Model 100A
Portable pH Meter
Manual

A digital version of this manual is available online at www.krugerandeckels.com

Contents

Description

Your pH Meter has been shipped with batteries in place. It is only necessary to standardize with buffer and is ready for use.

All controls and connections are on the front panel. The power switch has three positions. Two select the range. A temperature knob permits compensation for sample temperature. Electrode asymmetry potential (electrode zero output) may be compensated with use of a buffer and adjustment of the calibration knob. The meter has scales for both pH and millivolts. To the right of the meter are connections for a glass or a combination electrode (BNC connector) to the batteries is obtained by removing the rear cover.

Operation

1. Connect electrode
2. Set solution temperature knob
3. Turn on switch
4. Standardize electrode in buffer
5. Immerse electrode tip into solution
6. Read meter

The standard electrode (80417) furnished with the instrument is a combination glass and reference electrode. To use the electrode, remove the protective cap and rinse with DISTILLED or deionized water. Connect the electrode to the instrument.

Turn power switch to pH. To perform a test, first standardize the electrode with buffer. For best accuracy select a buffer with pH similar to that expected for the sample. Set the Temperature knob to the sample temperature. Immerse the electrode tip into the buffer just deep enough to cover the junction. Adjust the Calibration knob until the meter indicates the pH of the buffer. The meter is now ready for a test. Rinse the electrode. The solution to be tested is the best final rinse. Immerse the electrode tip in the solution to be tested. Slowly stir the solution until the meter reading is constant. The pointer is now at the pH of the sample.

The electrode will hold its calibration for a period of minutes to days depending on the treatment it receives. After a few recalibrations the user will learn the stability of the electrode in a specific application.

To store the electrode, fill the protective cap with tap water and slide over the bottom of the electrode.

During a test the BNC electrode connector should not be touched as an error may result. This connector is at electronic circuit ground potential which may be a few millivolts different from the potential of the solution being tested. The voltage difference is generated by the reference electrode.

Maintenance

Case exterior finish may be maintained by cleaning with a damp rag wetted with detergent. Spray type window cleaning materials are also effective but must never be allowed to wet the electrode connector.

The electronics are entirely solid state which essentially eliminates maintenance. All wearing parts such as potentiometers are standard type and available from electronic supply houses. It is possible for high voltage static electricity to damage the input transistor. Such damage would be evidenced by the meter being unable to be adjusted to pH 7.00 with the electrode connector shorted from the center terminal to the shell. Replacement of this transistor must be done under carefully controlled conditions. Factory authorized service is recommended.

Electrodes

Of all the parts of this instrument, the electrodes will require the most service. The two most critical service details are the cleanliness of the pH sensitive glass bulb and the cleanliness of the reference electrode junction. To clean, use a wet paper towel and wipe the glass bulb or junction several times. Detergent may be used to clean electrodes severely contaminated with oil or grease. During this process, the electrode must be held vertical to ensure filling solution flow out of the junction.

The refillable electrodes have a 3 millimeter hole in the side about 15 millimeters below the plastic cap. The solution level should be maintained within 10 millimeters of this hole. Except for the calomel electrode, only 4 molar potassium chloride saturated with silver chloride should be used to fill this reservoir. The calomel electrode requires saturated potassium chloride solution.

The procedure for refilling a reference electrode is to first open the vent hole. With the electrode held at an angle to vertical, touch the tip of the filling solution bottle against the vent hole and squeeze the bottle.

If the sample is allowed to enter the vent hole of the electrode, it may become permanently damaged. Evidence of this would be that an electrode which had operated correctly would fail to come to the buffer pH on the 1 to 14 scale even though the standardization knob was at one end of its travel.

Periodically, it will be necessary to refill the reservoir with solution. Use only 4M potassium chloride saturated with silver chloride. For one to three hours after addition of solution the pH signal may he low and drifting up. Periodic standardization with buffer will be necessary during this period. The internal solution should he maintained within one centimeter of the vent hole.

For short storage of the electrode (up to one week) the electrode may be placed in a beaker containing about two centimeters of water. leave the vent hole open. For long storage (over one week) the electrode should be filled with KCl to just below the filling hole and all rubbers should be placed in the original positions as when the electrode was received. The electrode may then be placed back in the box and stored.

There are several reasons for selecting a silver chloride reference. Many types will operate at a high temperature.

Combination Electrode

A combination electrode consists of a glass electrode and a reference electrode in a single probe. It has the advantage of requiring less sample and also of being easier to clean, than two separate electrodes

Since either a silver-silver chloride or a calomel cell may be used, it is important that the correct be followed for maintaining the electrode. Make certain that only filling solution containing silver is used with a silver chloride reference. Also make sure that filling solution containing silver never enters a calomel reference reservoir.

Sealed Combination Electrode

Sealed combination electrodes have the usual plastic body (80417). The reference cell contains potassium chloride saturated with silver chloride and thickened with a gel. The junction is porous ceramic. There is no vent hole for the reference cell. The gel reduces the solution flow rate sufficiently so it will last for many months depending upon the type of service.

Electrode Temperature

The pH calibration of all glass electrodes is dependent on temperature. Therefore, it is necessary to compensate for temperature of the electrode. A Temperature control knob is on the front panel for this compensation. For measurements within one pH of the buffer and between 10C and 40C, the temperature correction error is below 0.1 pH. Consequently, for this type of measurement, the temperature control may be left at 25 C. For measurements at greater than one pH from the buffer and requiring accurate results, the temperature knob must be adjusted. Set this knob to the temperature of the buffer when standardizing the electrode.

For best accuracy, the buffer temperature and the sample temperature must be the same. One method of accomplishing for field work is to immerse the bottle of buffer in the sample solution for a few minutes.

All glass electrodes have a temperature co-efficient proportional to the absolute temperature. The voltage produced by the electrode is greater at higher temperatures. For example, if an electrode is calibrated with buffer at pH 7.00 and a temperature of 25 C, each one pH change will produce an output change of 59 millivolts. At 50 C, each one pH change will produce an electrode output change of 64 millivolts. The meter Temperature knob adjusts the number of millivolts change at the input connector required to make a one pH change on meter. The instrument temperature compensation knob is essentially a slope control or in electronic terms, an amplifier gain control.

Electrodes

There are three types of electrodes available. These are glass, reference, and combination glass/reference. A combination electrode is usually supplied with the instrument.

The glass electrode produces a voltage as a result of the pH difference across a thin glass membrane. This membrane is in the form of a bulb at the lower end of the tubular body of the electrode. A silver wire coated with silver chloride makes an electrical connection to buffer solution on the inside of the membrane. In use, the outside of the electrode is immersed in buffer or sample solution. Electrical connection to the buffer or sample is made through a reference electrode. The reproducibility and stability of the pH reading is dependent on the reference electrode. Originally, these two electrodes were separate and many users prefer this arrangement.

Glass Electrode

These instructions are for either a glass pH electrode or the glass electrode portion of a combination electrode. For first time use or after long storage, soak the tip in tap water or buffer for five to thirty minutes, depending on the accuracy desired.

If the electrode is used in an oily solution, it will be necessary to periodically clean the electrode's pH sensitive surface with a towel. If detergent is necessary, the electrode should be rinsed thoroughly since a surface film will interfere with correct operation.

The output voltage of a glass electrode is approximately the same as a reference electrode at pH 7.0. The pH at which there is no voltage difference between the glass and reference electrode is zero asymmetry potential. The glass electrode is positive with respect to the reference electrode at lower pH values and negative at higher pH values.

Battery

Periodically test the battery by turning the switch to BATT and the meter should read above pH 11.6. If the reading is below 11.6, replace all cells at the same time with alkaline type AA batteries. This type should have a steel case to prevent leakage from dead batteries into instrument electronics.

Buffer Solution

Buffer solutions for calibrating the electrode are available from your pH meter dealer, or may be prepared from the instructions provided in many chemical handbooks. For best test accuracy, the buffer pH should be as close as possible to the sample pH. Buffer solution pH may change with time due to absorption of carbon dioxide. Solution stored in plastic bottles for more than a year should be suspect and checked against fresh buffer. Deterioration is greatest for high pH buffer, such as borate.

All buffer solutions change pH with a change in temperature.

The pH of buffer solutions available from your dealer is shown below:

Temperature	4.00 pH Buffer	7.00 pH Buffer	10.00 pH Buffer
0	4.00	7.12	10.31
10	4.00	7.06	10.17
15	4.00	7.04	10.11
20	4.00	7.02	10.05
25	4.00	7.00	10.00
30	4.01	6.99	9.95
35	4.02	6.98	9.91
40	4.03	6.97	9.87
50	4.06	6.97	9.81

Sample pH will also change with temperature depending on the composition. For accurate results, it is important that buffer and sample be at the same temperature. Conversely, if an accuracy of only 0.2 pH is required, buffer pH drift with temperature generally may be ignored.

Replacement Parts

Part Name	Part Number
Replacement meter	35521APM
Replacement battery holder	38659A