INSTRUCTION MANUAL

pH/mV METER
PHH-152

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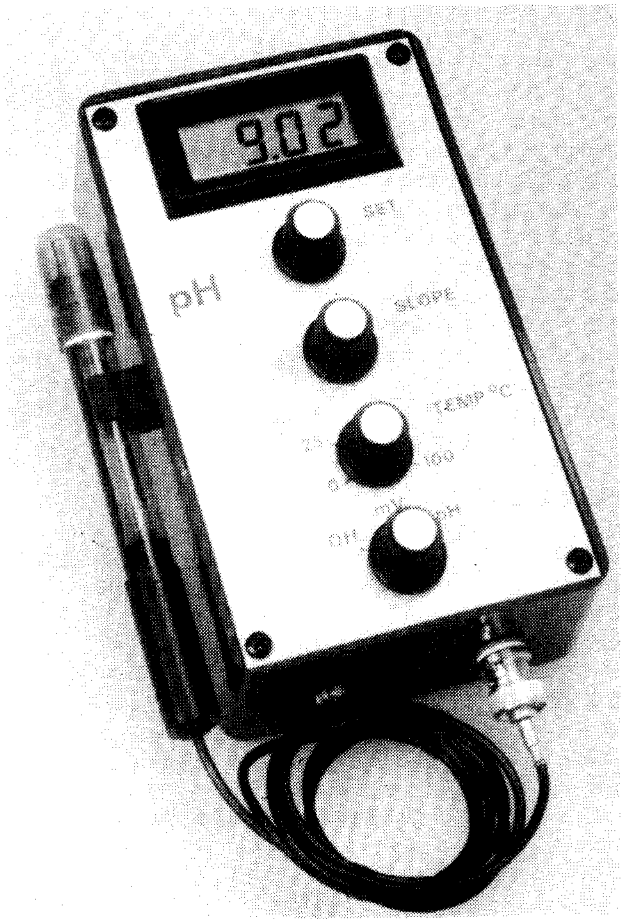
1.0 GENERAL OVERVIEW

This meter measures the pH/MV of most solutions. The meter includes all the functions necessary for precise and accurate pH/MV measurements, including set and slope knobs for two or three point calibration, a manual temperature adjustment allowing for temperature compensation, and a 3 1/2 digit LCD display.

Re-chargeable batteries and an AC adapter/re-charger allow versatility for use in the field and in the lab. The batteries will last approximately 400 hours before re-charging is required. The LCD display will give a "BAT" reading when the batteries are low.

2.0 SPECIFICATIONS

READOUT	3 1/2 .5" tall Digit LCD
RANGE	0-14 pH / ±1999 mV
ACCURACY	±0.02 pH / ±2 mV
RESOLUTION	0.1 pH / 1 mV
TEMP. COMP.	MANUAL
TEMP. RANGE	0 - 100°C ± 2°C
SIZE	6"H,3"W,2"D
WEIGHT	1.5 Lbs (0.7Kg)
POWER	8 "AA" Rechargeable Batteries



1.LCD

4.SET

5.SLOPE

3.TEMP

2.DISPLAY
SWITCH

7.PROBE
INPUT

6.POWER
JACK

8.pH PROBE

3.0 INSTRUMENT FAMILIARITY

1. **Liquid Crystal Display**
   3 1/2 digit display for pH/MV readings.

2. **Display Switch**
   Selects the MV or the pH function.

3. **Temp °C**
   Used for temperature compensation in the pH function. Set the dial to the temperature of the sample being measured.

4. **Set**
   pH 7.00 adjustment knob. Calibrates the offset of the pH meter. Corrects for variations in the probe as it ages.

5. **Slope**
   pH 4 or pH 10 adjustment knob. Calibrates the gain of the pH meter for a known pH value. Corrects meter for variations in the probe as it ages.

6. **Power Jack**
   The wall plug adaptor output is attached to operate from line voltage. Input is 12vdc, 500mA.

7. **pH Probe Input**
   A BNC connector for the pH probe.

8. **pH Probe** (Standard with Field Kit)
   Standard single junction, combination electrode. The body is 1/2 inch diameter, 5 inches long, and has a six foot cable.

4.0 OPERATION

1. The meter is powered with internal NICAD re-chargeable batteries. Connecting the AC adaptor will re-charge the batteries while allowing

continued operation. The batteries should be charged overnight prior to the inital use of the meter on battery power only.

2. Attach the pH probe to the BNC connector.

3. Set the **Function** switch to the **MV or pH** position.

4. Calibrate the meter as described in the **CALIBRATION** section.

5. Insert the probe into the unknown solution at least 1/2 inch.

6. Allow the display to settle and record the reading.

5.0 CALIBRATION

1. Attach the pH probe to the BNC connector.

2. Set the **Function** switch to the **mV or pH** position.

3. Adjust the **TEMP** knob to the temperature of the buffer.

4. Place pH electrode in pH 7 buffer. Sufficient buffer should be used to immerse the pH tip.

5. Adjust the **SET** knob to read pH 7.00 on the display.

6. Rinse the electrode with distilled water.

7. Immerse the electrode in a second standard buffer, either pH 4.00 or pH 10.00. Allow time for the probe to equilibrate.

8. Adjust the **SLOPE** knob to read 4.00 or 10.00 depending on the second buffer used.

9. Rinse the electrode.

10. For a three point calibration, repeat steps 8 thru 10, using the buffer not previously used.

11. The meter is now ready for use.

Note: The calibration of a pH meter is not permanent. It should be done on a regular basis, or any time the pH reading response becomes slow and or erratic.

6.0 MEASUREMENT GUIDELINES

1.Avoid contaminating the standard and sample solutions. For best results rinse in D.I. water after each measurement, then rinse with a small amount of the next standard or sample.

2.Choosing a calibration solution as close as possible to the sample solution value will increase the accuracy of the measurement.

3.If possible the calibration solution and sample solution should be at the same temperature.

4.The instrument functions by sensing very low signals at the electrode surface. Tests in solutions with stray AC voltages may cause erratic results. If in doubt, shield both the solution and electrode.

5.After exposure to a sample, buffer or rinse solution, shake the electrode with a snap motion, to remove residual drops of solution. This will minimize contamination from carryover.

6.As a rinse solution, use a part of the next sample or buffer which is to be measured. This will minimize contamination from carryover.

7.Never wipe an electrode. Wiping an electrode can cause erratic readings due to static charge. To dry the electrode, blot it lightly with a lint free tissue or cloth.

8.If bubbles are seen in the bulb area, hold the electrode near the cable and shake downwards to force the liquid to the bulb.

9.Stirring the electrode in the sample, buffer or rinse solution, will bring the ions to the electrode surface faster and improve response speed.

10.pH probes require a conductive path between the glass membrane and the ceramic junction to function. Therefore, a solution with little or no salinity will cause false readings.

11. All pH electrodes age with time. Aging is detected by slow response and reduced pH span. The slope control can be adjusted to compensate for electrode span errors.

7.0 pH BUFFERS

A pH electrode does not maintain an exact output. When the pH meter is calibrated, it is actually the electrode that is being calibrated. The pH buffers are designed to maintain accurate and stable pH values.

PH buffers are aqueous solutions with specific pH values that are resistant to the presence or addition of other materials. They are quite stable but can change when contaminated. It should be recognized that absorption of any chemical can alter the pH value. For example, addition of chemicals, dipping the electrodes or a stirring rod into the buffer bottle or even prolonged exposure to CO from the air can significantly alter the value of some buffers.

Measurements below pH 1.5 are subject to "acid error" and above pH 11.5 are subject to "sodium ion error". In these cases use electrodes especially built for these extremes.

8.0 ELECTRODE CARE

The pH probe is fragile. The key to it's accuracy and longevity is the glass membrane (bulb) at its tip, and the two porous ceramic junctions at the base of the bulb. Always store the probe in boot solution (pH 4 buffer with added KCl) when not in use. **NEVER** store the pH probe in DI water.

Storage

When pH readings are made infrequently, (for example, several days or a week apart) the probe can be stored by simply placing it in the storage bottle, containing boot solution. First slide the cap onto the probe, then the o-ring, then insert the probe into the bottle and firmly tighten the cap.

Cleaning

Coatings on the pH bulb can lead to erroneous readings including shortened life span. The type of coating will determine the cleaning technique. Soft coatings can be removed by vigorous stirring or by use of a squirt bottle. Organic chemicals or hard coatings should be chemically removed. Only in extreme cases should the bulb be mechanically cleaned as abrasion can lead to permanent damage. If cleaning does not restore performance, reconditioning may be tried.

Reconditioning

When conditioning is required due to probe aging, the following treatment can be tried:

A. Immerse the probe tip in 0.1N HCl for 15 seconds.
B. Rinse in tap water.
C. Immerse the tip in 0.1N NaOH for 15 seconds.
D. Rinse in tap water.
E. Repeat this sequence three times then recheck the probes performance. If this does not improve response, the probe should be replaced.

Note: Use proper precautions when handling these hazardous chemicals. They should be handled only by qualified personal.

9.0 BATTERIES

Prior to inital battery use charge the batteries overnight.
The batteries when fully charged should last approximately 400 hours.

Do not let the batteries run completely out before re-charging them. The LCD display will read "BAT" when the batteries are getting low. The batteries maybe re-charged while the meter is being used or with the meter turned off.

The meter may be left on the adaptor and charged indefinitely, if desired.

Should the batteries not hold a charge, contact the factory or your dealer.

10.0 TROUBLESHOOTING GUIDE

1. Meter display exhibits no response when measuring pH.

Check power to meter or display.

A. Dead batteries. Recharge batteries.
B. No input from AC adaptor.

Check pH circuitry.

A. Set selector switch to pH.
B. Open paper clip to U shape or use a piece of wire.
C. Insert one end of wire or opened paper clip into BNC connector center hole and touch other end to the outside raised cylindrical metal ring.
D. This should result in a stable reading around pH 7 which can be deflected more than 2 pH units using the **SET** knob.

Conclusion

If the pH meter responds correctly when shorted, the meter is in good working order and the problem is probably a faulty electrode. If the pH meter does not respond correctly when shorted, the meter is faulty and requires repair.

2. Unable to standardize meter.

A. Check temperature knob to verify correct setting.
B. Use new buffer standard and recheck.
C. Visually check electrode for cracks or other abnormalities. A cracked or damaged electrode should be replaced.

3. Clogged reference junction.

A. Follow the electrode maintenance guidelines for cleaning an electrode.

4. PH readings are unstable, slow, erratic, or drift.

Check the sample.

A. Changing sample temperature. Allow sufficient time for a sample temperature to stabilize.

Note: Stirring on an uninsulated stirring motor can lead to a small, but significant sample temperature change, which will effect the pH reading.

B. A non-uniform sample. pH "zones", which result in erratic or drifting readings, can be eliminated by gentle stirring using an insulated stirring motor.

C. A very low or very high ionic strength sample. These readings can take a long time to stabilize.

D. A sample that is incompatible with the pH electrode. When measuring pH of special solutions such as HF, strong oxidizing solutions, or solutions that contain elements that can poison an electrode, be certain that you are using the correct electrode. If you have questions your electrode supplier can usually help.

11.0 THEORY OF MEASUREMENT

pH is the measure of the acidity or alkalinity of a solution. It is defined as the negative logarithm of the hydrogen ion activity.

Since pH is a logarithmic function, a change in pH of 'one' represents a tenfold change in relative acidity or alkalinity. Therefore, an accurate pH measurement is necessary.

Color Methods

Over the years, researchers have discovered dyes and chemicals that will change color at prescribed pH values. Litmus paper is a good example of a commonly used indicator. In an alkaline solution, the paper turns blue, and in an acid solution the paper turns pink. There are two major drawbacks with the use of paper indicators. The first drawback is the difficulty of detection in highly colored or turbid solutions; the second drawback is chemical interferences with the indicator invalidating the test. With the invention of the pH probe and meter, scientists were able to eliminate these drawbacks as well as increase the precision of pH measurements.

Instrument Methods

There are three components of pH measurement. The measuring electrode, the reference electrode, and the pH meter. Instrumental pH measurement can be performed relatively fast and with a high degree of precision.

Measuring Electrode

The key to the pH measuring system is the glass bulb at the end of the measuring electrode. This glass bulb is manufactured from special glass which is very sensitive and highly selective to hydrogen ions. The pH measurement is then a function of a voltage charge across the bulb which is directly related to the hydrogen ion concentration.

Reference Electrode

A second electrode, the reference electrode, is then required to complete the electrical circuit between the measuring electrode, through the meter, into the sample being measured. The reference electrode completes this circuit by very, very slow seepage of KCl into the sample through a porous junction. Clogging of this junction can cause erratic and incorrect pH readings.

Combination Electrode

Combination electrodes are electrodes which contain both a measuring and a reference electrode in one probe.