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Part 1 - Introduction

1.1 General

The Model PHE-45P pH Sensor measures the pH of aqueous solutions in industrial and municipal process applications. It is designed to perform in the harshest of environments, including applications that poison conventional pH sensors. All seals are dual o-ring using multiple sealing materials. The sensor is designed for use with the Omega PHTX-45 Monitor/Analyzer.

1.2 Sensor Features

- A high volume, dual junction saltbridge is utilized to maximize the in-service lifetime of the sensor. The annular junction provides a large surface area to minimize the chance of fouling. Large electrolyte volume and dual reference junctions minimize contamination of the reference solution. The saltbridge is replaceable.

- The reference element of the sensor is a second glass pH electrode immersed in a reference buffer solution. This glass reference system greatly increases the range of sensor applications.

- An integral preamplifier is encapsulated in the body of the sensor. This creates a low impedance signal output which ensures stable readings in noisy environments and increases the maximum possible distance between sensor and transmitter to 3,000 feet (914 meters).

- System diagnostics warn the user in the event of electrode breakage, loss of sensor seal integrity or integral temperature element failure.

- Pt1000 RTD. The temperature element used in the PHE-45P sensor is highly accurate and provides a highly linear output.

1.3 Sensor Specifications PHE-45P

Measuring Range	0 to 14.00 pH
Sensitivity	0.002 pH
Stability	0.02 pH per 24 hours, non-cumulative
Wetted Materials	PEEK, ceramic, titanium, glass, Viton, EDPM (optional: 316 stainless steel with 316SS body)
Temperature Compensation	Pt1000 RTD
Sensor Cable	6 Conductor (5 are used) plus 2 shields, 15 feet (4.6 meters) length standard
Temperature Range	-5 to +95 °C (23 to 203 °F)
Pressure Range	0 to 100 psig
Maximum Flow Rate	10 feet (3 meters) per second
Max. Sensor-Analyzer Distance	3,000 feet (914 meters)
Sensor Body Options	1" NPT convertible, 1¼" insertion, 1½" or 2" sanitary-style
Weight	1 lb. (0.45 kg)

Notes: 1. The type of hardware used to mount the sensor may limit the maximum temperature and pressure ratings. Please consult the hardware manufacturer's specifications to obtain the relevant temperature and pressure rating information.

2. The maximum flow rate specification is lower for process solutions with low ionic conductivity or high suspended solids concentration. High flow rates in low ionic conductivity processes may cause a measurement error due to static electrical discharge. High flow rates in processes with high suspended solids concentration may decrease the functional life of the sensor by eroding the pH-sensitive glass electrode.

Inches (mm)

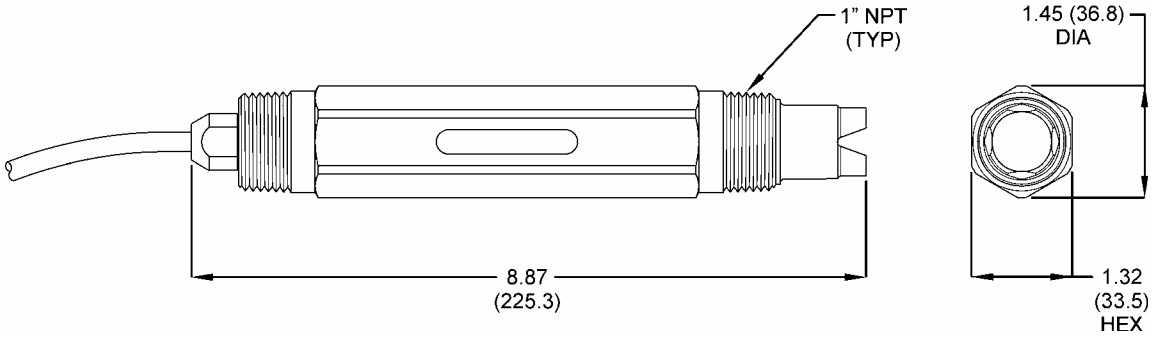


Figure 1-1 PHE-45P Sensor Dimensions (standard, convertible-style)

1.4 Important Notes

1. The PHE-45P process electrode is made of glass and can break if not handled properly. Should the electrode ever break, USE CAUTION when handling the sensor to avoid serious cuts.
2. The glass electrode must be wetted at all times to ensure proper functionality. PHE-45P sensors are shipped with a fluid-filled cap over the electrode to enable immediate use (remove cap before installing, save for storage and shipping purposes). Electrodes that have dried out for any reason should be hydrated for 24 hours to restore full functionality.
3. Hydrofluoric acid (HF) will dissolve conventional glass electrodes. Please contact the factory when the process application involves this or any other questionable substance.

Part 2 - Installation

2.1 General

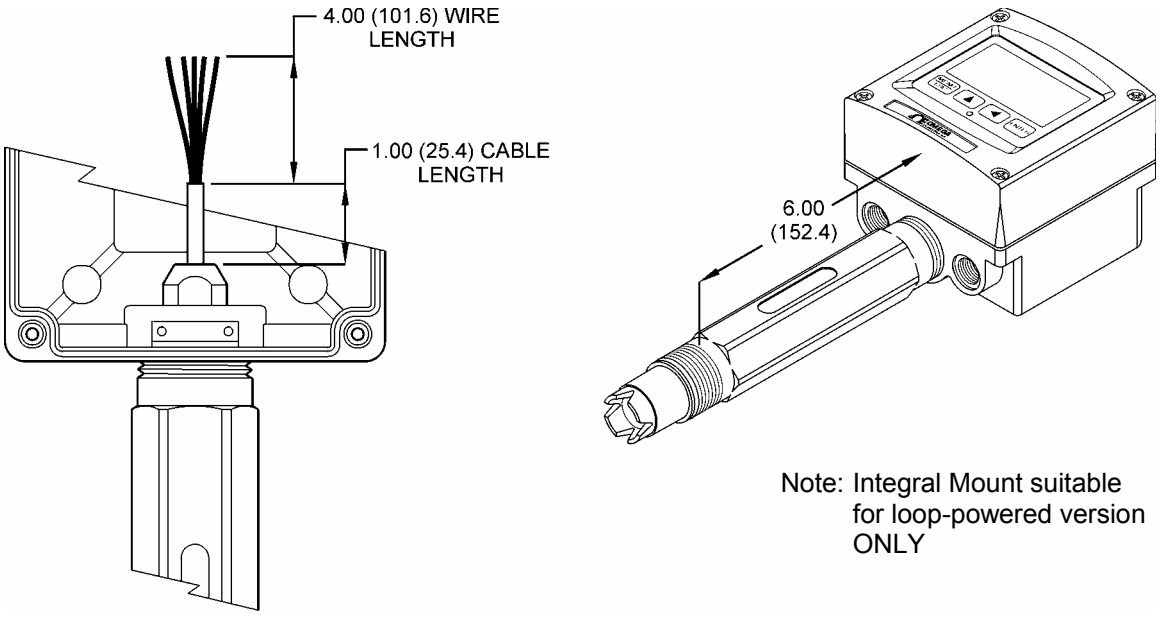
The PHE-45P pH Sensor is designed for industrial and municipal process applications. Mounting options include flow-through, submersion, insertion (special hardware required), or integral mount to the Omega PHTX-45 pH Monitor/Analyzer (see Figures 2-1 and 2-2). The sensor's built-in preamp allows sensor-to-instrument distances of up to 3,000 feet (914 meters). However, to ensure ease of calibration, install the transmitter as close to the sensor as possible.

The sensor should be mounted vertically (electrode face down) whenever possible. When mounting on an angle, make sure sensor is at least 10º above horizontal. Do not mount sensor completely on its side or upside down.

Do NOT use a sealant (e.g., pipe dope) when mounting the insertion or convertible style sensor. Use industrial/ plumber pipe tape when needed.

Calibrate the sensor before placing it into the process. See Model PHTX-45 Monitor/Analyzer Instruction Manual for detailed calibration instructions.

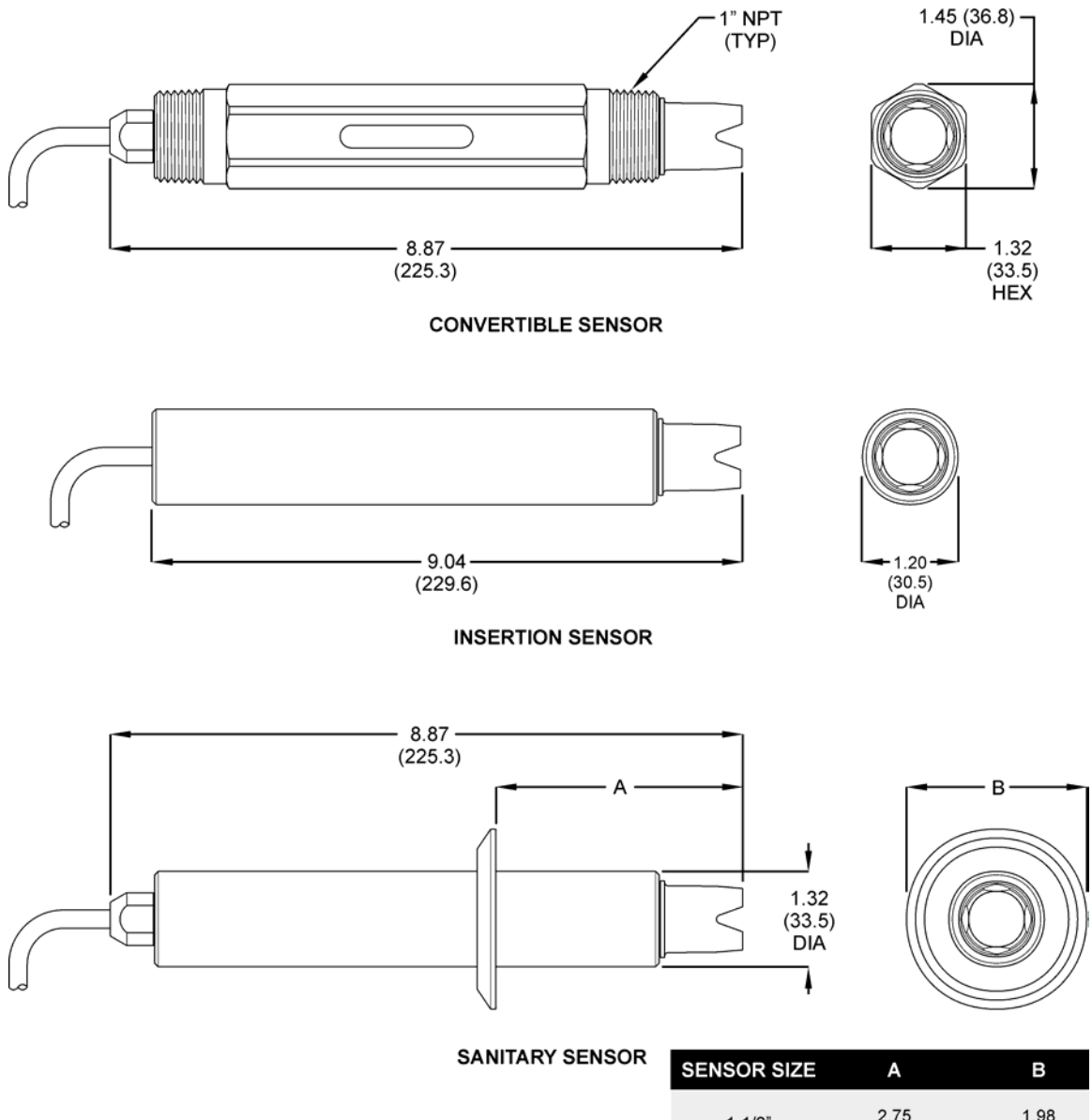
Inches (mm)



Note: Integral Mount suitable for loop-powered version ONLY

Figure 2-1 Integral Mount to PHTX-45 Monitor/Analyzer

Inches (mm)



SENSOR SIZE	A	B
1-1/2"	2.75 (70.0)	1.98 (50.4)
2"	3.50 (88.9)	2.50 (63.5)

Figure 2-2 PHE-45P Sensor Types

2.2 Electrical

The Model PHE-45P Sensor has a built-in preamplifier and comes standard with 15 feet of 6 conductor (only 5 are used) double shielded cable. The cable is permanently attached to the sensor, and a PEEK cordgrip is used to seal around the cable. Nevertheless, the cable should always be kept as clean and dry as possible.

DANGER: DO NOT connect sensor cable to power lines. Serious injury may result.

Take care to route sensor cable away from AC power lines, adjustable frequency drives, motors, or other noisy electrical signal lines. Do not run signal lines in the same conduit as AC power lines. Run signal cable in dedicated metal conduit if possible. For optimum electrical noise protection, run an earth ground wire to the ground terminal in the transmitter.

Refer to Figure 2-3, Cable Description and Figure 2-4, Wiring Diagram for illustrative details on electrical installation.

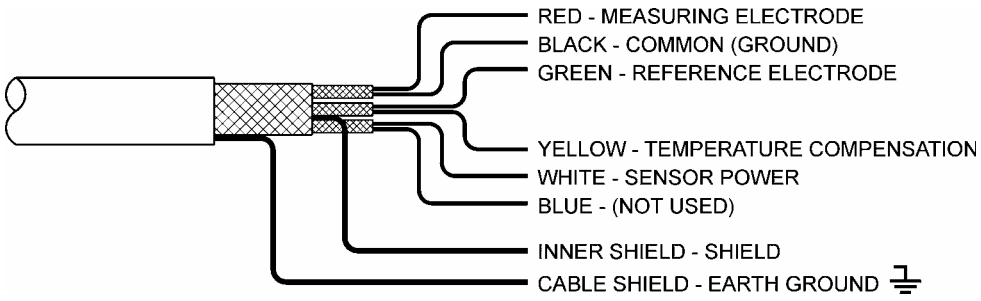
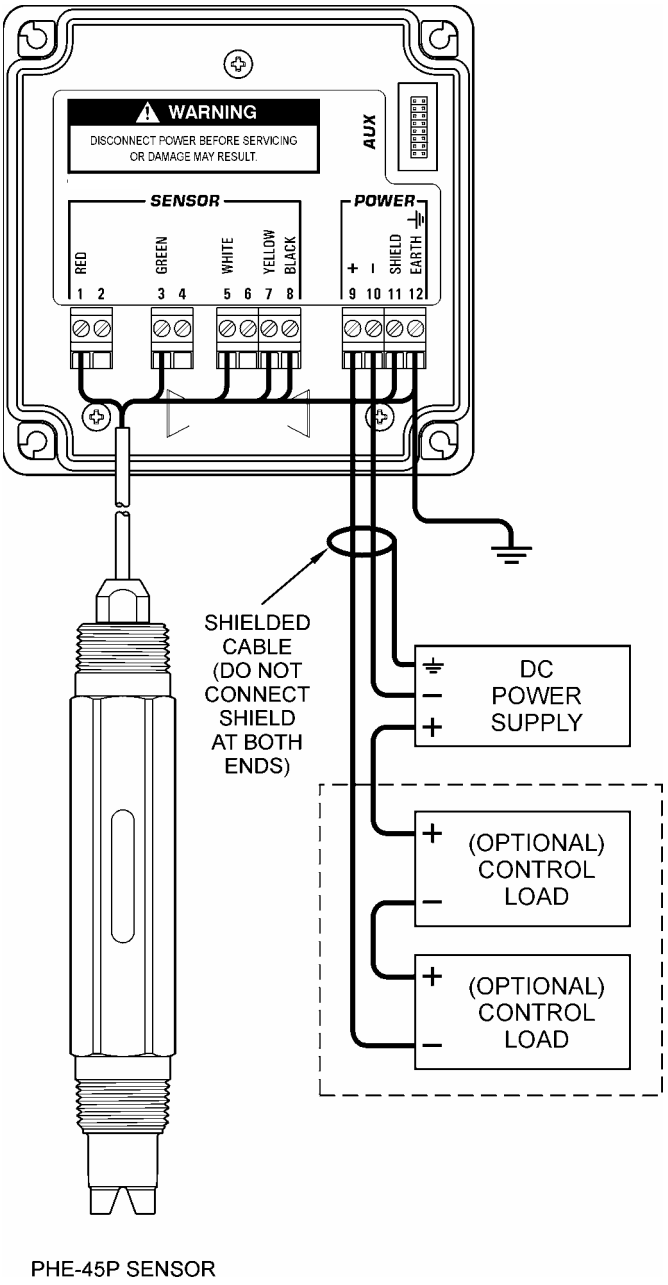


Figure 2-3 Cable Description, Model PHE-45P

Note: Only the custom 6-wire shielded interconnect cable attached to the sensor must be used when connecting the Model PHE-45P sensor to the analyzer. This high-performance, double shielded, polyethylene jacketed cable is specially designed to provide the proper signal shielding for the sensor used in this system. No substitutions can be made. Substituted cables may cause problems with system performance.



Notes: 1. Voltage between Terminals 9 and 10 MUST be between 16 and 35 VDC.

2. Earth ground into Terminal 12 is STRONGLY recommended. This connection can greatly improve stability in electrically noisy environments.

Figure 2-4 Wiring Diagram, PHE-45P Sensor and PHTX-45 Transmitter

Part 3 - Maintenance and Troubleshooting

3.1 Cleaning the Sensor

Keep the sensor as clean as possible for optimum measurement accuracy - this includes both the saltbridge and the measuring electrode glass. Frequency of cleaning depends upon the process solution.

1. Carefully wipe the measuring end of the sensor with a clean soft cloth. Then rinse with clean, warm water - use distilled or de-ionized water if possible. This should remove most contaminate buildup.
2. Prepare a mild solution of soap and warm water. Use a non-abrasive detergent (such as dishwashing liquid).

Note: DO NOT use a soap containing any oils (such as lanolin). Oils can coat the glass electrode and harm sensor performance.

3. Soak the sensor for several minutes in the soap solution.
4. Use a small, extra-soft bristle brush (such as a mushroom brush) to thoroughly clean the electrode and saltbridge surfaces. If surface deposits are not completely removed after performing this step, use a dilute acid to dissolve the deposits. After soaking, rinse the sensor thoroughly with clean, warm water. Placing the sensor in pH 7 buffer for about 10 minutes will help to neutralize any remaining acid.

Note: DO NOT soak the sensor in dilute acid solution for more than 5 minutes. This will help to prevent the acid from being absorbed into the saltbridge.

WARNING: ACIDS ARE HAZARDOUS. Always wear eye and skin protection when handling. Follow all Material Safety Data Sheet recommendations. A hazardous chemical reaction can be created when certain acids come in contact with process chemicals. Make this determination before cleaning with any acid, regardless of concentration.

3.2 Replacing the Saltbridge

1. Hold the sensor with the process electrode pointing up. Place a cloth or towel around the saltbridge. Turn the saltbridge counterclockwise (by hand) to loosen and remove the saltbridge. Do NOT use pliers.
2. Pour out the old reference buffer by inverting the sensor (process electrode pointing down). If the reference buffer does not run out, gently shake or tap the sensor.
3. Rinse the reference chamber of the sensor with de-ionized water. Fill the reference chamber of the sensor with fresh Reference Cell Buffer. The chamber holds 6 to 7 mL of solution. MAKE SURE that 6 to7 mL is used when refilling. The chamber should be FULL.

NOTE: The Reference Buffer Solution, 7.0 pH included with the saltbridge is NOT typical pH 7 buffer, it is a special "high-capacity" buffer developed to ensure the highest possible stability of the reference portion of the pH measurement. No substitutions should be made.

4. Inspect the new saltbridge to verify that there are 2 o-rings inside the threaded section of the saltbridge.
5. Place the new saltbridge over the ground assembly of the sensor. Place a cloth or towel around the saltbridge and hand-tighten the saltbridge by turning it clockwise.

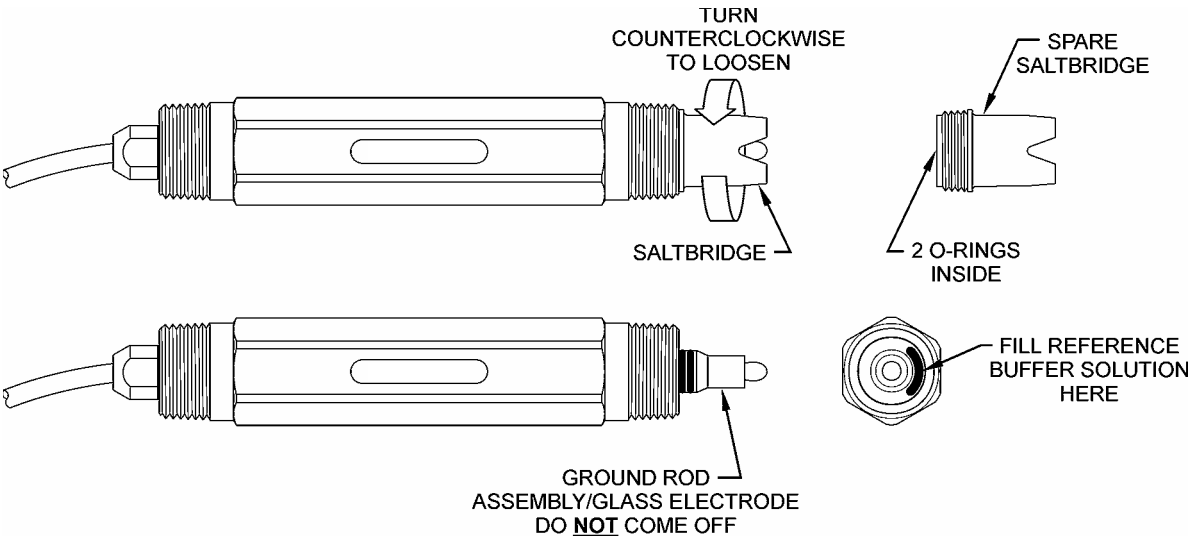


Figure 3-1 Replacing the Saltbridge and Reference Buffer

3.3 Troubleshooting

The first step in resolving any measurement problem is to determine whether the trouble lies in the sensor or the transmitter. Since measurement problems can often be traced to dirty sensor electrode glass and/or saltbridge, cleaning the sensor using the method outlined in Section 3.1 should always be the first step in any troubleshooting.

If the sensor cannot be calibrated after cleaning, replacplace the saltbridge and reference cell buffer 7 pH as outlined in Section 3.2.

If the sensor still cannot be calibrated, perform the followlowing test. A multimeter, 7 pH buffer and another buffer at least 2 pH units away will be needed.

1. With transmitter power on and sensor connected, place the multimeter's positive (+) lead on the white position of the transmitter terminal strip and the negative (-) lead on the black position. The multimeter should read between –4.2 and –6.5 VDC.
2. Disconnect the sensor's red, green, yellow, and white wires from the transmitter or junction box. Re-check Step 1.
3. Place the sensor in pH 7 buffer. As in calibration, allow the temperatures of the sensor and buffer to equilibrate at room temperature (approximately 25 ºC).
4. Verify that the sensor's temperature element (Pt1000 RTD) is functioning properly by measuring the resistance between the sensor's yellow and black wires. The nominal resistance value at 25 ºC is 1097 ohms. Use the following table as a guide to the approximate resistance value:

ºC	RTD Ω
20	1078
25	1097
30	1117
35	1136

5. Reconnect the yellow and white wires.
6. Connect the multimeter's positive (+) lead to the red wire and its negative (-) lead to the green wire. With the sensor in the pH 7 buffer at approximately 20-30 ºC, measure the DC millivolts. The sensor offset reading should be between –50 and +50 mV. If it is not, replace sensor reference solution and saltbridge (See Section 3.2) and re-test.
7. With the multimeter connected as in Step 5, rinse the sensor with clean water and place it in the second buffer. Allow the temperatures to equilibrate as before. Now measure the sensor span reading. Use the following table to determine approximate mV:

pH	mV
2.00	+296
4.00	+178
7.00	0
9.18	-129
10.00	-178

Note: The mV values listed above are for ideal conditions (sensor offset = 0 mV) and therefore represent midpoints in a range. The table shows the difference in mV which should be seen when going from one pH value to another. For example, at 7.00 pH, the mV reading will be from –50 to +50 mV (at room temperature) if the sensor is working properly. If the reading is exactly +20 mV, then going to 4.00 pH buffer should produce a reading of +198 mV, or a difference of +178 mV.