



DHA-3000 DIGITAL pH METER

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WHAT IS pH?

pH is one of the most common analyses in soil and water testing. An indication of the sample's acidity, pH is actually a measurement of the activity of hydrogen ions in the sample.

pH measurements run on a scale from 0 to 14, with 7.0 considered neutral. Those solutions with a pH below 7.0 are considered acids, and those between 7.0 and 14.0 are designated bases. The pH scale is logarithmic, so a one unit change in pH actually reflects a ten fold change in the acidity. For instance, orange juice, pH 4, is ten times more acidic than cottage cheese, which has a pH of 5.

Many industries rely heavily on pH for their process to work properly, or to maintain expensive equipment. Breweries maintain the pH between 4.2 and 4.6 to keep infectious bacteria from breeding during the fermentation process. In many industrial applications if the pH is too low the water may corrode metal equipment, but if it is too high scaling may result.

pH can be measured visually or electronically. Visual comparisons use pH indicators where color changes reflect the pH, which are then matched to color standards. pH meters, such as the DHA-3000, simplify the pH test. An electrode is placed in the sample, and the pH read directly from the meter.

While the meter is very easy to use, the electronics within the meter are more complex. After the pH electrode measures the millivolts of potential between the reference electrode and the pH electrode, the meter converts this reading to pH units using the Nernst Equation:

$$E = E_x + \frac{2.3RT_k}{nF} \log(a_i)$$

where E_x = constant depending upon reference electrode

R = constant

T_k = absolute temperature

n = charge of the ion (including sign)

F = constant

a_i = activity of the ion

For actual use in converting pH readings to millivolts, this equation can be simplified to:

$$(\text{pH} - 7.00) \times (-0.198) = \text{mV}$$

GENERAL INFORMATION

The DHA-3000 pH meter consists of three major components: the pH electrode, the temperature probe and the meter.

The pH electrode consists of a glass, hydrogen-ion selective electrode, and a reference electrode, combined into a single unit. The glass electrode is specially treated to measure only hydrogen ions, while the reference electrode is silver surrounded by silver chloride, and it provides a “zero” or reference point for the measurement. This “zero” point means any change in potential measured at the glass electrode is attributed to hydrogen ions, and therefore expressed as pH.

The temperature probe serves a dual purpose, and may be connected to the pH electrode. When the temperature probe is in the sample at the same time as the pH electrode, it measures the temperature and allows the meter to automatically compensate the temperature to 25°C. Secondly, it allows the user to measure the actual temperature of the sample in °C.

When the temperature probe and pH electrode are immersed in the sample, the meter measures the difference in potential between the glass electrode and the reference electrode. This electronic measurement is converted from millivolts to pH units, and the result appears on the display.

If, for some reason, the temperature probe can not be used during the pH measurement, the meter must be manually compensated for temperature. To do this standardize the meter with buffers which are the same temperature as the sample, and use the “Slope” knob to standardize meter to the proper pH.

METER SPECIFICATIONS

Range	0-14 pH units (-1999 mV 0 to 50°C)
Readout	3 1/2 digit LCD
Readout	0.01 pH units
Resolution	1 mV 0.1°C
Controls	pH millivolts °C Temperature Off Standardize Slope
Temp. Comp.	Automatic by separate probe
Electrode	pH: Combination gel-filled epoxy body, Ag/AgCl; 3' cable, BNC connector
Probe	Temperature: 3' cable, plug connector
Power	1604 A type Alkaline (9V), 3.5 mm jack for optional adapter
Size	5 7/8" L x 3 1/4" W x 1 3/4" H

METER ACCESSORIES

DESCRIPTION	CODE
DHA-3000 pH meter with electrodes, buffers & case	1706-02
pHElectrode	1904
Temperature Probe	1771
pH Buffer, 4.0, 100 mL	2866-J
pH Buffer, 7.0, 100 mL	2881-J
pH Buffer, 10.0, 100 mL	2896-J
Beakers, plastic, 50 mL	0944
AC Adapter, 9 volt	1708

METER PREPARATION

The DHA-3000 is shipped ready for standardization and use. See **Meter Care** for information regarding any repairs which may be required. The pH electrode and temperature probe can be connected together with a rubber band for easier use.

STORING THE PROBE

To protect the pH electrode it should always be stored in the accompanying soaker bottle (0668), with the lid tightened to prevent leakage. The soaker bottle contains a dilute mixture of potassium chloride and buffer.

STANDARDIZING

The DHA-3000 pH meter should be standardized daily, or as operating conditions are altered during use, for instance if changes occur in the unknown or temperature. pH buffers should be replaced every three to six months to assure accurate standardization. If the temperature probe is not used during standardization, the buffers must be the same temperature as the sample.

1. Press button labeled “pH”.

NOTE: If “BAT” appears in the lower left corner, the battery is low and should be replaced. See **Battery Replacement** for instructions.

2. Remove pH electrode from soaker bottle. Rinse pH electrode and temperature probe with deionized or tap water.

3. Pour a small amount of pH 7.0 Buffer (2881) into a small flask or beaker. Place pH electrode and temperature probe in beaker. Wait until display stabilizes.

NOTE: The tip of the pH electrode must be immersed in the buffer solution.

4. Adjust upper knob labeled “STANDARDIZE” until display reads 7.00.

5. Remove electrode and probe from buffer. Rinse with deionized or tap water.

6. Select a second buffer based on expected pH to complete standardization procedure.

NOTE: For solutions with an estimated pH below 7.0 use pH 4.0 Buffer (2866). For solutions with an estimated pH above 7.0 use pH 10.0 Buffer (2896).

7. Pour a small amount of selected buffer into a small flask or beaker. Place pH electrode and temperature probes in beaker. Wait until display stabilizes.

NOTE: The tip of the pH electrode must be immersed in the buffer solution.

8. Adjust lower knob labeled “SLOPE” until pH of selected buffer is displayed.

9. Repeat Steps 3 through 8 if necessary to check calibration.

10. Remove electrode and probe. Rinse electrode with deionized or tap water. Place in soaker bottle for storage or proceed to **Measuring pH**.

11. Discard buffers.

NOTE: Do not disturb these adjustments.

MEASURING pH

NOTE: If necessary standardize the DHA-3000. See **Standardizing** for instructions.

1. Press button labeled “°C”.

NOTE: If “BAT” appears in the lower left corner, the battery is low and should be replaced. See **Battery Replacement** for instructions.

2. Remove pH electrode from soaker bottle. Rinse pH electrode and temperature probes with deionized or tap water.

3. Place pH electrode and temperature probe in unknown sample. Wait until display stabilizes.

NOTE: The tip of the pH electrode must be immersed in the sample.

4. Press button labeled “pH”. Record reading as pH.

5. Press button labeled “OFF” when finished testing.

6. Remove electrode and probe. Rinse with deionized or tap water. Place pH electrode in soaker bottle for storage.

MEASURING THE pH OF SOIL

1. Place a 1 to 1 ratio of soil and distilled water in a small beaker.

NOTE: For most analyses 20 grams of soil and 20 mL of distilled water is sufficient.

2. Wait 15 minutes, stirring occasionally with a stirring rod.

3. Stir sample. Immediately place pH electrode and temperature probe in sample.

4. Press button labeled “°C” on DHA-3000. Wait until display stabilizes.

NOTE: If “BAT” appears in the lower left corner, the battery is low and should be replaced. See **Battery Replacement** for instructions.

5. Press button labeled “pH”. Record result as pH.

6. Press button labeled “OFF” when finished testing.

7. Remove electrode and probe. Rinse with deionized or tap water. Place pH electrode in soaker bottle for storage.

MEASURING TEMPERATURE

1. Rinse temperature probe with deionized or tap water.
2. Place temperature probe in unknown sample.
3. Push button labeled “°C”. Wait until display stabilizes.
4. Record result as temperature in “°C”.
5. Press button labeled “OFF” when finished testing.
6. Remove probe. Rinse with deionized or tap water.

MEASURING MILLIVOLTS

1. Disconnect pH electrode from DHA-3000.
2. Connect ion specific electrode or ORP probe to BNC connector.
3. Place ion specific electrode or ORP probe in sample.
4. Push button labeled “mV”. Wait until display stabilizes.
5. Record result as millivolts.
6. Press button labeled “OFF” when finished testing.
7. Remove ion specific electrode or ORP probe. Rinse with deionized or tap water.

METER CARE

BATTERY REPLACEMENT

When “Bat” appears on the display, the battery should be replaced. The temperature reading will be the first to be affected by the low battery.

1. Use a #1 Phillips head screwdriver to remove four screws on the back of the meter case.
2. Gently lift back panel from meter.
3. Lift battery from bottom of meter. Remove battery from connector.
4. Snap new battery onto connector.

NOTE: The DHA-3000 uses a type 1604A battery.

5. Lower the battery back into the meter.
6. Replace back panel on meter. Replace screws.

AC ADAPTER

An AC adapter is available for use with the DHA-3000. Order as LaMotte Code #1709. See Figure A for proper connection to meter.

CONNECTING THE PROBES

A. pH ELECTRODE

1. Slide BNC connector over receptacle on meter, making sure the pin on the meter connector is in the lower end of the slot. Turn outer ring on BNC connector until the pin slides to upper end of the slot. See Figure A.

B. TEMPERATURE PROBE

1. Slide connector pin into smallest hole on meter. See Figure A.
2. Hold probes next to each other. Slide rubber band to top of probes to hold them together.

WARRANTY INFORMATION

REPAIRS

If it is necessary to return the instrument for repair, contact LaMotte Company at 1-800-344-3100 for a return authorization number.

INSTRUMENT GUARANTEE

This instrument, excluding the electrode, is guaranteed to be free of defects in material and workmanship for 12 months from original purchase. If in that time it is found to be defective, it will be repaired without charge, except for transportation expenses. This guarantee does not cover the batteries.

This guarantee is void under the following circumstances:

- operator's negligence
- improper application
- unauthorized servicing.

LIMITS OF LIABILITY

Under no circumstances shall LaMotte Company be liable for loss of life, property, profits or other damages incurred through the use or misuse of their products.

PACKAGING AND DELIVERY

Experienced packaging personnel at LaMotte Company assure adequate protection against normal hazards encountered during shipping. After the product leaves the manufacturer, all responsibility for its safe delivery is assured by the transporter. Damage claims must be filed immediately with the transporter to receive compensation for damaged goods.