INSTRUCTION MANUAL

pH/mV METER

QUICK OPERATION

1. Open shipping box - take out instrument.

2. Any damage?
   - Report to freight company.
   - Call Distributor/Dealer

3. Turn instrument on. If meter “pegs”,
   - Don’t panic - turn it off.

4. Connect desired pH electrode.

5. Now turn instrument on.

6. Set **TEMP** control to 25°C or solution temperature.

7. Set **OFF-mV-pH-EXP** switch to **pH**.

8. Place pH electrode in pH 7 buffer; adjust **SET** control for a pH reading of 7.

9. Rinse electrode in distilled water and place in pH 4 or 10 Buffer, whichever is closer to measurement being taken.

10. Adjust **SLOPE** control for a pH reading of 4 or 10.

11. Rinse electrode in distilled water; gently shake dry.

12. Measure pH of unknown.
   - READ INSTRUCTION MANUAL.

NOTE: Calibration of a pH meter is NOT permanent. It should be done on a regular basis.

LIMITED ONE YEAR WARRANTY

Manufacturer warranties all instruments (excluding batteries, damage caused by batteries, probes, standards, buffers) against defects in materials and workmanship for one year from date of original purchase. During this warranty period, the manufacturer will repair or at their option, replace at no charge a product which proves to be defective, provided the product is returned, shipping prepaid to the manufacturer's service center.

This warranty does not apply to damage caused by accident or misuse or as a result of service or modification by other than an authorized service center. No other express warranty is given. Repair or replacement of product is your exclusive remedy. In no event shall the manufacturer be liable for consequential damages.

10.3.1 Check the sample.
a. A changing sample temperature.
Allow sufficient time for sample temperature to stabilize.

NOTE: Vigorous stirring on an un-insulated stirring motor can lead to small but significant sample temperature changes.

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 high ionic strength sample.
These readings can take a long time to stabilize.
d. A sample that is incompatible with your pH electrode.

NOTE: When measuring pH of special solutions such as HF, strong oxidizing solutions, or solutions that contain elements which are poisonous to an electrode, be sure to use the correct electrode. If you have any questions, consult your electrode supplier.

10.4 Who to Contact

10.4.1 Faulty Electrode
Faulty electrodes can not be repaired. Contact your electrode supplier to purchase a new probe.

10.4.2 Faulty Meter
If the electrode works correctly on another meter or the meter does not work correctly when the BNC is shorted, your meter needs to be repaired or serviced. Contact your distributor/ dealer.

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d. This should result in a stable reading 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.

10.2 Unable to standardize meter.

10.2.1 Check temperature knob to verify correct setting.

10.2.2 Open a new bottle or make a fresh batch of standard buffer and recheck standardization.

10.2.3 Check electrode for physical defects.
a. Visually check electrode for cracks or other abnormalities. A cracked or damaged electrode should be replaced.
b. Visually check electrode for low filling solution or excess KCl crystals. Filling solution should be at least 2/3 full, bulb and filling hole should be free of excess KCl crystals.

10.2.4 Clean the electrode to eliminate a clogged reference junction.
a. Immerse the tip of the electrode into concentrated NH_4OH for 10-15 minutes.

CAUTION: NH_4OH is very caustic and should be used in a hood.

b. Rinse the electrode.
c. Soak the electrode in pH 4 buffer for 10 - 15 minutes.
d. Recheck calibration.

10.3 pH readings are unstable, slow, erratic, or drift.

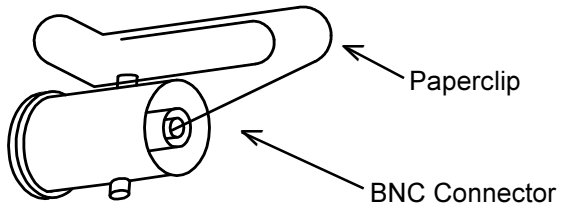


Illustration 1 Shorting The BNC Connector

10.0 TROUBLESHOOTING GUIDE

10.1 Display exhibits no response when measuring pH.

10.1.1 Check power to meter or digital display.
a. Dead batteries.
b. No input from wall-plug transformer.

10.1.2 Electrode not properly connected.

Replacing batteries in lab models:
a. Turn meter **OFF**.
b. Unscrew rubber feet and remove shroud.
c. Loosen screws securing batteries, then remove battery packs.
d. Replace all eight AA batteries, one at a time, to insure proper orientation.
e. Return battery packs to holder and tighten screws.
f. Replace shroud and feet.
g. Turn meter on and recheck function.

Replacing batteries in field models:
a. Turn meter OFF.
b. Replace all eight AA batteries, one at a time, to insure proper orientation.
c. Turn meter on and recheck function.

10.1.3 Check millivolt function.
a. Turn selection knob to **mV**. Place electrode in fresh pH 7 buffer. Meter or digital display should read 15 mV.
b. Place electrode in fresh pH 4 buffer. Meter or digital display should read +177 mV.
c. Place electrode in fresh pH 10 buffer. Meter or digital display should read -177 mV.
d. If display responds correctly in mV mode, the fault is pin pointed to the pH board. The pH meter should be returned to manufacturer for service.
e. If the pH meter does not respond correctly, you may have a faulty electrode or meter. Proceed to the next step.

10.1.4 Check pH circuitry.
a. Turn selection knob to pH.
b. Open a paper clip to form a 'U' shape or use a piece of wire.
c. Insert one end of wire or paper clip into BNC connector center hole. Touch the other end to the outside raised cylindrical metal ring. See Illustration 1.

NOTE: This procedure does not pose any electrical risk.

1.0 INTRODUCTION

The pH meters covered by this manual are for general purpose use. The meters work with most commercially available electrodes. Power is supplies by batteries. Lab models have internal batteries and will also run on an optional AC power source. Field models have external batteries for easy replacement. All models have two point standardization and manual temperature compensation.

2.0 THEORY of pH 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 of 'one' represents a tenfold change in the relative acidity or alkalinity. **Therefore, an accurate pH measurement is necessary.**

2.1 Color Methods

Over the years, researchers have discovered dyes and chemicals which 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. 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 pH 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 electrode and meter, scientist were able to eliminate these drawbacks as well as increases the precision of pH measurements.

2.2 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 a 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 (K+ + Cl-), into the sample through a porous junction. Clogging of this junction will cause erratic and incorrect pH readings.

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

pH Meter - The input signals from the electrodes are displayed on the pH meter. A direct reading of the voltage input is displayed when the meter is set on the millivolt scale. For the more common usage, the meter converts the voltage input to pH units which are displayed when the meter is set to the pH mode.

3.0 SPECIFICATIONS

pH Range/Accuracy.....0-14±0.01pH

mV Range/Accuracy (Bench Models).....±700mV±5mV

mV Range/Accuracy (Field Models).....±1990mV±2mV

Temperature Compensation.....Manual 0-100°C

pH probe (Bench Models).....Any BNC connector (Not supplied)

pH Probe (Field Models).....H-105 general purpose (Supplied)

Power.....8 AA Batteries (Included)
110 or 220 VAC transformer(Optional for bench models only)

Battery Life.....approx. 200 hrs.

Shipping Weight (Bench Models).....3 lbs/1.4 Kg

Shipping Weight (Field Models).....4 lbs/1.8 Kg

Size (Bench Models).....5H x 8W x 5D in (12 x 21 x 12 cm)

Size (Field Models).....4H x 12W x 5D in (10 x 30 x 12 cm)

8.0 mV CALIBRATION

8.1 The mV input can be adjusted for zero by shorting the mV BNC connector to ground and setting the display to read zero.
(See Illustration 1.)
8.2 mV scale is factory calibrated. For specific ORP or ISE calibration procedures, see your electrode manufacturer's instructions**.**

9.0 ELECTRODE CARE

Many electrode problems can be eliminated with reasonable care. Proper storage and use decreases down time and provides maximum benefits.

STORAGE

9.1 Gel and refillable electrodes should be stored in an acidic solution with a low salt content. Commercial soaking solutions are avail able or you can make your own by mixing 1M KCl solution ad- justed to pH 4.

USE

9.2 Electrodes should always be used in a vertical postion.

9.3 Electrodes should be rinsed between samples with distilled or deionized water. NEVER WIPE AN ELECTRODE. To remove excess water, shake the electrode gently. Wiping an electrode can cause spurious readings due to static charges.

9.4 The level of filling solution in refillable electrodes should be kept at least 2/3 full. If practical, the filling hole should be open during use.

9.5 pH electrodes are fragile. A proper electrode holder should be used to provide support and aid in raising and lowering the probe into solutions.

7.0 EXPANDED pH MODE CALIBRATION
(Analog Models Only)

It is important to understand that in the expanded mode, the full scale will span a range of 1.4 pH units. Before deciding to use the expanded mode, the user must first establish that the total pH range required will not exceed this value.

7.1 Turn selection switch to pH**.**

7.2 Calibrate the meter in the standards pH mode. (See section 4.0)

7.3 Place electrode in pH 7 buffer or solution of known pH.

7.4 Use the **SET** knob to adjust meter to read pH 7.00

7.5 Switch function from **pH** to **EXP** (expanded).

7.6 Use **SET** knob to reset meter needle to the appropriate position for pH range**.**

7.7 The meter is now calibrated in the expanded mode and will reflect a change of 1.4 pH units full scale.

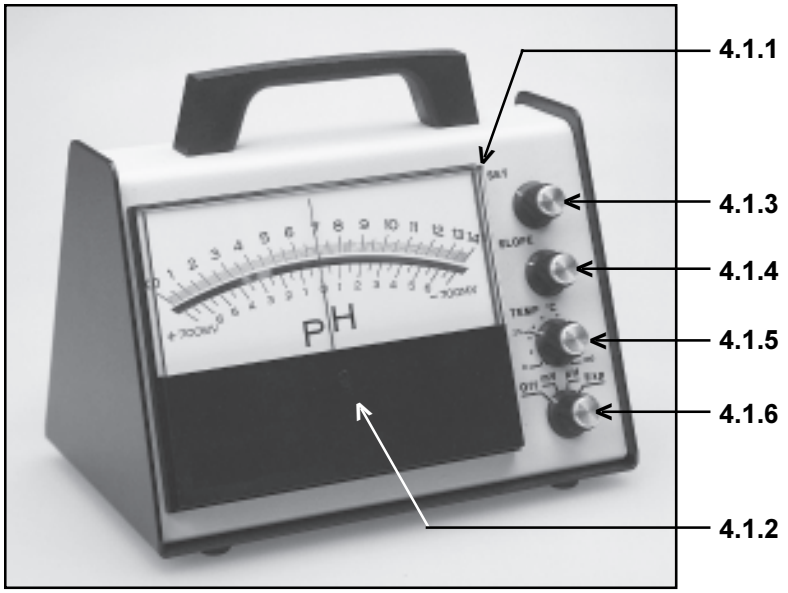
EXAMPLE

A solution has a starting pH of 3.25 and needs to be adjusted to an excess pH of 4.30±01. A pH 4.00 buffer solution is a good reference point. The electrode is placed in pH 4.00 buffer. Once in the expanded mode, the meter needle is set at pH 10.00.

In the expanded mode, the pH scale would read as follows:

pH 0.0 = 3.00
pH 1.0 = 3.10
pH 3.0 = 3.30
pH 7.0 = 3.70
pH 10. 0 =4 .00
pH 13.0 = 4.30
pH 14.0 = 4.40

4.0 INSTRUMENT FAMILIARITY



4.1 FRONT PANEL

4.1.1 DISPLAY
Analog - 6" analog display for pH and millivolt readings.
Digital - $3^1/_2$ digit LCD for pH and millivolt readings.

4.1.2 ZERO Adjust Screw - zero calibration adjustment for analog meters.

4.1.3 SET Knob - Used for first point in two point calibration, usually with pH 7 buffer. Also used for millivolt calibration.

4.1.4 SLOPE Knob - Used for second point in two point calibration, usually with pH 4 or 10 buffers.

4.1.5 TEMP Knob - temperature compensation setting. Set to sample temperature for accurate temperature compensation readings.

4.1.6 OFF-mV-pH switch
OFF - Power to instrument is off.
mV - Millivolt - meter will display millivolt input from oxidation-reduction (ORP) or pH electrode.
pH - Meter will display pH input from pH electrode 0-14.

4.2 REAR PANELS (lab models only)

4.2.1 pH-BNC-INPUT - For pH or ORP combination or measuring electrodes with BNC end fittings.

4.2.2 REF - Pin jack connector for ORP reference electrode input, or

the pin portion of a U.S. standard combination fitting. The pin jack is unscrewed to expose the hole in the post. The reference pin is inserted and the pin jack tightened to secure the pin.

4.2.3 **REDOX** - Pin jack input for pH or ORP measuring electrodes with pin or spade lug fittings. The pin jack is unscrewed to expose the hole in the post. The pin is inserted into the hole and the pin jack then tightened to secure the pin connection.

4.2.4 **POWER** - Input for 12vdc from transformer power pack accessory.

5.0 OPERATION

5.1 **Connect pH electrode to the meter.**

5.2 **Turn instrument on.**

5.3 Set **TEMP** control to 25°C or sample temperature. pH electrodes and measurements are temperature sensitive. To ensure accuracy, the sample temperature must be compensated for .

5.4 Set **OFF-mV-pH-EXP** switch to pH.

5.5 Place pH electrode in pH 7 buffer. Adjust **SET** knob for a pH reading of 7.

5.6 Rinse electrode in distilled water, shake dry, and place in pH 4 or 10 Buffer, whichever is closer to measurements to be taken. (If your sample will be reading below pH 7, use pH 4 buffer. If your sample will read higher than pH 7, use pH 10 buffer.)

5.7 Adjust **SLOPE** control for a pH reading of 4.00 or 10.00.

5.8 Rinse electrode in distilled water; shake dry.

5.9 Measure pH of unknown.

5.10 See section 6.0 and 7.0 for calibration procedures.

NOTE: Calibration of a pH meter is NOT permanent. It should be done on a regular basis. For best results, check calibration prior to use.

6.0 STANDARD pH CALIBRATION

6.1 Three buffers are normally used to calibrate pH meters. A pH 7 buffer is use to SET the meter. Then a pH 4 or 10 is used along with the slope knob. Use the buffer which is closest to the pH range you will be measuring. If your use will span the entire pH range, the instrument would be calibrated with two buffers and checked with the third.

6.2 Check meter needle position (analog only) before calibrating. The needle position should be checked with the meter turned off. If the needle does not read zero, then use the mechanical zero screw to adjust needle to zero**.**

6.3 Set the TEMP knob to 25°C or solution temperature.

6.4 Place pH electrode in pH 7 buffer. The electrode tip should be immersed completely. Freshly poured buffers should be used for each calibration.

NOTE: DO NOT POUR USED BUFFERS BACK IN THE BOTTLE. This will contaminate the buffer and give inaccurate results.

6.5 Make sure the front panel switch is set on **pH.**

6.6 Use the **SET** knob to adjust the analog needle to read a pH of 7.00.

6.7 Rinse the electrode with distilled water and carefully shake dry. **CAUTION: Do not wipe the electrode.** Wiping can cause static electrical charges which can result in faulty readings.

6.8 Immerse the electrode in a second standard buffer, either pH 4.00 or pH 10.00. Allow time for the electrode to reach equillibrium.

6.9 Use the **SLOPE** knob to adjust the readout to read exactly 4.00 or 10.00 depending on the second buffer used.

6.10 Rinse the electrode and shake dry.

The meter is now ready for use in the pH mode.

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.