13. Warranty

OAKTON warrants this controller to be free from significant deviations in material and workmanship for a period of three years from date of purchase. If repair or adjustment is necessary and has not been the result of abuse or misuse within the warrantied time period, please return—freight prepaid—and correction will be made without charge. OAKTON alone will determine if the product problem is due to deviations or customer misuse.

Out-of-warranty products will be repaired on a charge basis.

14. Return of items

Authorization must be obtained from our Customer Service Department before returning items for any reason. When applying for authorization, please include data regarding the reason the items are to be returned. For your protection, items must be carefully packed to prevent damage in shipment and insured against possible damage or loss. We will not be responsible for damage resulting from careless or insufficient packing. A restocking charge will be made on all unauthorized returns.

NOTE: We reserve the right to make improvements in design, construction, and appearance of products without notice.

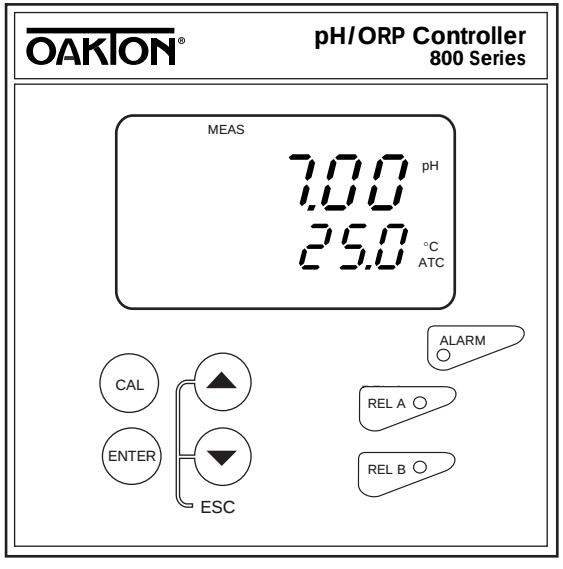
00702-77 R1

OAKTON®

OPERATING INSTRUCTIONS

OAKTON 800 series

¼ DIN pH/ORP Controller



CE

Printed in the U.S.A. 9/99

OAKTON®

Table of Contents

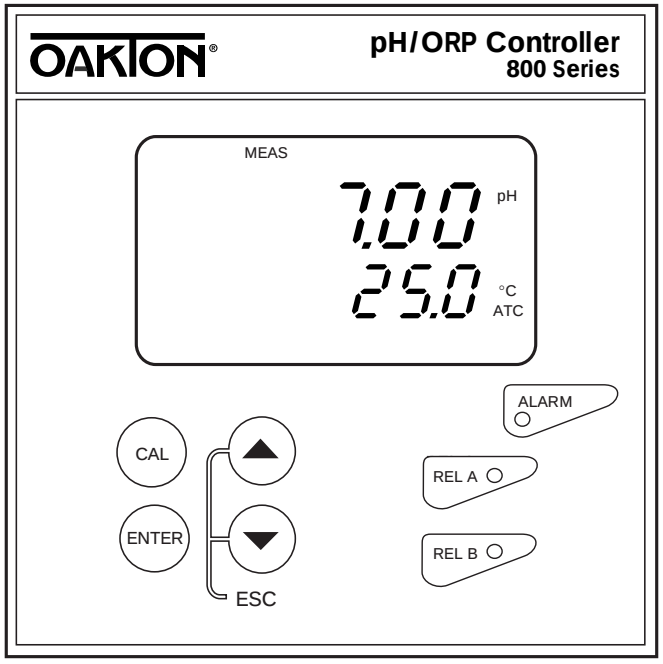
1. Introduction

Thank you for purchasing a microprocessor-based OAKTON 800-series ¼ DIN pH / ORP controller. You can use this unit to measure either pH or ORP with on / off control. This controller has many user-friendly features; some of its features include:

- A **menu-driven program** that simplifies set-up
- Large **dual display** shows pH (ORP) and temperature along with multiple annunciators
- **Two set point, two SPDT relay operation** for lo / lo, lo / hi, hi / lo or hi / hi control
- **Fast-responding on/off control**
- 0 to 2000 second **time delay adjustment** on all relays—minimizes false alarms
- Separately adjustable **high and low set point hysteresis bands** prevent rapid contact switching if your pH (ORP) value is fluctuating near the set point
- **4-20 mA transmitter/recorder output** for remote monitoring and hard copy recording
- Protection against electromagnetic interference—**galvanically isolated output**
- **Push button two-point calibration** and electrode offset adjustment from the keypad
- Easy, fast calibration with **auto buffer recognition**
- **LED indicators** signal control activities to monitor controller status from a distance
- **Nonvolatile memory** maintains setup even when power fails

Use the 800-series controller in panel-mounted enclosures for applications such as:

- **water treatment and monitoring**
- **chemical processing**
- **food processing**
- **waste water control.**



Included with your controller

Your controller includes:

- 17-way and 5-way right angled terminal block (one each)
- side threaded rod with catch (two)
- receptacle cable lug (one)
- rubber gasket (one)

About the manual

Please read the first five sections carefully. Section 6 is designed so you can either read the whole section linearly, or skip to the sections that are pertinent to your application. You may want to read through these sections in entirety to familiarize yourself with all of the controller's features.

If you have any questions about this controller, please contact your OAKTON distributor.

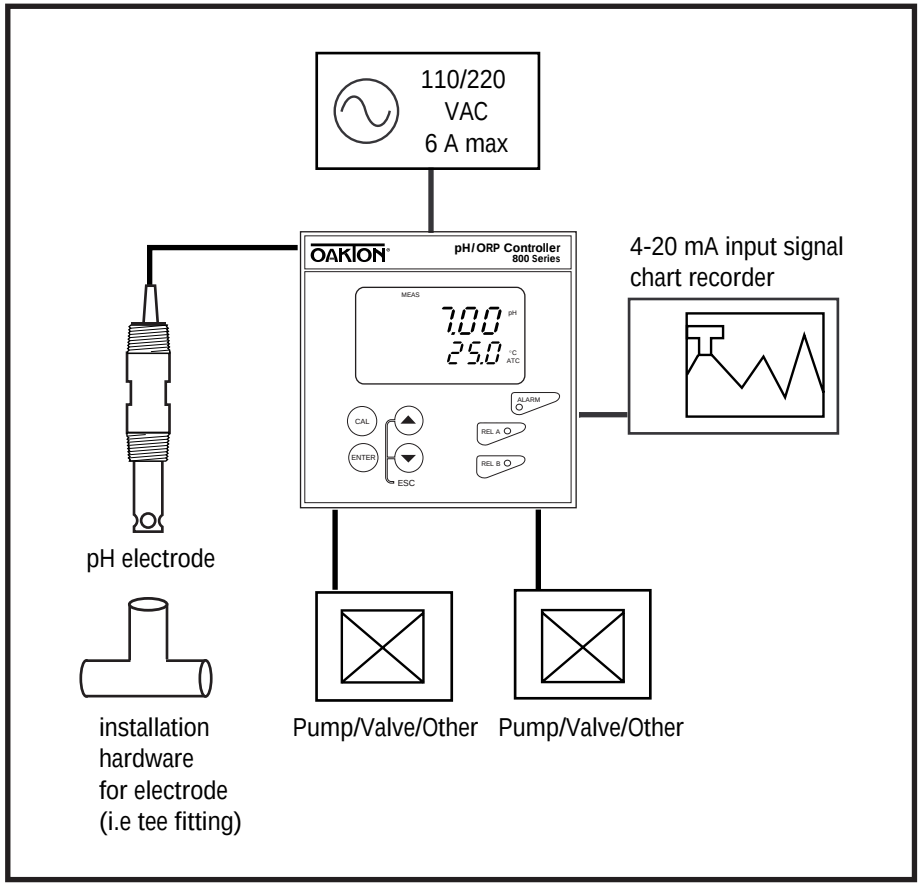
Please read through this manual carefully before installing and operating your controller.

2. Assembly and Installation

2.1 Typical Measurement and Control System

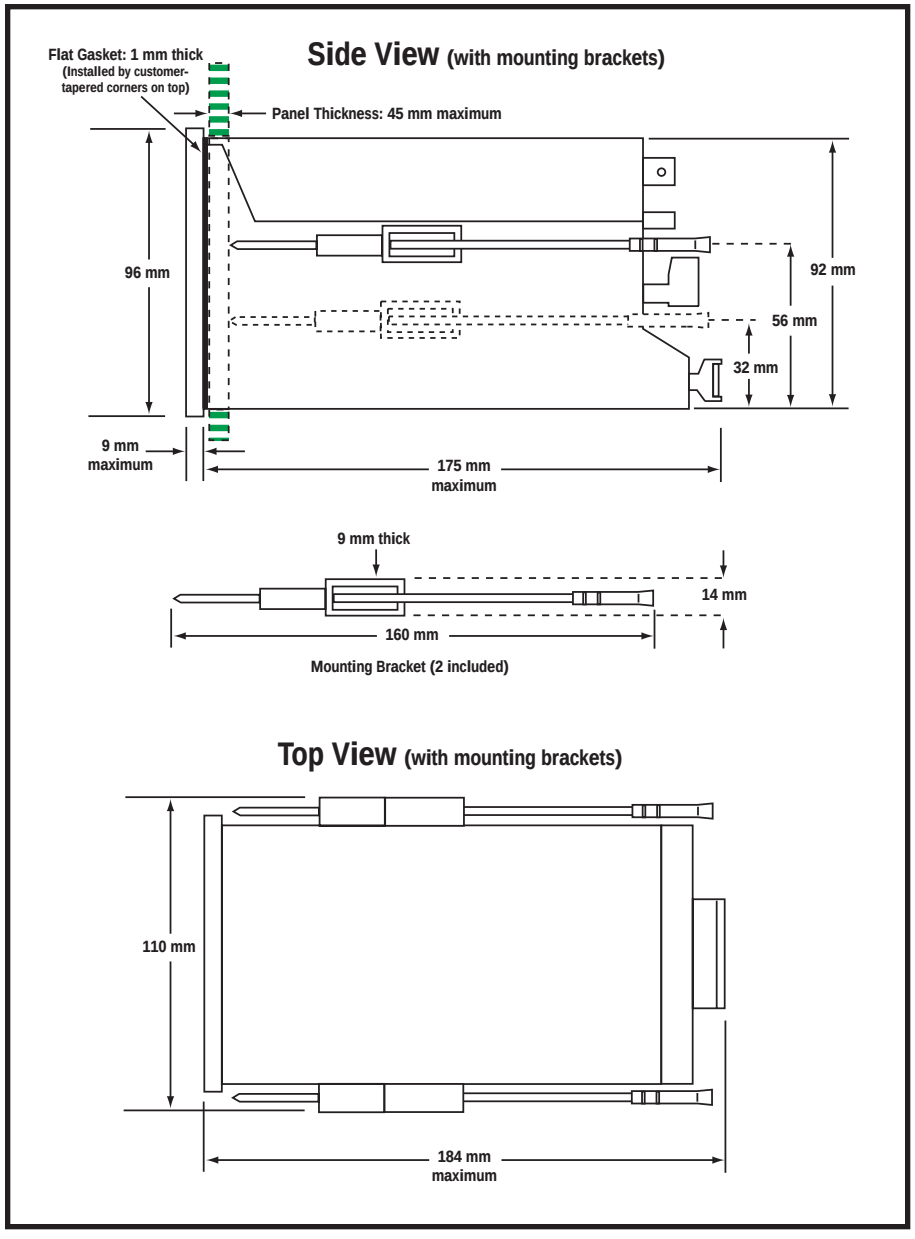
A typical measurement system consists of:

- power source
- the OAKTON 800-series controller
- a pH (or ORP) combination electrode with integrated or separate temperature sensor (Pt 100 or 1000)
- installation hardware for electrode
- an appropriate pH or ORP measurement cable
- a final control element such as a pump or valve
- a recorder (optional)



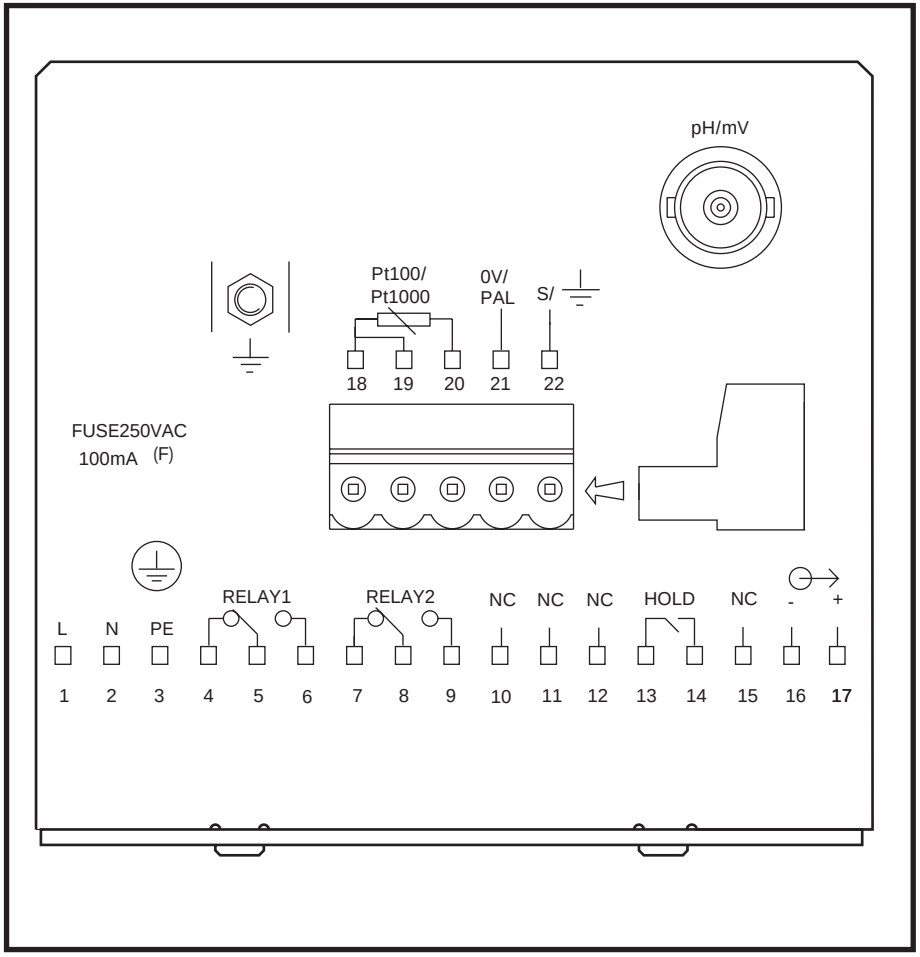
2.2 Unit dimensions

The field-tested control panel housing is 3.78" x 3.78" (96 x 96 mm).
The front panel meets protection class IP 54.



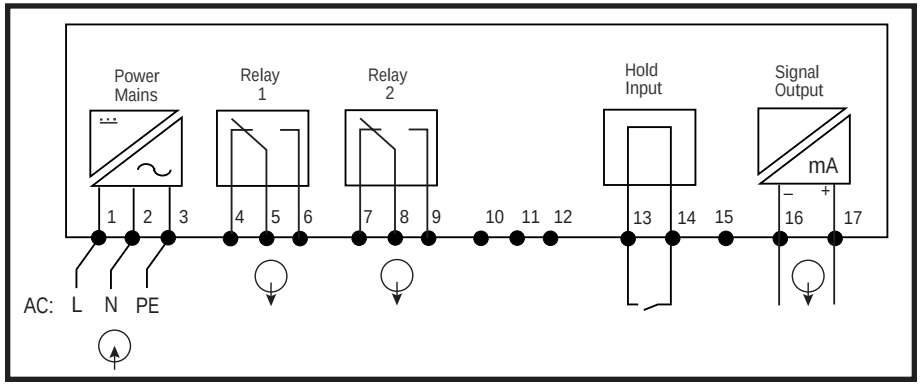
2.3 Back panel

The back panel consists of two different connectors: the 17-way PCB edge connector and the 5-way screw terminal connector.



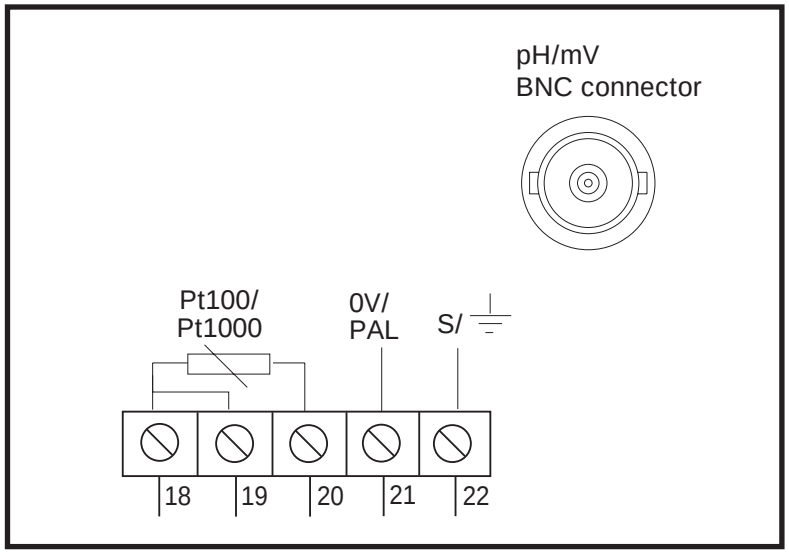
2.4 Electrical Connections

CAUTION: Electrical shock hazard! Make sure to remove AC power to the controller before wiring input and output connections, and before opening the controller housing.



1. VAC live wire
2. VAC neutral wire
3. VAC protective ground wire
   NOTE: Power is selectable for 110 or 220 VAC via an internal jumper.
   Factory setting is indicated on the label on top of the controller.
   See Appendix 3 on page 46 for directions on switching the power type.
4. Low set relay resting position
5. Low set relay common
6. Low set relay working position
7. High set relay resting position
8. High set relay common
9. High set relay working position
10. No connection
11. No connection
12. No connection
13. Hold function switch terminal 1
14. Hold function switch terminal 2
15. No connection
16. 4 - 20 mA for – current connection
17. 4 - 20 mA for + current connection

2.5 Probe connections



18. Pt100 / Pt1000 lead 1 terminal (compensating)
19. Pt100 / Pt1000 sense lead terminal (three-wire RTD)
20. Pt100 / Pt1000 sense lead 2 terminal

NOTE: If using a two-wire RTD, short terminal 19 to terminal 18.

NOTE: Pt100 / Pt1000 is selectable via an internal jumper. Factory default is Pt100. See Appendix 3 on page 46 for directions on switching the RTD type.

21. pH / ORP lead 1 (solution ground, or potential matching pin)
22. pH / ORP lead 2 (shield)

Connect any pH or ORP electrode with a BNC connector to the BNC connector located the upper right side of the controller back panel.

IMPORTANT: when using controller in symmetrical mode, be sure to connect solution ground (potential matching pin) to terminal 21. Failure to connect potential matching pin will result in unstable, erroneous readings. See Appendix 2 on page 45 for more information on symmetrical mode.

2.6 HOLD function

The HOLD function lets you force the relays to their resting position by applying a contact closure across terminals 13 and 14.

When the HOLD function is activated, the HOLD indicator will appear on the display (see page 13 for a diagram of display characters).

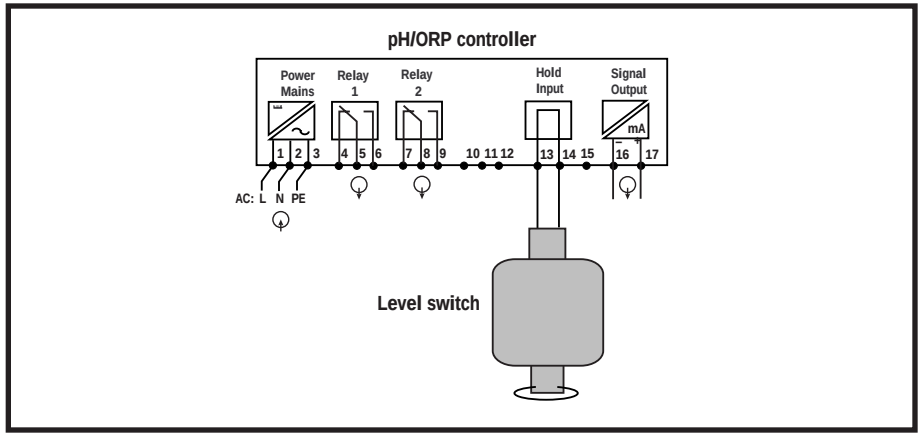
Typical applications:

Float or level switch: Connect to a float switch in your reagent feed tank to shut down pumps or tanks when out of reagent.

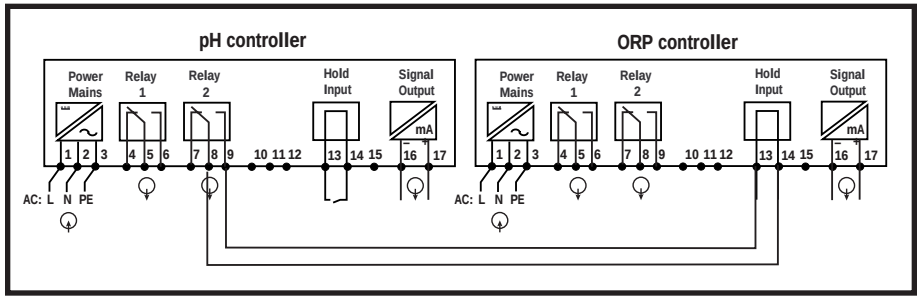
Flow switch: Connect to a flow switch to shut down pumps or valves when the process stream is shut down.

Dual pH/ORP control: Connect relay of pH controller to hold input of the ORP controller to ensure that Reducing / Oxidizing agent is only added when at a specified level for both pH and ORP..

Typical level switch wiring



Typical dual controller wiring



3. Overview: Keypad and display

3.1 Keypad

Calibration key

Lets you:

1. Perform rapid 1- or 2-point calibration.

Enter key

Lets you:

1. Select individual parameters within the parameter group.
2. Store input data in the Set-up mode.
3. Start calibration in the Calibration mode.

▲ and ▼ keys

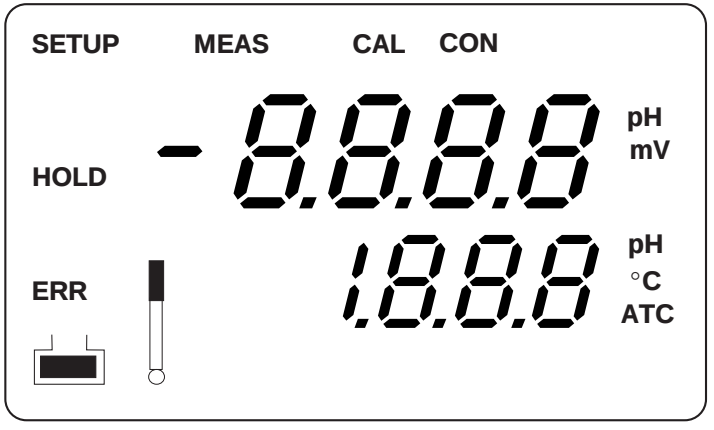
Let you:

1. Select various parameter groups.
2. Set parameters and numerical values in the Set-up mode.
   If you continuously hold the button, the setting speed increases.
3. Return to the Measurement mode when both keys are pressed at once.

3.2 Display

The LCD display features two numerical displays that show measured values and status messages for easy, quick reference. The display provides short-text information for configuration and for setting parameters.

- The upper (primary) display shows pH or ORP readings
- The lower (secondary) display shows temperature readings



The LCD display area includes the following indicators:

HOLD: HOLD indicator

SETUP: Advanced Set-up mode

MEAS: Measurement mode

CAL: Calibration mode

CON: Confirmation indicator

ERR: error / alarm indicator

°C: temperature units

ATC: indicates automatic temperature compensation

 : buffer indicator

 : electrode indicator

3.3 LED Indicators

The LED indicators provide a quick way to check controller status. They show whether a parameter within its set limits (green light) or outside its set limits (red light).

Relay A

GREEN — Measured value is within limit entered for Set-point 1.

RED — Measured value is outside limit entered for Set-point 1.

Relay B

GREEN — Measured value is within limit entered for Set-point 2.

RED — Measured value is outside limit entered for Set-point 2.

Alarm

NONE — No alarm condition exists.

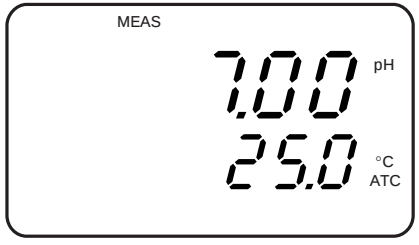
RED — Alarm condition exists. Measured value has been outside of set-point 1, set-point 2, or both for longer than set relay delay time value. This indicator also will light if the temperature sensor fails. The error indicator will also appear on the display.

4. Starting up

When you initially connect power to the controller, it will automatically enter Measurement mode. This controller features a large dual display.

- The upper display will show the present pH (ORP) value
- The lower display will show the temperature value

In normal measurement mode, the display will appear as shown in the figure at right. The readings will be in pH or ORP (mV), depending on set up mode selection—see page 36 for more information.

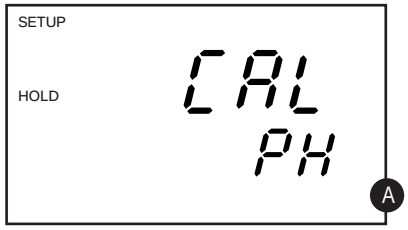


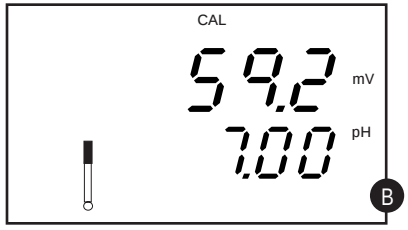
If ATC is selected on, the ATC indicator appears. If manual temperature selection is chosen, the ATC annunciator will be off. When the controller is in ATC mode, and the temperature sensor wire is broken or disconnected, an error message will be displayed, plus the alarm LED indicator and relay will be activated. See page 25 for information on selecting or deselecting ATC.

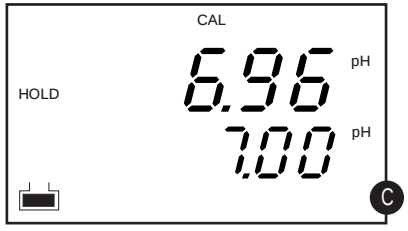
5. CALIBRATION mode

You can reach the Calibration mode in two ways:

- **From calibration mode.** From measurement mode, press the CAL key.
- **From advanced set up mode.** From measurement mode, press the ENTER key. Press the ▲ and ▼ keys to scroll to set up mode "CAL PH".







5.1 pH Calibration

This unit features seven preset buffer values (pH 1.00, 4.00, 6.86, 7.00, 9.00, 9.18 or 10.00) for fast auto-calibration at two points. When you calibrate this instrument, you need a standard pH buffer solution that matches one of these values.

NOTE: You must calibrate at either pH 7.00 or pH 6.86 for the first calibration.

1. **Enter Calibration mode**. From measurement mode, press the CAL key.

See figure A

NOTE: The upper and lower display should read CAL pH. If they read CAL OrP, see section 6.5.1 on page 36 for directions on how to switch from ORP to pH readings.

2. Press the ENTER key. The upper display shows the slope in mV from the most recent calibration. The lower display will show the offset as the pH reading at 0 mV electrode output.

See figure B

3. **Press the ENTER key again** to begin calibration. The "CAL" and buffer indicators appear on the display.

   The upper display shows your present uncalibrated reading. The lower display indicates one of the preset pH buffer values.

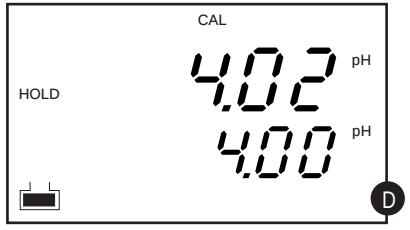
4. If necessary, **press the ▲ and ▼ keys** to scroll the lower display to the buffer value that matches your standard solution.

See figure C

5. **Make sure the electrode is in your buffer solution**. In ATC mode, you must also immerse the temperature sensor in the buffer solution. In the symmetrically high-resistance measurement mode, you must also immerse the solution ground (potential equalization pin) in the buffer.
6. **Press the ENTER key** to confirm the buffer value. The electrode indicator and CAL indicator will both flash.
7. **Allow the electrode to stabilize.** You can press the ENTER key to enter the calibration value. If you do not press the ENTER key, the controller will automatically enter the calibration value when the electrode reading is stable.
8. Repeat steps 4 through 7 with a second buffer for the second calibration point.

See figure D

9. After calibrating to a second buffer value, this controller automatically displays the new slope in the upper display and new offset in the lower display.
10. If you entered the Calibration mode using the CAL key, **press the CAL key again** to return to the measurement mode. Or, press ▲ and ▼ (escape) together to return to measurement mode.

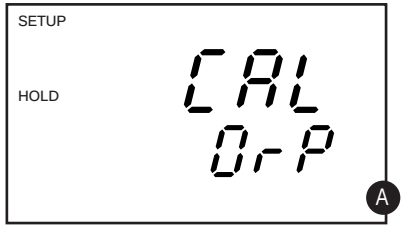


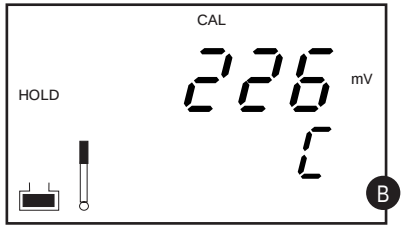
Notes

If there is a calibration error, the controller flashes the buffer and electrode icons. If this happens, push both ▲ and ▼ (escape) to restart the calibration beginning from step 1.

When calibrating with manual temperature compensation, the controller automatically changes from the preset process temperature to the preset calibration temperature. After leaving the Calibration mode, the controller switches back to the process temperature. To set the calibration temperature and the process temperature, see pages 27-28.

The slope and offset are re-determined after each calibration.





5.2 ORP Calibration

1. **Enter Calibration mode**. From measurement mode, press the CAL key.

See figure A

NOTE: If the upper and lower display read CAL PH, see section 6.5.1 on page 36 for directions on how to switch from pH to ORP readings.

2. **Place sensor in the calibration solution.**
3. **Press the ENTER key** to begin calibration. The "CAL" indicator will appear on the display. The upper display shows the current mV output of the electrode without any offset adjustment.

See figure B

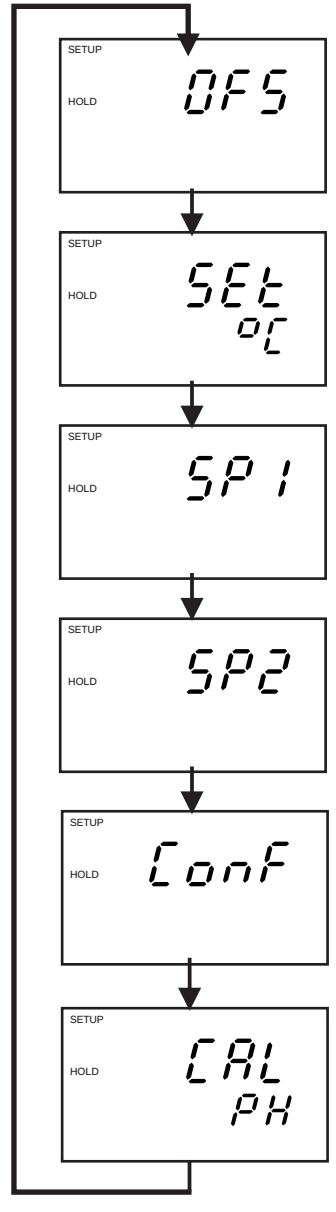
4. Determine the mV value of your solution with a meter known to be accurate.
5. **Press the ▲ and ▼ keys** to offset the mV value on the controller display to match the value of the solution you are measuring.
6. To return to Measurement mode, **press the ENTER key** again.

6. Advanced set up mode

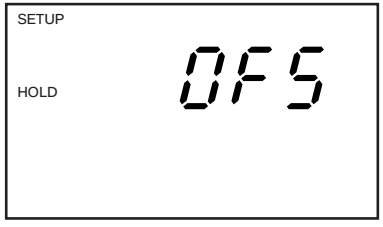
The OAKTON 800-series pH / ORP controller features six sub groups that organize all set-up parameters. These parameters let you customize your controller for your exact process.

The sub groups are:

1. Offset adjustment (OFS)
2. Temperature settings (SEt °C)
3. Control Relay 1 configuration (SP1)
4. Control Relay 2 configuration (SP2)
5. Controller configuration (ConF)
6. pH (ORP) calibration (CAL pH or CAL ORP)



6.1 Advanced set-up mode sub group overview

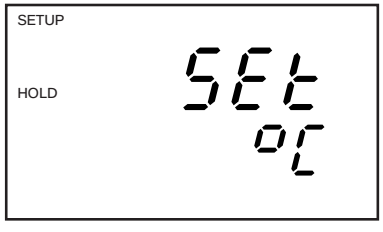


See pages 22-23 for complete offset mode set up instructions

OFS: Offset mode

Available during pH operation only:

- Set probe offset value



See pages 24-28 for complete temperature settings set up instructions

SET °C: Temperature settings

Available during pH operation only:

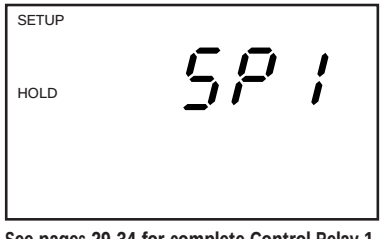
- Toggle automatic temperature compensation (ATC) on or off

If ATC selected on:

- Temperature sensor calibration

If ATC selected off:

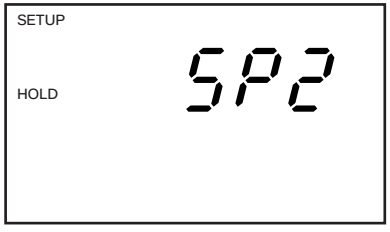
- Set process temperature
- Set calibration temperature



See pages 29-34 for complete Control Relay 1 set up instructions

SP1: Set up for relay 1

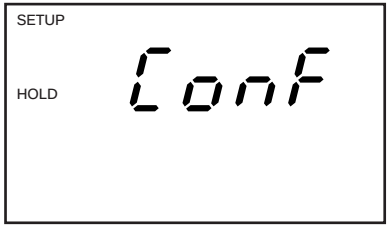
- Select value for relay 1
- Select relay as low or high set point
- Set hysteresis (dead band)
- Set time delay for when relay switches on
- Set time delay for when relay switches off



See pages 29-34 for complete Control Relay 2 set up instructions

SP2: Set up for relay 2

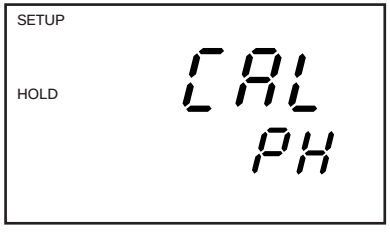
- Select value for relay 2
- Select relay as low or high set point
- Set hysteresis (dead band)
- Set time delay for when relay switches on
- Set time delay for when relay switches off



See pages 35-37 for complete controller configuration set up instructions

ConF: Controller configuration

- select pH or ORP measurement, plus symmetrical or asymmetrical mode
- Reset to controller default settings



See pages 38-40 for complete calibration set up instructions

CAL pH (ORP): pH (ORP) Calibration

- Calibrate first value
- Calibrate second value
- Automatic display of slope and offset after second calibration point

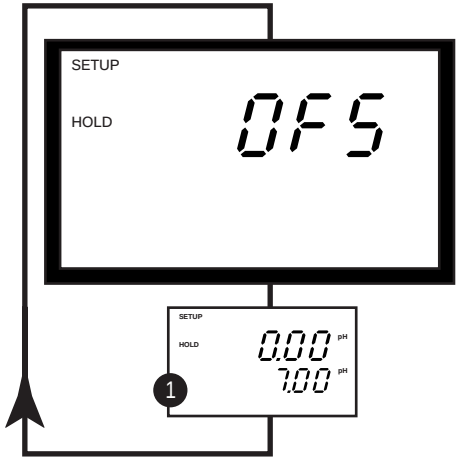
6.2 OFS: Offset sub group

OFS: Offset subgroup overview

The Offset sub group lets you:

1. Set pH probe offset value

This sub group is available during pH operation only.



6.2.1 Calculating the pH electrode offset value

NOTE: *you can only perform electrode offset in the pH mode.*

The offset sub group lets you change the pH probe offset without removing the probe from your system. You can make adjustments of up to ±120 mV of the displayed value.

The controller will add or subtract the offset value from the measured pH and display the correct value. However, if you need to offset the value beyond the average offset you would expect in your application type, consider a full calibration or even electrode replacement. To determine your pH offset value:

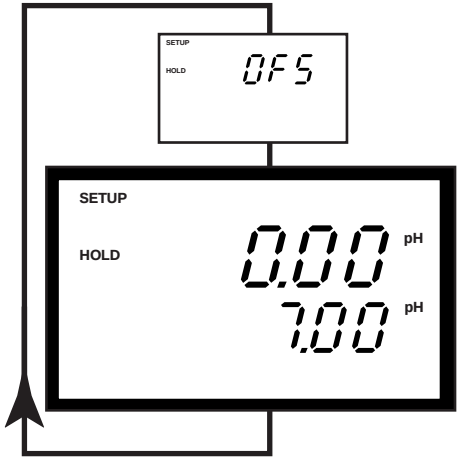
1. **Pull a grab sample from your system.** Record the controller's pH reading at the time you take the sample.
2. **Measure the pH of your grab sample using a calibrated pH meter.** Record the correct pH value.
3. **Subtract the the controller's reading from the correct pH value (found in step 1).** This value is your offset.

6.2.2 Entering the pH offset value:

From measurement mode:

1. **Enter Advanced set-up mode.** Push the ENTER key.
2. **Press the ▲ and ▼ keys** to scroll until the upper display shows OFS.
3. **Press the ENTER key.** The lower display shows the current measured pH value. The upper display shows the current offset value.

   See bold figure at right.
4. **Press the ▲ and ▼ keys** to adjust the offset value until the upper display shows the offset value calculated as explained in directions above. As you adjust the offset value, the lower display will update to match the current reading plus the electrode offset.



5. **Press the ENTER key** to enter the offset value.
6. **Press the ▲ and ▼ keys together** to return to measurement mode.

Notes

The offset value is reset during full calibration. See Section 5 starting on page 16 for pH calibration instructions.

6.3 SET °C: Temperature settings

SET °C: Temperature settings

The temperature settings sub group lets you:

1. Toggle automatic temperature compensation (ATC) on or off

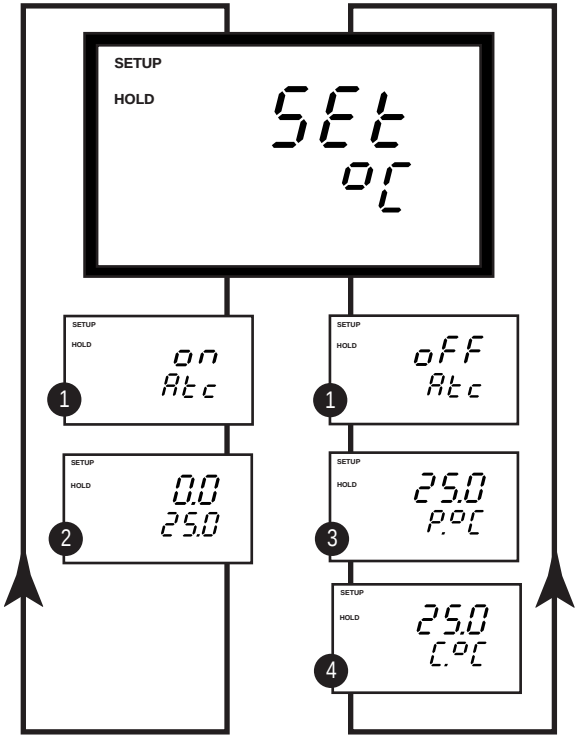
If ATC selected on:

2. Temperature sensor calibration

If ATC selected off:

3. Set process temperature
4. Set calibration temperature

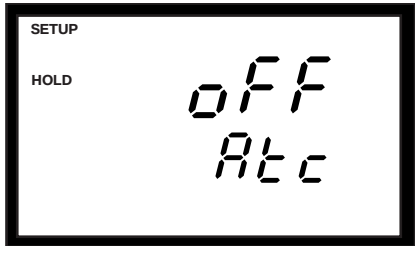
This sub group is available during pH operation only.



This set up group has two different sub paths. The screens you see depend on if you select ATC on or off.

6.3.1 Selecting automatic or manual temperature compensation

From measurement mode:



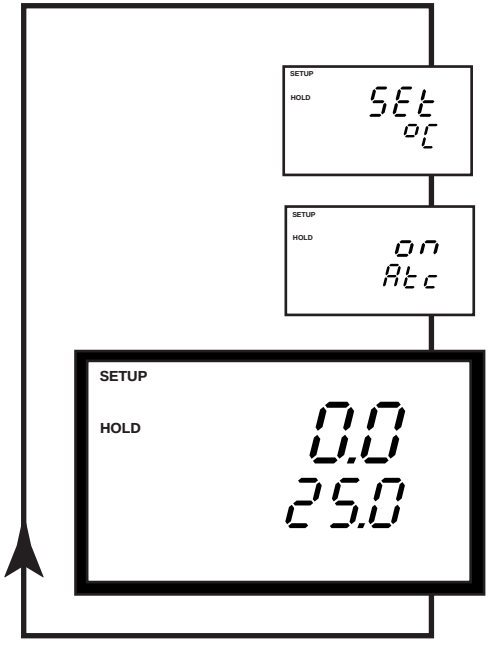
1. **Enter Advanced set-up mode.** Push the ENTER key.
2. **Press the ▲ and ▼ keys** to scroll until the upper display shows SEt °C.
3. **Press the ENTER key.** The lower display will show “Atc”; the upper display will show “on” or “oFF”.

   See figures at right
4. **Press the ▲ and ▼ keys** to toggle between ATC on and off.
5. **Press the ENTER key** to confirm selection.
6. • **If you selected ATC on:** Proceed to step 3 of section 6.3.2
   • **If you selected ATC off:** Proceed to step 3 of section 6.3.4
   • **To return to Measurement mode:** Press the ▲ and ▼ keys together

6.3.2 Temperature sensor calibration (ATC mode only)

NOTE: *This parameter is blanked out when the controller is set for ATC off.*

This mode lets you offset the controller to compensate for small inaccuracies in your temperature sensor. You can offset the temperature sensor up to ±5°C.



1. **Select "ATC on"** as described in Section 6.3.1.
2. **Press the ENTER key.** The upper display shows the temperature offset. The lower display shows the current measured temperature.

   See bold figure at right
3. **Compare the current measured temperature on the controller display to a thermometer known to be accurate.**
4. **Press the ▲ and ▼ keys** to scroll the lower display to match the known temperature. The upper display shows the amount of offset. You can offset temperature up to ±5°C.
5. **Press the ENTER key** to confirm selection and return to advanced set up mode.

Return to Measurement mode by pressing the ▲ and ▼ keys (escape) simultaneously.

6.3.3 Manual temperature compensation

Manual temperature compensation lets you ignore your temperature probe input or use a probe without a built-in temperature sensor. The controller will compensate for temperature at the values you enter.

For manual temperature compensation, you can set two different temperatures:
- process temperature
- calibration temperature

This allows calibration at a temperature other than your process temperature.

Example: setting a calibration temperature of 25°C lets you calibrate using standard buffer solutions at 25°C, even if your process temperature is a different temperature.

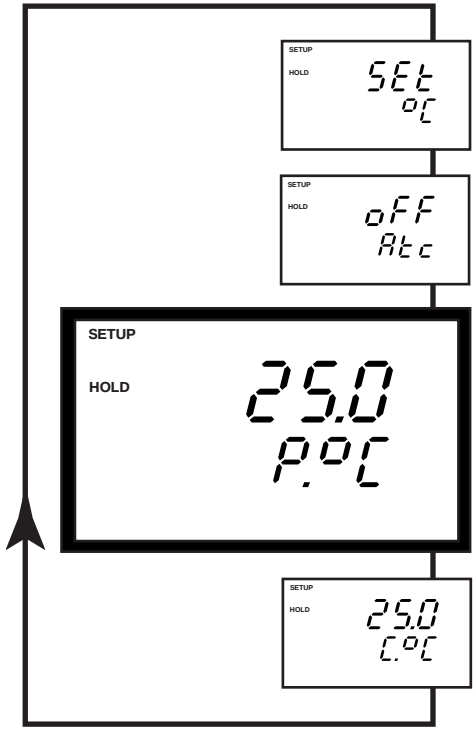
You can set process and calibration temperatures between –9.9 to 125°C.
Default temperature is 25°C.

6.3.4 Setting process temperature

NOTE: *This parameter is blanked out when the controller is set for ATC on.*

1. **Select "ATC off"** as described in Section 6.3.1.
2. **Press the ENTER key.** The upper display shows the current process temperature and the lower display shows P.°C (process temperature).

   See bold figure at right
3. **Press the ▲ and ▼ keys** to adjust the process temperature value. You can adjust the value from –9.9 to 125°C.
4. **Press the ENTER key** to confirm selection.
5. Proceed to step 3 of section 6.3.5, or press the ▲ and ▼ keys together to return to measurement mode.



6.3.5 Setting calibration temperature

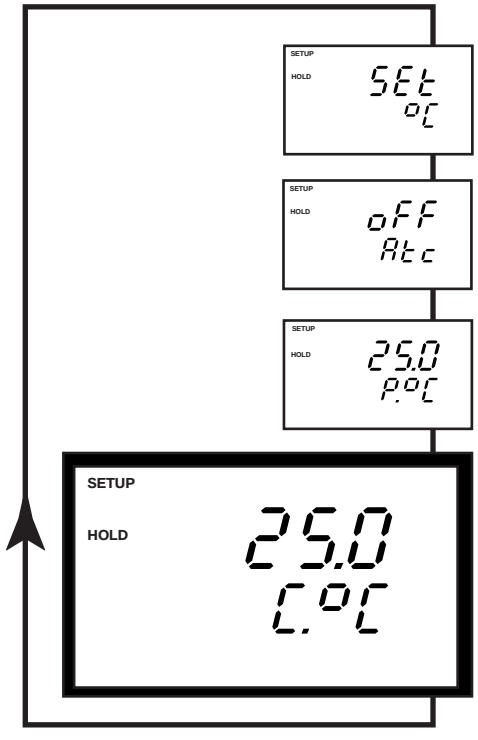
NOTE: *This parameter is blanked out when the controller is set for ATC on.*

From measurement mode:

1. **Select "ATC off"** as described in Section 6.3.1.
2. **Press the ENTER key twice.** The upper display shows the current calibration temperature and the lower display shows C.°C (calibration temperature).

   See bold figure at right
3. **Press the ▲ and ▼ keys** to adjust the calibration temperature value. You can adjust the value from –9.9 to 125°C.
4. **Press the ENTER key** to confirm selection and return to advanced set up mode.

Return to Measurement mode by pressing the ▲ and ▼ keys (escape) simultaneously.



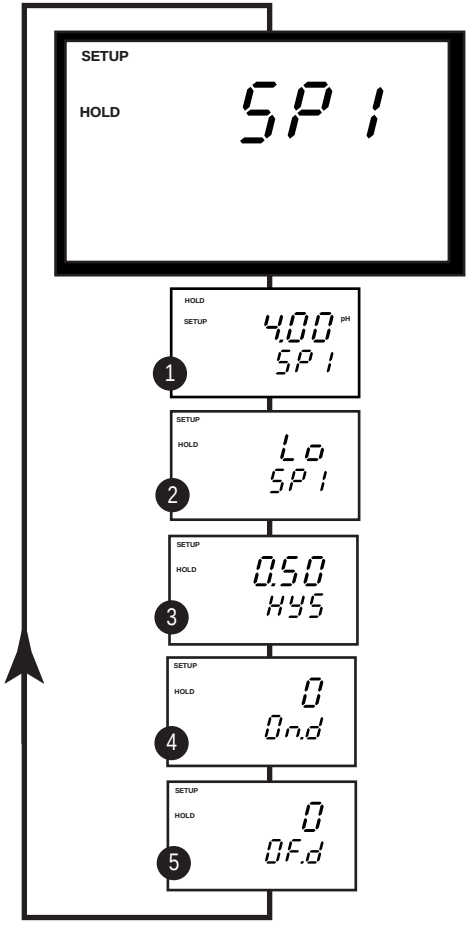
6.4 SP1 (SP2): Set up for Relay 1 (2) sub group

SP1 (SP2): Set up for relay SP1 (SP2) overview:

Relay set up 1 and relay set up 2 sub groups let you:

1. Select value for relay SP1 (SP2)
2. Select relay as low or high set point
3. Set hysteresis (dead band)
4. Set time delay for when relay switches on
5. Set time delay for when relay switches off

The SP1 option sets the operating parameters for relay 1; the SP2 option sets the operating parameters for relay 2. Since these two groups offer the same set-up parameters, they are described together.



6.4.1 Selecting the relay set point values

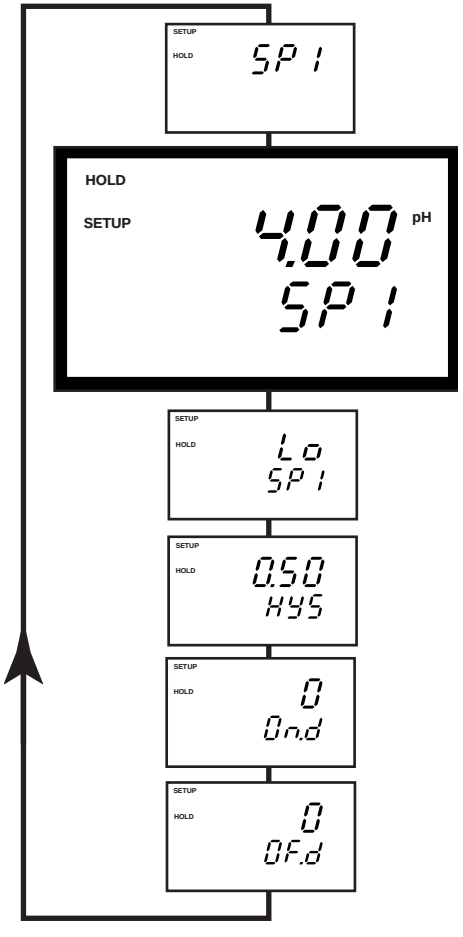
This lets you choose the pH (or ORP) value that will cause your controller to activate. If this value is crossed, the set point relay LED will turn from green to red.

From measurement mode:

1. **Enter Advanced set-up mode.** Push the ENTER key.
2. **Press the ▲ and ▼ keys** to scroll until the upper display shows SP1 (SP2).
3. **Press the ENTER key.** The upper display shows the current set point value and the lower display shows SP1 (SP2).

See bold figure at right.

4. **Press the ▲ and ▼ keys** to enter your value for Set Point 1 (Set Point 2). Your controller will activate at the value you select.
5. **Press the ENTER key** to confirm your selection.
6. Proceed to step 3 of section 6.4.2, or press the ▲ and ▼ keys together to return to measurement mode.



6.4.2 Selecting relay as high or low set point

Select a low set point to activate controller when your value undershoots the set point; select a high set point to activate controller when your value overshoots the set point.

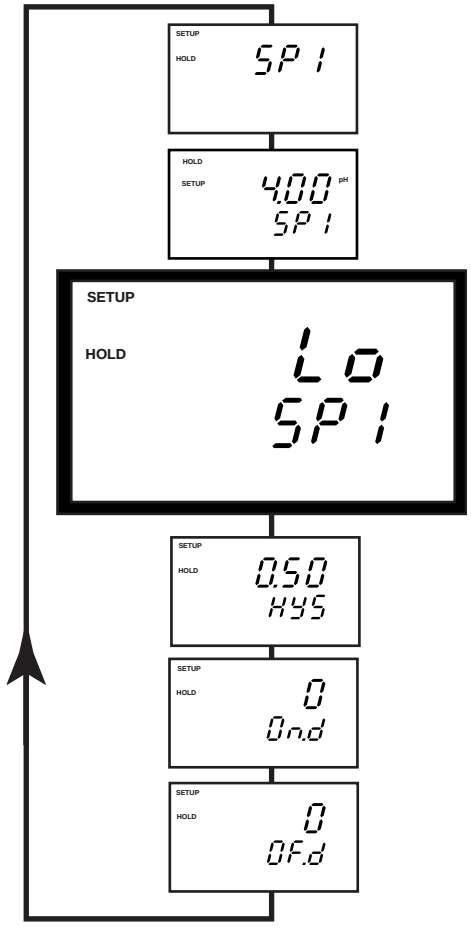
Using both SP1 and SP2, you can select lo / lo, lo / hi, hi / lo, or hi / hi set points.

From measurement mode:

1. **Enter Advanced set-up mode.** Push the ENTER key.
2. **Press the ▲ and ▼ keys** to scroll until the upper display shows SP1 (SP2).
3. **Press the ENTER key** until the upper display shows Lo or Hi (for low or high set point) and the lower display shows SP1 (SP2).

See bold figure at right.

4. **Press the ▲ and ▼ keys** to toggle between low (lo) or high (hi) set point for SP1 (SP2).
5. **Press the ENTER key** to confirm your selection.
6. Proceed to step 3 of section 6.4.3, or press the ▲ and ▼ keys together to return to measurement mode.



6.4.3 Selecting a hysteresis (dead band) value

Hysteresis prevents rapid contact switching if your value is fluctuating near the set point. It allows the set point value to overshoot by the specified hysteresis value. You can set the hysteresis value from:

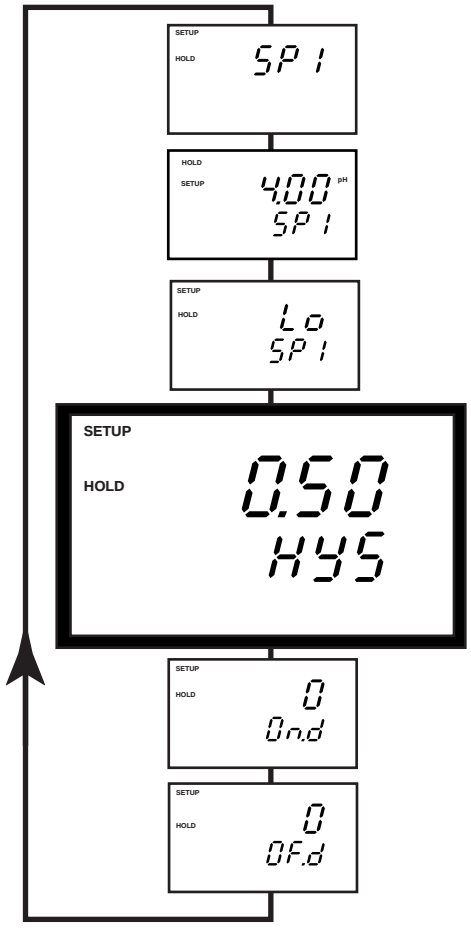
- pH mode: 0.1 to 1.0 pH
- ORP mode: 10 to 100 mV

From measurement mode:

1. **Enter Advanced set-up mode.** Push the ENTER key.
2. **Press the ▲ and ▼ keys** to scroll until the upper display shows SP1 (SP2).
3. **Press the ENTER key** until the upper display shows the hysteresis (dead band) value and the lower display shows HYS.

See bold figure at right.

4. **Press the ▲ and ▼ keys** to enter your hysteresis value for SP 1 (SP 2). Your controller will activate at the value you select.
5. **Press the ENTER key** to confirm your selection.
6. Proceed to step 3 of section 6.4.4, or press the ▲ and ▼ keys together to return to measurement mode.



6.4.4 Setting an on-delay time lag

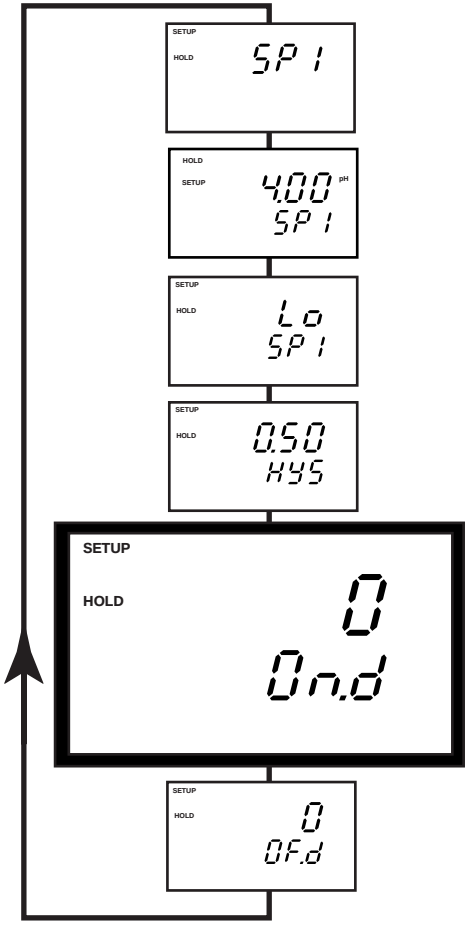
You can set a time delay for each relay, which stops the relay from switching on too soon. This helps prevent premature relay action and false alarms. This controller lets you set a 0 to 2000 second time delay before your relay activates.

From measurement mode:

1. **Enter Advanced set-up mode.** Push the ENTER key.
2. **Press the ▲ and ▼ keys** to scroll until the upper display shows SP1 (SP2).
3. **Press the ENTER key** until the upper display shows the "on delay" time and the lower display shows On.d.

See bold figure at right.

4. **Press the ▲ and ▼ keys** to enter on delay time for Set Point 1 (Set Point 2). Your controller will delay activation for the number of seconds (0 to 2000) you select.
5. **Press the ENTER key** to confirm your selection.
6. Proceed to step 3 of section 6.4.5, or press the ▲ and ▼ keys together to return to measurement mode.



6.4.5 Setting an off-delay time lag

You can set a time lag for each relay, which helps to prevent your relay from switching off too soon. This helps prevent premature relay action and false alarms. This controller lets you set a 0 to 2000 second time delay before your relay deactivates.

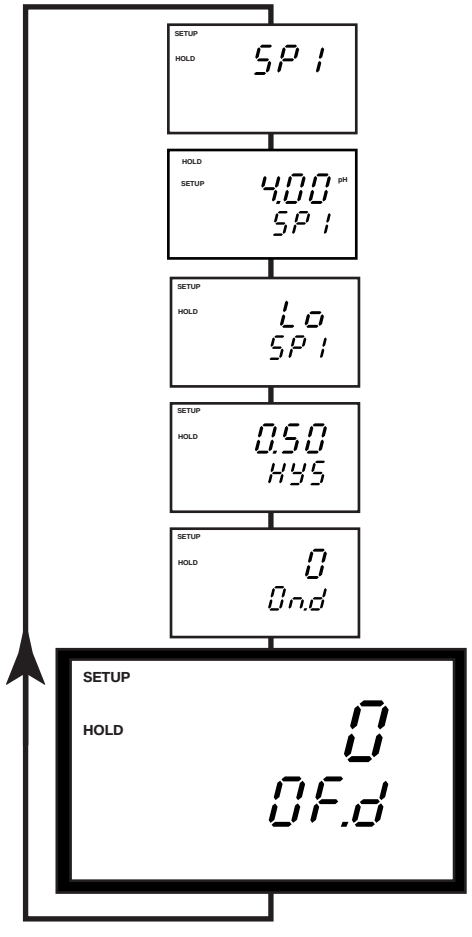
From measurement mode:

1. **Enter Advanced set-up mode.** Push the ENTER key.
2. **Press the ▲ and ▼ keys** to scroll until the upper display shows SP1 (SP2).
3. **Press the ENTER key** until the upper display shows "off delay" time and the lower display shows OF.d.

See bold figure at right.

4. **Press the ▲ and ▼ keys** to enter off delay time for Set Point 1 (Set Point 2). Your controller will delay activation for the number of seconds (0 to 2000) you select.
5. **Press the ENTER key** to confirm your selection and return to advanced set up mode.

Press the ▲ and ▼ keys together to return to measurement mode.

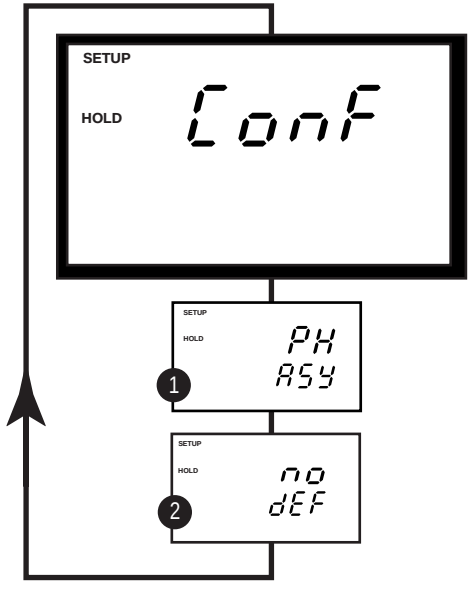


6.5 ConF: Configuration sub group

ConF: Configuration subgroup overview

Configuration sub group lets you:

1. Select pH or ORP (mV) measurement units
2. Reset to default settings



6.5.1 Selecting pH or ORP measurement units

This parameter group lets you select pH or ORP readings, and input type symmetrical or asymmetrical. Use asymmetrical mode under normal operating conditions. Use symmetrical mode when the measuring environment is electrically noisy (i.e. in electroplating environments). Default setting is pH measurement in asymmetrical mode.

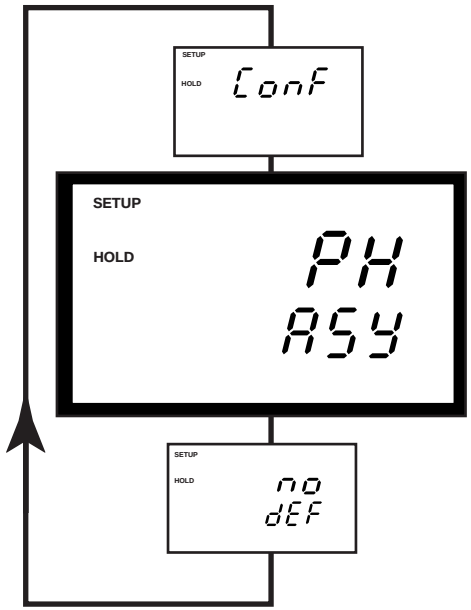
See Appendix 2 on page 45 for more details on operation in symmetrical and asymmetrical modes.

From measurement mode:

1. **Enter Advanced set-up mode.** Push the ENTER key.
2. **Press the ▲ and ▼ keys** to scroll until the upper display shows ConF.
3. **Press the ENTER key** until the upper upper display shows the control type (pH or ORP) and the lower display shows symmetrical (SY) or asymmetrical (ASY) input type.

See bold figure at right.

4. **Press the ▲ and ▼ keys** to select the measurement units you require.
5. **Press the ENTER key** to confirm your selection.
6. Proceed to step 3 of section 6.5.2, or press the ▲ and ▼ keys together to return to measurement mode.



Notes

When you switch the controller from pH to ORP readings, or vice versa, the other control parameters are reset to factory default.

IMPORTANT: when using controller in symmetrical mode, be sure to connect solution ground (potential matching pin) to terminal 21. Failure to connect solution ground will result in unstable, erroneous readings.

6.5.2 Reverting to default settings

Use this parameter to reset the controller to default settings. You have three options:

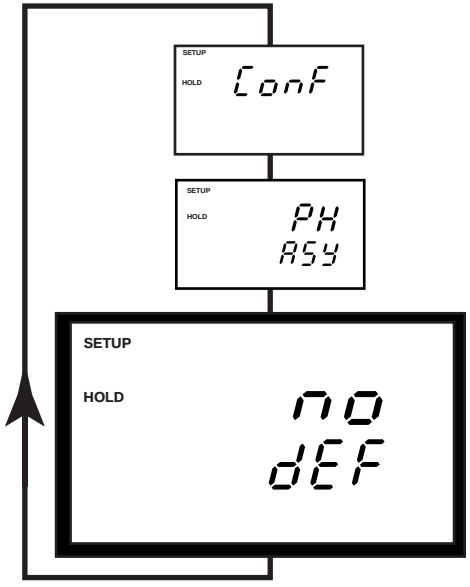
1. **no dEF:** No default retains all current settings.
2. **CAL dEF:** Calibration default clears all calibration data only.
3. **FCt dEF:** Factory default resets all settings (except the temperature mode and input mode settings) to factory default.

From measurement mode:

1. **Enter Advanced set-up mode.** Push the ENTER key.
2. **Press the ▲ and ▼ keys** to scroll until the upper display shows ConF.
3. **Press the ENTER key** until the upper display shows no and the lower shows dEF (default).

See bold figure at right.

4. **Press the ▲ and ▼ keys** to choose your selection:
   - **no dEF:** No default retains current settings
   - **CAL dEF:** Calibration default clears all calibration settings
   - **FCt dEF:** Factory default reverts to factory default settings
5. **Press the ENTER key** to confirm your selection and return to advanced set up mode.



Notes

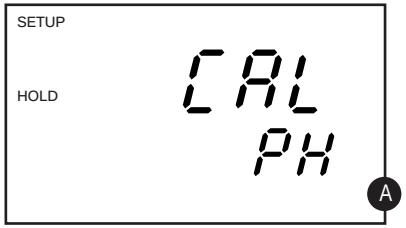
See Appendix 1 on page 44 for a chart of all factory default settings.

6.6 CALIBRATION mode

The calibration procedure in Advanced Set-up mode is identical to the procedure in Calibration mode. The only difference is that the controller will revert back to Set-Up Mode (instead of Measurement mode) after calibration is complete.

To reach Calibration mode, perform one of the following:

- **From calibration mode.** From measurement mode, press the CAL key.
- **From advanced set up mode.** From measurement mode, press the ENTER key. Press the ▲ and ▼ keys to scroll to set up mode “CAL PH”.



6.6.1 pH Calibration

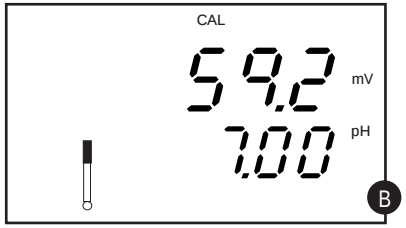
This unit features seven preset buffer values (pH 1.00, 4.00, 6.86, 7.00, 9.00, 9.18 or 10.00) for fast auto-calibration at two points. When you calibrate this instrument, you need a standard pH buffer solution that matches one of these values.

NOTE: You must calibrate at either pH 7.00 or pH 6.86 for the first calibration.

1. **Enter Calibration mode**. From measurement mode, press the ENTER key. Press the ▲ and ▼ keys to scroll to set up mode “CAL PH”.

See figure A

NOTE: The upper and lower display should read CAL pH. If they read CAL OrP, see section 6.5.1 on page 36 for directions on how to switch from ORP to pH readings.



2. **Press the ENTER key.** The upper display shows the slope in mV from the most recent calibration. The lower display will show the offset as the pH reading at 0 mV electrode output.

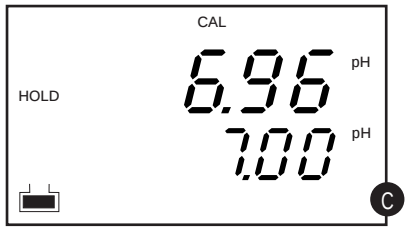
See figure B

3. **Press the ENTER key again** to begin calibration. The “CAL” and buffer indicator appear on the display.

   The upper display shows your present uncalibrated reading. The lower display indicates a preset pH buffer value.

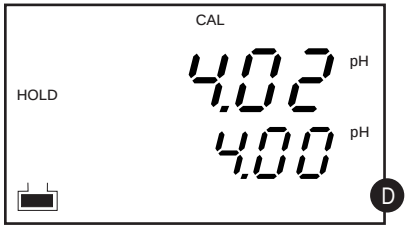
4. **Press the ▲ and ▼ keys** to scroll the lower display to the buffer value that matches your standard solution.

See figure C



5. **Make sure the electrode is in your buffer solution**. In ATC mode, you must also immerse the temperature sensor in the buffer solution. In the symmetrically high-resistance measurement mode, you must also immerse the potential equalization pin in the buffer.
6. **Press the ENTER key** to confirm the buffer value. The electrode indicator and CAL indicator will both flash.
7. **Allow the electrode to stabilize.** You can press the ENTER key to enter the calibration value. If you do not press the ENTER key, the controller will automatically enter the calibration value when the electrode reading is stable.
8. Repeat steps 4 through 7 with a second buffer for the second calibration point.

See figure D



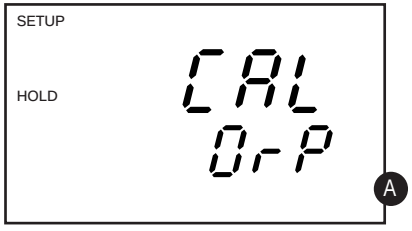
9. After calibrating to a second buffer value, this controller automatically displays slope in the upper display and offset in the lower display.
10. Press the CAL key to return to the Set-Up mode. Or, press ▲ and ▼ (escape) together to return to measurement mode.

Notes

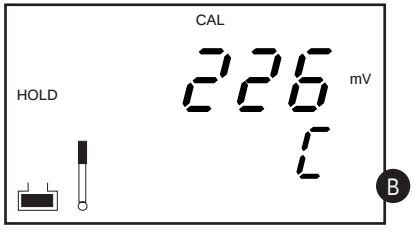
If there is a calibration error, the controller flashes the buffer and electrode icons. If this happens, push both ▲ and ▼ (escape) to restart the calibration beginning from step 1.

When calibrating with manual temperature compensation, the controller automatically changes from the preset process temperature to the preset calibration temperature. After leaving the Calibration mode, the controller switches back to the process temperature. To set the calibration temperature and the process temperature, see pages 27-28.

The slope and offset are re-determined after each calibration.



A



B

6.6.2 ORP Calibration

1. **Enter Calibration mode**. From measurement mode, press the ENTER key. Press the ▲ and ▼ keys to scroll to set up mode "CAL ORP".

See figure A

NOTE: If the upper and lower display read CAL PH, see section 6.5.1 on page 36 for directions on how to switch from pH to ORP mV readings.

2. **Place sensor in the calibration solution.**
3. **Press the ENTER key** to begin calibration. The "CAL" indicator will appear on the display. The upper display shows the current mV output of the electrode without any offset adjustment.

See figure B

4. Determine the mV value of your solution with a meter known to be accurate.
5. **Press the ▲ and ▼ keys** to offset the mV value on the controller display to match the value of the solution you are measuring.
6. To confirm your selection and return to Advanced Set Up mode, **press the ENTER key** again.

7. Specifications

	pH	ORP (mV)	Temperature
Range	–2.00 to 16.00	±1000 mV	–9.9 to 125.0°C
Resolution	0.01 pH	1 mV	0.1°C
Accuracy	±0.01 pH	±1 mV	±0.5°C

Control type	on / off
Number of inputs	one
Number of set points	two: high and low
Output	Control: 2 SPDT relays; 6A @ 110 VAC, 250 VAC max Current: galvanic 4-20 mA, 600 Ω maximum load
Hysteresis (dead band)	0.1 to 1.0 pH or 10 to 100 mV
Relay delay	0 to 2000 seconds
Input impedance	10^6 MΩ
Electrical isolation	yes, galvanically
pH calibration	2 points (pH 1.00, 4.00, 6.86, 7.00, 9.00, 9.18 or 10.00) via keypad. One point must be pH 6.86 or 7.00.
Temperature sensor	100 Ω or 1000 Ω Platinum RTD, terminal strip
Display	dual-line LCD; 4-digit upper and 3½-digit lower
Housing	IP54 front; ¼ DIN size
Dimensions	3 13/16"W x 3 13/16"H x 6 15/16"D (9.6 x 9.6 x 17.5 cm)
Panel cut-out	3⅜"W x 3⅜"H (9.2 x 9.2 cm)
Operating temperature	14 to 140°F (–10 to 60°C)
Weight	1.5 lbs (0.7 kg) unit only; 2.5 lbs (1.2 kg) boxed

8. Accessories

Extra controllers

WD-35108-00 **800 series pH/ORP controller,** 120 VAC

WD-35108-05 **800 series pH/ORP controller,** 220 VAC

WD-35100-90 **Power cord; 3 ft with bare leads,** 3 prong U.S. plug, 110 VAC

Semi-domed electrodes

These double-junction electrodes feature a unique surface design that provides protection from particulates while increasing flow across the junction to provide cleaning. Ceramic junction provides toughness along with steady electrolyte flow. **The graphite body probes act as a solution ground and take advantage of the controller's symmetrical mode (see page 45 for more information).** Sealed KCl / AgCl reference. Have 10-ft cable, BNC connector, and stripped ends for ATC element. Dimensions: 5.875"L

WD-35807-00 **Semi-domed bulb electrode,** epoxy body, ¾" NPT thread

WD-35807-05 **Semi-domed bulb electrode,** epoxy body, 1" NPT thread

WD-35807-10 **Semi-domed bulb electrode,** graphite body, ¾" NPT thread

WD-35807-15 **Semi-domed bulb electrode,** graphite body, 1" NPT thread

In-line/submersible electrodes

These permanently encapsulated combination electrodes have a CPVC body and ¾" NPT threads on both ends. Install in a tee fitting or on a submersion pipe for tank mounting. Sealed KCl / AgCl reference. Have 10-ft cable, BNC connector, and stripped ends for ATC element. Dimensions: 6.325"L x 1"OD

WD-35801-02 **In-line/submersible pH electrode;** single junction

WD-35801-08 **In-line/submersible pH electrode;** double junction

WD-35801-21 **In-line/submersible ORP electrode;** double junction, Pt band sensor

Submersible electrodes

These combination electrodes are permanently encapsulated in a 3-ft L x 1"OD ABS pipe—install in a tank. Sealed KCl / AgCl reference. Have 10-ft cable, BNC connector, and stripped ends for ATC element.

WD-35806-00 **Submersible pH electrode;** single junction

WD-35806-01 **Submersible pH electrode;** double junction

WD-35806-02 **Submersible ORP electrode;** double junction, Pt band sensor

8. Accessories, continued

pH buffer solutions

These buffer solutions are standardized to ±0.01 pH at 25°C. They are labeled with pH vs. Temperature tables to adjust readings for accurate calibration. They are also labeled with the name and CAS number for all ingredients to conform to "Right-to-Know" requirements, and are supplied with an MSDS (Material Safety Data Sheet). Certified to NIST-traceable standards.

WD-00654-00 **pH 4.01,** 1 pint bottle

WD-00654-04 **pH 7.00,** 1 pint bottle

WD-00654-08 **pH 10.00,** 1 pint bottle

9. Appendix 1: Factory default settings

Type	Parameter	Value	Remarks
OFS	pH offset	0.00 pH	Zero offset value
SET C	ATC	ATC = ON	Automatic Temperature Compensation*
	Temp. offset	0.0°C	Zero temperature offset*
SP1	SP1	4.00 pH	set point 1
	LO / HI trigger	LO	LO trigger mode
	Hysteresis	0.50 pH	—
	On delay time	0 seconds	—
	Off delay time	0 seconds	—
SP2	SP2	10.00 pH	set point 2
	LO / HI trigger	HI	HI trigger mode
	Hysteresis	0.50 pH	—
	On delay time	0 seconds	—
	Off delay time	0 seconds	—
ConF	pH / ORP units	pH / ASY	Asymmetrical pH mode*
	Factory default	no	Do not reset to factory default
CAL	Calibration	59.2 mV	default setting assumes 0 mV offset at 7 pH with 59.2 mV slope

*These settings are in place when the controller is shipped to you. However, if you change these settings and then revert the controller to factory default settings, these settings will remain as you changed them (these settings do not revert to factory default). See page 37 for instructions on reverting to factory default settings.

10. Appendix 2: Symmetrical mode

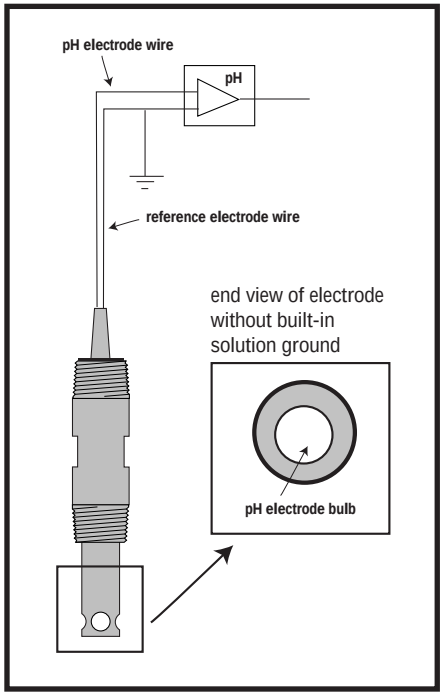
Your controller can operate in asymmetrical or symmetrical mode. See Section 6.5.1 on page 36 for information on selecting the appropriate mode.

Asymmetrical mode works well in environments with where there is little or no electrical noise. When there is electrical noise, the noise acts as a common signal and is picked up by both the pH and the reference electrodes. However, since the reference electrode is grounded to the ground potential of the amplifier, electrical noise will be present only on the pH electrode. This noise is amplified along with the pH signal, which causes reading fluctuations in an electrically noisy atmosphere. Electrical noise from a DC source (as in an electroplating tank) will typically result in stable but incorrect values.

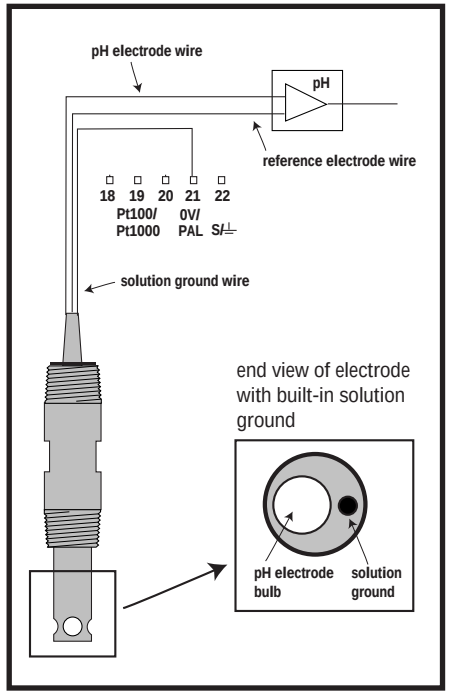
Symmetrical mode. For noisy electrical environments, this controller offers Symmetrical Mode operation. ***To take advantage of Symmetrical operation, you must have an electrode with a solution ground (potential matching) pin.***
If your electrode does not have a solution ground, be sure to set the controller to Asymmetrical mode.

Symmetrical mode avoids grounding the reference electrode by reconfiguring the input to a floating differential mode (see diagram below right). The electrical noise appears equally on the pH and reference electrodes, and is therefore rejected by the operational amplifier.

Asymmetrical mode



Symmetrical mode



11. Appendix 3: Jumper positions

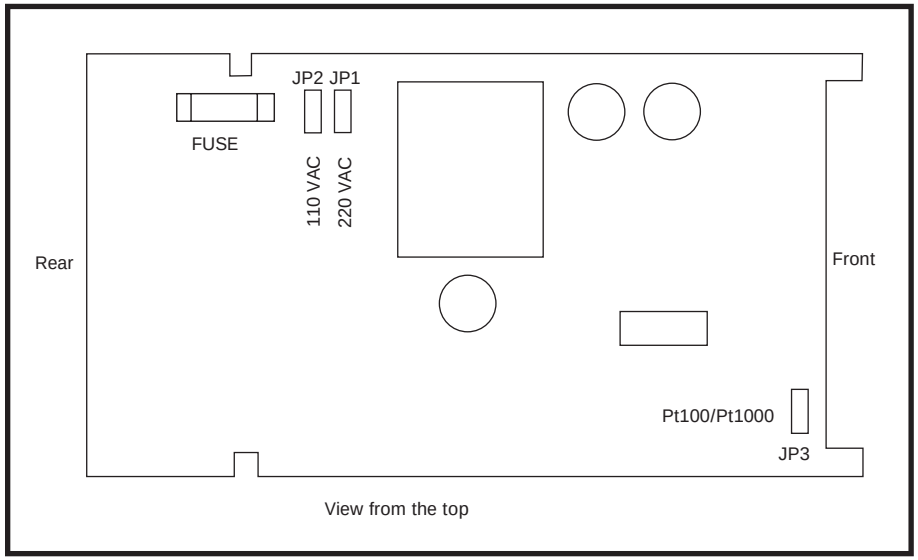
Note that there is a fuse internal to the controller. Before opening the unit, ENSURE that the power cable is physically separated from the mains supply. Replace the fuse with the recommended part specified by the manufacturer.

Jumper Positions - Internal to the controller

JP 1 Selects the input voltage 220 VAC. To switch to 110 VAC, use tweezers or needle nose pliers to remove jumper from JP1 pins to JP2 pins.

JP 2 Selects the input voltage 110 VAC. To switch to 220 VAC, use tweezers or needle nose pliers to remove jumper from JP2 pins to JP1 pins.

JP 3 Selects between Pt100 and Pt1000. To switch between Pt 100 and Pt 1000, desolder jumper and resolder jumper in new position as indicated inside controller housing. If you are not equipped to do this, please contact your OAKTON distributor for further information.



12. Index