4 solution. Again, if calibration is successful, the message **good** will briefly appear and then the controller will enter normal operation.
10. Calibration is complete. Rinse the electrode in tap water and reinstall in the line.
11. Open the bypass isolation valves.
12. If pH control has been turned off, reset the setpoints to turn it back on.

**A.1.1****Calibration Problems**

The controller has some internal standards against which it checks the buffer solutions during calibration. If the values it reads are too far from what it expects, it will not proceed with calibration, but will indicate **bad** on the display and abort the process. Here are some possible causes of calibration problems, along with some suggested cures:

1. Contaminated reference solutions.  
*Be sure to use fresh solution for each calibration. Keep solutions in tightly closed containers.*
2. Using the wrong solution for the calibration point.
3. Faulty, worn out, or dirty electrode.  
*Check the electrode for contaminants, dirt or scale. Clean the electrode if necessary.*  
*Inspect the electrode for cracks or breaks. Replace the electrode if necessary.*
4. Faulty pH preamplifier, cable or connections.  
*Check to see that all connections to the controller terminal block are secure.*  
*The electrodes we supply have the pH preamplifier mounted directly to the electrode. This eliminates many problems common to other electrodes with long cables between electrode and preamplifier. However, if you are using the optional signal conditioner (P/N 1148-6, See Appendix A.) with other electrodes, you may have problems with dirt and moisture. Check to see that the Electrode BNC connector is clean and dry.*
5. Unit resumes normal operation during calibration.  
*Too much time has elapsed between steps. Repeat step (6) of the calibration*

*procedure to resume. You will not have to start over from the beginning.*

**A.1.2****Sources of pH Buffer Solutions**

The dealer from which you purchased your controller should be able to supply you with pH buffer solutions. If not, you can order direct from us, or from the following suppliers:

HACH COMPANY  
P.O. Box 389  
Loveland, CO 80539  
800-227-4224  
FAX 303-669-2932

COLE-PARMER  
7425 North Oak Park Avenue  
Chicago, IL 60648  
800-323-4340  
or 708-647-7600

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**A.2 CARE OF PH ELECTRODES**

The standard pH electrode supplied with Ratio:Guard® controllers is a flat surfaced self-cleaning sealed double junction electrode with integral signal conditioner. Order our replacement part number 11494.

The electrode comes with a liquid filled cap to keep the electrode surface wetted. You will need to remove this cap to insert the electrode into the manifold fitting. Save this cap in case you should ever need to remove the electrode.

**Warning: The electrode should never be allowed to dry out. Permanent damage will result.**

The primary maintenance for the electrode is simply to keep it clean. The self-cleaning design will reduce the need for cleaning, but will not eliminate completely the need for periodic cleaning. Here are two problems which frequently occur:

1. Inorganic scale deposits

*Dissolve the deposit by immersing the electrode in dilute hydrochloric acid for a few minutes. Rinse the electrode thoroughly in tap water and place it back in service.*

2. Organic oil or grease films

*Wash electrode tip with detergent and water. If the film is known to be soluble in a certain organic solvent then wash with this solvent. Rinse the electrode thoroughly in tap water and place it back in service.*

If you will be removing the electrode from service you should fill the plastic cap with a pH 4 buffer solution with a pinch of salt

added, or if that is not available, with tap water.

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### A.3 THE P/N 1148-6 SIGNAL CONDITIONER

The optional signal conditioner adapts other types and brands of pH electrodes for use with Ratio:Guard® controllers. It may be used with any glass pH electrode which has a BNC connector.

When using this signal conditioner, you should mount it at the sensor manifold. Do not use electrodes with long cables. Protect the connector from dirt and moisture.

We cannot guarantee performance when using electrodes from other sources.