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1. Scope

This Standard Operating Procedure (SOP) applies to the staff and students making use of the Hanna® Portable pH Meter HI 9025 in the laboratories of the Pharmacy Department, University of Malta.

2. Objective

To describe the procedure for the installation, operation, calibration, maintenance and troubleshooting of the Hanna® Portable pH Meter HI 9025.

3. Definitions

3.1. ↑ °C and ↓ °C Keys (8): To manually set the temperature or the pH buffer value.

3.2. Automatic Temperature Compensation (ATC): A feature in which the temperature probe is able to detect the temperature of the solution in which it is immersed in.

3.3. Bayonet Neill-Concelman (BNC) Electrode connector (1): A common type of cable connector used to connect the pH electrode to the meter.

3.4. CAL Key (6): To enter or exit calibration mode.

3.5. CFM Key (7): To confirm calibration.

3.6. Display (3): Digitally displays the pH, temperature and mV results.

3.7. MEM Key (9): To store a pH value in memory.

3.8. MR Key (10): To recall the stored value from memory.

3.9. Manual Temperature Compensation: A feature in which the temperature of the sample solution is manually inputted when this is already known.

3.10. On/Off Key (5): To turn the meter on or off.
3.11. **Primary Display (11):** The upper part of the display that shows the resultant pH, temperature and mV value readings.

3.12. **RANGE Key (4):** To select between pH and mV results.

3.13. **Secondary Display (12):** The lower part of the display that shows a number of different commands to be taken.

3.14. **Temperature Probe Socket (2):** The socket at which the temperature probe is connected to the meter.

4. **Responsibility**

4.1. The members of the Department of Pharmacy (staff and students) are responsible for following this SOP.

4.2. The designated Laboratory Officer or Laboratory Assistant is responsible for ensuring that this SOP is followed.

5. **Procedure**

5.1. **Diagram of Display and Control Panel**
5.2. Installation

5.2.1. Install batteries in the back compartment of the meter.
5.2.2. Connect the pH electrode and the temperature probe to the BNC and temperature sockets respectively.
5.2.3. Switch the meter on by pressing and holding the On/Off Key for a fraction of a second.

5.3. Operation

5.3.1. Measuring pH

5.3.1.1. Ensure that before use, the meter is being calibrated frequently to allow more accurate measurements to be taken.
5.3.1.2. Remove the electrode protective cap.
5.3.1.3. Submerge the pH electrode into the sample to be tested.
5.3.1.4. Turn the meter on and if necessary press the RANGE Key until the display changes to the pH mode.
5.3.1.5. Allow the pH electrode to adjust and stabilise in the sample.
5.3.1.6. Read off the displayed stable reading.

5.3.2. Automatic and Manual Temperature Compensation

5.3.2.1. Submerge the temperature probe into the sample as close to the pH electrode as possible and wait for a couple of minutes to allow it to stabilise if automatic temperature compensation is desired.
5.3.2.2. Disconnect the temperature probe from the meter if manual temperature compensation is desired whenever the temperature of the sample to be tested is already known. Adjust the displayed temperature by using the Up and Down Keys respectively.

5.3.3. Measuring Temperature

5.3.3.1. Turn the meter on and press the RANGE Key until the display changes to temperature mode.
5.3.3.2. Dip the temperature probe into the sample.
5.3.3.3. Allow a couple of minutes for the reading to stabilise.

5.3.3.4. Read off the displayed stable reading.

5.4. Calibration

5.4.1. Pour small quantities of pH 7.01 and pH 4.01 or pH 10.01 buffer solutions into two separate clean beakers and use another two separate beakers for rinsing.

5.4.2. Switch on meter and ensure that it is in pH mode.

5.4.3. Press the CAL Key.

5.4.4. Ensure that the secondary display is showing the desired buffer solution and if not, press the Up and Down keys until the desired pH of the buffer solution to be used is displayed.

5.4.5. Remove protective cap and rinse the electrode with the pH 7.01 buffer calibration solution.

5.4.6. Immerse the pH electrode into the pH 7.01 buffer solution and stir gently.

5.4.7. Ensure that the electrode is kept submerged approximately 4cm into the solution.

5.4.8. Ensure that the temperature probe is located as close to the pH electrode as possible.

5.4.9. Wait until the display has [READY] and [CON] blinking to ensure that reading is stable.

5.4.10. Press the CFM Key to confirm the calibration.

5.4.11. If [WRONG] is seen blinking, ensure that the buffer solution used corresponds with the buffer solution chosen in the meter.

5.4.12. Wait until the pH of the buffer is displayed on the primary display and the pH of another buffer solution is being displayed on the secondary display.

5.4.13. Press the Up and Down keys to select the desired pH buffer solution (pH 4.01 or pH 10.01) for the next calibration.

5.4.14. Rinse the pH electrode with distilled water and then with the second buffer solution.

5.4.15. Immerse the pH electrode into the second buffer solution and stir gently.

5.4.16. Wait until the display has [READY] and [CON] blinking to ensure that reading is stable.

5.4.17. Press the CFM Key to confirm the calibration.

5.4.18. If [WRONG] is seen blinking, ensure that the buffer solution used corresponds with the buffer solution chosen in the meter.
5.4.19. Wait until meter returns to the operating mode to ensure that calibration process was successful.

5.5. Maintenance

5.5.1. Inspect the cables of the electrodes for any signs of broken insulation.
5.5.2. Inspect the pH electrode for any cracks in its stem or bulb.
5.5.3. Rinse off any salt deposits with water.
5.5.4. Soak the pH electrode in Hanna HI 7061 or HI 8061 General Cleaning Solution for approximately 1/2 hour to perform general cleaning.
5.5.5. Soak the pH electrode in Hanna HI 7073 or HI 8073 Protein Cleaning Solution for 15 minutes if protein deposits are present on the membrane and/or junction of the electrode.
5.5.6. Soak the pH electrode in Hanna HI 7074 or HI 8074 Inorganic Cleaning Solution for 15 minutes if inorganic deposits are present on the membrane and/or junction of the electrode.
5.5.7. Rinse the pH electrode with Hanna HI 7077 or HI 8077 Oil and Fat Cleaning Solution if oil films or deposits are present on the membrane and/or junction of the electrode.
5.5.8. Rinse the pH electrode thoroughly with distilled water after performing any of these cleaning procedures.
5.5.9. Refill the reference chamber with fresh electrolyte and soak it in HI 70300 or HI 80300 Storage Solution for at least 1 hour before taking any measurements.
5.5.10. If [LOW BAT] is displayed on the lower left hand corner of the secondary display, unscrew the back panel of the meter, remove all 4 batteries and replace with new 1.5V ones ensuring that their polarity is correct.
### 5.6. Trouble Shooting

<table>
<thead>
<tr>
<th>Fault</th>
<th>Possible Cause/s</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meter working slowly or giving faulty readings</td>
<td>Electrode not working or reference junction clogged</td>
<td>Leave electrode in storage solution after cleaning junction. If problem persists, replace electrode</td>
</tr>
<tr>
<td>Meter does not accept 2nd buffer solution for calibration</td>
<td>pH electrode is out of order</td>
<td>Follow normal cleaning procedure. If problem persists, replace electrode</td>
</tr>
<tr>
<td>Reading is drifting</td>
<td>pH electrode is out of order</td>
<td>Replace pH electrode</td>
</tr>
<tr>
<td>Display shows [E1] or no pH value</td>
<td>pH scale is out of range</td>
<td>- Recalibrate</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Ensure pH sample is in the 0 to 14 range</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Check electrolyte level and the general state of the pH electrode</td>
</tr>
<tr>
<td>Display shows [E2] or no pH and temperature values</td>
<td>Temperature scale is out of range</td>
<td>- Ensure temperature probe is plugged in</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Ensure temperature is in the 0 to 100°C range</td>
</tr>
<tr>
<td>Display shows [E3] or no mV value</td>
<td>mV scale is out of range</td>
<td>Appropriate electrode is not connected</td>
</tr>
<tr>
<td>Display shows [E4] or [WRONG BUF 1]</td>
<td>- Erroneous buffer solution used for offset calibration</td>
<td>- Ensure buffer setting in meter is correct and the solution used is fresh</td>
</tr>
<tr>
<td></td>
<td>- Out of order electrode</td>
<td>- Replace the pH electrode</td>
</tr>
<tr>
<td>Meter is not working with temperature probe</td>
<td>Temperature probe is out of order</td>
<td>Replace temperature probe</td>
</tr>
<tr>
<td>Meter fails to calibrate or gives faulty readings</td>
<td>pH electrode is out of order</td>
<td>Replace pH electrode</td>
</tr>
<tr>
<td>Display is acting erratically</td>
<td>Microprocessor electronically disturbed</td>
<td>Remove one of the batteries for 1 minute to reset microprocessor</td>
</tr>
</tbody>
</table>
5.7. Flow Charts

5.7.1. Installation

5.7.1.1. Installation

Start

Install batteries in back compartment of meter

Connect pH electrode and T probe to BNC and T sockets respectively

Switch meter on by pressing On/Off key for a fraction of a second

End
5.7.2. Operation

Start

Measure pH

Yes

Measure T

No

Yes

Calibration carried out frequently

No

Perform calibration (see section 5.7.3)

Yes

Remove electrode protective cap

No

Turn meter on

Yes

Submerge pH electrode into sample to be tested

No

Display pH mode

Yes

Allow pH electrode to adjust and stabilise in sample

No

Use ATC feature

Yes

Attach T probe to T socket

No

Change displayed T with T of sample by using the Up and Down Keys

MTC

Yes

Submerge T probe into sample as close to pH electrode as possible

No

Wait for a couple of minutes to allow it to stabilise

Read off displayed stable pH reading

End

Press RANGE Key until display changes to T mode

Dip T probe into sample

Wait for a couple of minutes to allow it to stabilise

Read off displayed stable T reading

Yes

No

Yes

No

Yes

No

Yes

No
5.7.3. Calibration

Start

Pour small quantities of pH 7.01 and pH 4.01 or pH 10.01 buffer solutions into 2 separate clean beakers

Use 2 other beakers for rinsing

Switch on meter

Meter in pH mode

Press CAL Key

2" display showing desired buffer solution

Yes

Remove protective cap

Rinse electrode with some of the pH 7.01 buffer solution

Immerse electrode into pH 7.01 buffer solution and stir gently

Electrode submerged 4cm into solution

Yes

Place the T probe as close to the pH electrode as possible

Submerge accordingly

No

Press RANGE Key until display changes to pH mode

Press Up and Down keys until desired buffer solution is displayed

No

Yes
1

[WRONG] seen blinking

Yes

Buffer solution used corresponds with buffer solution in meter

No

Use a fresh supply of buffer solution

2

Wait until [READY] and [CON] are blinking on display

Press CFM Key to confirm calibration

3

Arranged accordingly

Wait until pH of buffer is displayed on 1st display

Desired pH of next buffer solution displayed on 2nd display

Press Up and Down keys until desired buffer solution is displayed

Rinse pH electrode with distilled water and then rinse with second buffer solution

Immerse pH electrode into this second buffer solution and stir gently

[WRONG] seen blinking

Yes

Buffer solution used corresponds with buffer solution in meter

No

Wait until [READY] and [CON] are blinking on display

Press CFM Key to confirm calibration

Wait until programme returns to operating mode to ensure calibration was successful

End

Yes

Use a fresh supply of buffer solution

No

Arrange accordingly

Buffer solution used corresponds with buffer solution in meter

Yes

Wait until programme returns to operating mode to ensure calibration was successful

End

Valid for: 2 years from approval
5.7.4. Maintenance

Start

Inspect cables of electrodes for any signs of broken insulation

Inspect pH electrode for any cracks in stem or bulb

Rinse off any salt deposits with water

General cleaning

Yes

No

Protein deposits present

Yes

No

Oil films / deposits present

Yes

No

Soak pH electrode in Hanna HI 7061 or HI 8061 General Cleaning Solution for ½ hour

Soak pH electrode in Hanna HI 7073 or HI 8073 Protein Cleaning Solution for 15 minutes

Soak pH electrode in Hanna HI 7074 or HI 8074 Inorganic Cleaning Solution for 15 minutes

Inorganic deposits present

Yes

No

Soak pH electrode in Hanna HI 7074 or HI 8074 Inorganic Cleaning Solution for 15 minutes

Rinse pH electrode thoroughly with distilled water

Refill reference chamber with fresh electrolyte

Soak in HI 70300 or HI 80300 Storage Solution for at least 1 hr before use

[LOW BAT] displayed

Yes

No

Unscrew back panel of meter, remove all 4 batteries and replace with new 1.5V ones ensuring polarity is correct

End
6. Precautions

6.1. Always keep the pH electrode wet and rinse it thoroughly with the sample to be measured before use.
6.2. Keep in mind that the pH is directly affected by temperature. Thus in order to measure the pH accurately, the temperature must be taken into consideration.
6.3. If the sample temperature is quite different from the temperature at which the pH electrode is kept, allow a few minutes for thermal equilibrium to take place.
6.4. When performing a two-point calibration, use pH 7.01 and pH 4.01 when measuring acidic samples and pH 7.01 and pH 10.01 for alkaline measurements. This provides more accurate readings to be taken.
6.5. Do not be alarmed when salt deposits are present on the electrode since these normally form and can easily be rinsed off with water.
6.6. If any air bubbles form inside the glass bulb, “shake it down” firmly to remove them.
6.7. Always store the electrode in its appropriate storage solution and never store it in distilled or deionised water.
6.8. Perform a calibration:

   6.8.1. When pH electrode or temperature probe is replaced
   6.8.2. At least once a month
   6.8.3. After testing aggressive chemicals
   6.8.4. When batteries have been replaced
   6.8.5. When greater accuracy is required

7. References


8. Appendices

N/A
9. Revision History

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<thead>
<tr>
<th>Version Number</th>
<th>Amendments/ Reasons for change</th>
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<tr>
<td>01</td>
<td>Initial Release</td>
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